Papers and Materials Presented at the Unemployment Insurance Expert System Colloquium, June 1991

U.S. Department of Labor
Employment and Training Administration
Unemployment Insurance Service
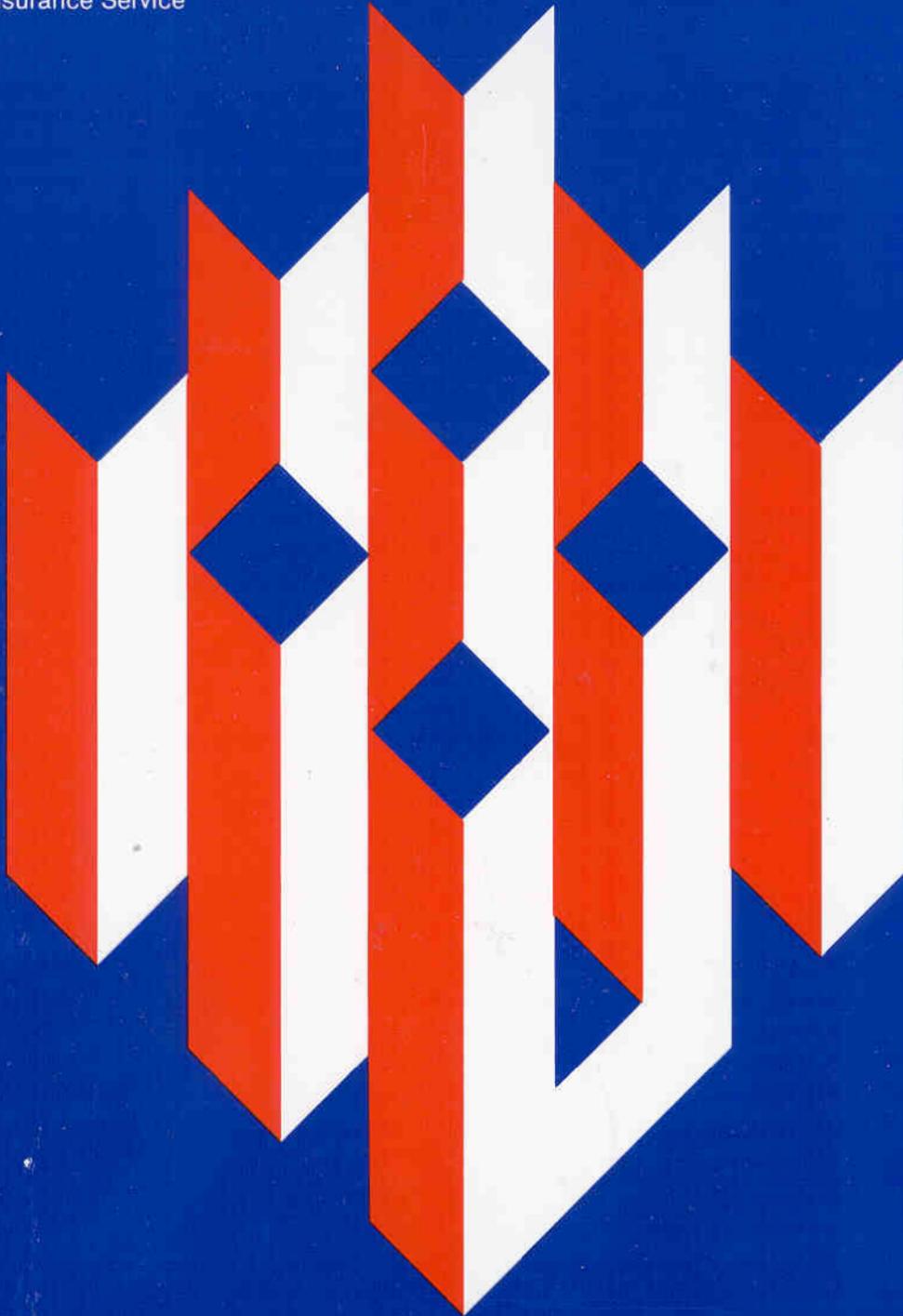
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PREFACE

This publication contains a compilation of papers delivered at the Unemployment Insurance (UI) Expert System Colloquium. The indisputable progression of UI expert systems research is characteristic of the Federal-State partnership. Experiments conducted by State employment security agencies and funded by the U.S. Department of Labor have conclusively demonstrated the manifold uses of expert systems technology in the operation of UI programs. State employment security agencies' demonstrations have proven, for example, that expert systems can provide advice to claims staff in adjudicating UI issues and can determine employer coverage. Moreover, expert systems can advise a local office claims taker as to whether an individual qualifies for benefits under a State UI law or a combination of State UI laws.

Most importantly, UI expert systems can be built to perform a part of any function within an automated UI structure. Certainly, an operational UI expert system is not a total systems' solution. However, it is part of the solution. Specifically, it can become an invaluable part of a State agency's carefully designed plan of benefit and tax automated systems.

The demonstration projects developed under the research grants provided for by the U.S. Department of Labor and guided within ETA by the UI Expert System Advisory Group have proven the hypothesis proffered in 1983 by a small group of ETA UI professionals. This hypothesis - proven correct - is that expert systems technology can play a vital role in the delivery of UI benefits and services. During the next decade, the towering question of the whether expert systems will be inculcated into day-to-day UI operations rests in the hands of Federal and State policy makers.

ACKNOWLEDGEMENTS

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Expert System Colloquium

by

David E. Balducchi and Wayne D. Zajac

Introduction

In April 1991 the U.S. Department of Labor's Employment and Training Administration (ETA) announced a Colloquium in unemployment insurance (UI) expert systems exploration. The Colloquium was held in Austin, Texas during the period June 12-14, 1991. Approximately 50 employment security, federal and private business representatives attended. Employment security officials from twenty-six State employment security agencies (SESAs) were able to listen to colleagues report on UI expert systems research and to exchange ideas. The origins of this convocation go back nine years.

Beginning in 1983, ETA's Unemployment Insurance Service (UIS) began investigating the use of a form of artificial intelligence called expert systems as a possible means to enhance UI local office decision making. Since 1987, UIS has funded five SESA expert system research demonstration projects. The first, Kansas' Nonmonetary Expert System Prototype, was completed in March 1990. The remaining demonstration projects are Maine's Nonmonetary Expert System Prototype, Missouri's Advisor in Determining Employment (AIDE) Expert System, Texas's Claims Examiner's Assistant, and Texas's Disaster Unemployment Assistance (DUA) Determiner's Assistant. In addition, ETA provided UI automation support account funds to Oregon for the development of two expert systems prototypes. The Oregon prototypes are: the Expert System Nonmonetary Separation Training Tool and the Expert System Initial Claim Options for Filing.

The Colloquium raised awareness of technological changes underway in the administration of UI programs. This awareness will likely precipitate a fundamental change in the manner in which UI business is conducted. Discussions -- both formal and informal -- among the SESA participants enhanced this awareness. The Colloquium previewed advancements in UI computer concepts and expert systems research. It proved to be a watershed gathering of SESA officials. Colloquium deliberations revealed that Federal-State UI technical capacity needs to be strengthened. Why it needs to be strengthened and how this can be accomplished are the subjects of this composition.

Indispensable Piece of Software

As a result of Federal-State UI expert systems research, it is anticipated that expert systems software can become a practical tool for assisting UI operations. Of course, expert systems software is merely one element in an emerging domain of new technology that includes voice response units, telephone customer services, and automated teller machine (ATM) payment systems. Importantly, expert systems, with moderate acquisition and training costs and substantial user involvement in systems' design, may become the keystone of this technological boom.

In the recent past, critics of UI expert systems research said that expert systems would dehumanize the benefit delivery system. Cynics said it would never work. These understandable concerns were based, in part, upon a spurious assumption that expert systems technology would attempt to replace human reasoning and compassionate judgment. As far back as 1983, UI proponents of expert systems research never considered the replacement of claims staff with machine experts. Nevertheless, to address these delicate issues, several SESAs worked with the U.S. Department of Labor to tackle these concerns. They succeeded. As a result, the Colloquium's objectives were to dispel, if possible, these concerns and share the fruits of their research. Unemployment insurance expert systems' prototypes have demonstrated that expert systems can accurately replicate human reasoning.

Expert systems can play a preeminent role in enhancing a productive UI local office environment. Albeit, the role and value expert systems will play in an automated UI environment resides in the vision of Federal and State UI policy makers. Policy makers should know that the choices for utilizing expert systems are abundant and that their selections must be carefully planned and implemented.

Grafting Expert Systems

Expert systems are not an end in themselves. A UI expert system should not be built as a discrete component. It should be built to complement an existing UI automated environment. Expert systems can augment a mature automated benefits distribution process. They have the potential to emerge as the conventional vehicle to streamline and reconfigure twenty-first century UI automated systems. For example, an expert system can be used as a consultant to claims staff seeking advice in decision making. In this way, it can become a time saving and integrated piece of software in an advanced chain of automated UI applications. Grafting an expert system into an existing UI automated rootstock is the challenge.

Not Built to Decide Every UI Issue

Expert systems will shift the organizational culture of the UI
local office. This cultural shift relates to the computerphobic
presence of a "thinking" machine. To confront this phobia, SESA
officials should make a potent effort to thoroughly describe the
attributes of expert systems. Claims staff will require a broad
awareness of how expert systems can help them better serve
unemployed workers as well as detailed knowledge of how to operate
specific expert systems.

In practice, this means defining expert systems' relative share of
the UI automated market. Unemployment insurance expert systems
should not be built to assist claims staff in determining every UI
issue. They should be built to assist in routine and repetitive
decision making. Influential decision making that is repetitive
may not necessarily be less complex.

Unemployment insurance expert systems should not be built to
perform one hundred percent of any UI function. Distinctly, in
development of the Kansas UI nonmonetary prototype, the expert
system was designed to assist claims staff in deciding only the
most predominant voluntary quit issues. It was built to assist in
deciding approximately fifty percent of all voluntary quit issues.
Overall, this represented approximately fifteen percent of the
total UI adjudication issues determined per year. The salient
features of the Kansas prototype are consistent decision making and
liberation of experienced claims staff from routine casework.
Hence, claims staff can devote more time to the most difficult
cases.

Quality claims interviewing and fact finding mean doing it right,
and doing it right the first time. Employment security officials
should strive to obtain optimum efficiency in expert systems
applications. Plainly speaking, this means that UI expert systems
should not be built to resolve all UI cases. As in any
organizational decision, administrative cost ultimately governs
program choices. State employment security officials should not
get bogged down in the costly mire of building for the most
troublesome cases.

Innovate

In the Colloquium's keynote address, Mr. James Ronay, President,
Synergistic Solution Technologies, Inc. stated that modern
companies must innovate or evaporate. But how does this epigram
apply to employment security expert systems exploration?

State employment security UI components perform two fundamental
tasks. First, they collect employer taxes and, second, they pay
benefits to eligible unemployed workers. These are tasks not
unlike those performed in private sector banking and insurance

industries. Both of these private industries have researched, tested and developed operational expert systems. The commitment by private sector banking and insurance industries' top management to invest in this technology is already paying off. Today, private sector banking and insurance industries' expert systems are performing multi-faceted tasks. For example, Japan's Nippon Life Insurance Company developed an operational expert system using KEE, IntelliCorp's expert system shell, that assists claims specialists in determining ninety percent of the company's 800,000 most arduous cases.[1]

In the public sector, Britain's Social Security Department offers an expert system called "Pension Forecasting Service" to citizens. The British system was implemented in April 1988. It handles a variety of questions citizens have about their pension concerns.[2] In the United States, the Internal Revenue Service (IRS) in the mid-eighties made a strategic decision to develop proficiency in expert systems. They sent numerous employees to graduate programs in artificial intelligence. Currently, IRS operates four expert systems with other expert systems under development. The Social Security Administration (SSA) has an entire unit, the Expert Systems and Future Technologies Branch, devoted to expert systems research. Recently, it has begun testing an expert system for telephone claims processing.[3]

The authors conducted interviews with IRS and SSA managers and development team members. Both IRS and SSA top managers have made an energetic commitment to research in advanced computer concepts. Mr. Ronay's epigram, "innovate or evaporate," should serve as a prudent admonition for those in the business of administering UI programs. State and Federal UI policy makers need to establish cooperative programs to develop and nurture fifth generation computer and technological expertise.

State Leadership

Expert systems have a distinct proficiency. They can become a front-end quality management tool for local UI delivery systems. State employment security officials need to invest greater resources to strengthen UI expert systems' capacity. Attention needs to be paid to the quality dividends that can be derived from expert systems. If a problem has not been solved before, it is not a candidate for expert systems. Therefore, State employment

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[1] Edward Feigenbaum, Pamela McCorduck, H. Penny Nii, The Rise of the Expert Company, 1988, Times Books, p. 116.

[2] Feigenbaum, The Rise of the Expert Company, pp. 118-119.

[3] Ann M. Mercier, "Expert System," Federal Computer Week, July 15, 1991, p. 21.

security officials need to merge their development efforts at the intersection of expert systems and program quality.

Expert systems can perform quality tasks. Although, success in developing expert systems rests with the development team. Team membership should include individuals who are proficient in the nuances of UI programs. They will have to make intricate judgments. State employment security officials should select domain experts and knowledge engineers who are committed and decisive and who are empowered with the authority to complete their mission.

After designing and testing a UI expert system, gaining end user acceptance may be the hardest task. According to a study conducted by Joe Bryant, technical service scientist with Johnson & Johnson Consumer Products, Inc., of twenty-five operational expert systems analyzed at Johnson & Johnson's Royston, Georgia facility, eighty percent were underutilized.[4] Based upon Mr. Bryant's study, it is apparent that employment security officials need to educate end users in the attributes of UI expert systems.

Federal Leadership

Over the years, research into applied UI expert systems has occurred. Notwithstanding, after nine years of investigation by the Federal-State partnership, only a few SESAs have implemented expert systems. The five experiments discussed in the UI Expert System Colloquium were object lessons for future UI delivery systems.

In private banking and insurance industries a technological boom is underway. A burgeoning number of technological innovations and expert systems software is available to private industries. These innovations and software can be adapted to numerous UI applications. Therefore, Federal efforts in providing technological research, encouragement and dissemination need to be strengthened. An effort underway by staff of the Unemployment Insurance Service to articulate a mission, vision, value and goal statement for the organization may promote resolution of this need. The UIS in conjunction with its State partners has renewed its commitment to investigate advanced technologies.

Logically, the Federal-State UI partnership needs to structure and nurture its advanced computer capabilities. It needs to build for the future. The Federal partner can facilitate a Federal-State

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[4] Joe Bryant, "Expert System Follow-Up," PC AI, p. 36, July/August 1990.

technological dialogue. In conjunction with its State partners, the Federal partner should consider enhanced:

o   Review of private and public sector advanced technologies.

o   Development of Federal partner and State partners advanced technologies competence.

o   Discourse between and among the State partners regarding the attributes of various advanced technological hardware and software.

o   Sharing of technological information and advice between and among the State partners.

o   Examination of advanced technologies such as, artificial intelligence, voice response units, telephone claims processing,[5] and ATM payment systems.

The era of UI intelligent technologies is at hand. Colloquium participants concluded that UI expert systems can be built to perform a part of many functions within an automated UI design. They recognized that an operational UI expert system is not a State's total systems' solution. However, it can be part of the solution. Colloquium participants also emphasized that the Federal-State UI partnership's management of expert systems and other intelligent technologies needs to be nurtured in order to realize the full potentialities of these technologies.

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[5] In April 1991, the Colorado Department of Labor and Employment implemented a centralized telephone UI claims service. The U.S. Department of Labor is conducting an evaluation of the Colorado project.

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KEYNOTE ADDRESS

BY

JAMES E. RONAY

June 12 - 14, 1991
UI Expert System Colloquium
Hosted by: the
U.S. Department of Labor and the
Texas Employment Commission

Keynote Address delivered by:
James E. Ronay
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SYNERGISTIC SOLUTION TECHNOLOGIES, Inc.
7602 Bell Flower Cove
Austin, Texas 78759
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June 12, 1991

Ladies and Gentlemen, it is an honor to be here today. I am
honored because most of you have stepped "up front" to risk being
different by trying new ways of helping your fellow workers
become more productive in a time of fewer resources. And today
you are openly seeking to share experiences and work as a larger
team.

That's all possible because you had courage and the leadership
who is willing to provide opportunities.

Truly, tomorrow's success begins with today's dream.

Imagine yourself as a youngster looking with wonder and
determination at a circus poster. You saw possibilities!   You
saw your imagined future! You saw the excitement of travel,
risk, sharing, learning, and adventure.

And now you have a another dream. A dream of working together in
support of your worthwhile goals. A dream of helping others do
more with what they have.

That dream fulfillment will not happen in the 90s unless we
collectively move to the "second order change". The "first order
change" is the way we have approached change in the past twenty
or thirty years. The game is played by moving the same old
pieces into "new" places. We then call it change even though we
have only changed the appearance and not the substance.

Second order change is required to survive, to compete, to
leverage our knowledge, and to help more people use existing
resources. Second order change is seeing the game itself in NEW
ways and creating NEW types of moves and actually changing the
substance. Countries are doing it. Citizens are doing it.
Technology is bringing the tools and techniques to do it.

But, it requires strategy!

This colloquium is part of that strategy. It provides a time for
honest sharing of dreams through demonstration and conversation.

It provides the risky opportunity of sharing work accomplished yet uncompleted. It provides an intelligent pause for sharing Information Technology (IT) resources enabling a little better journey into the future.

Mark these words. The threads of synergy throughout this collective group will shine during the next two days. It will be a time of paradigm shift for many of you.

In the 70s we saw life and technology in a hierarchical fashion. Orderly. Linear. In the 80s we began to squeeze the excess looking for "the beef" and that uncovered some of the reality of Tom Peters chaos.

To manage and leverage what we have and what we need in the 90s we will transition into self guided teams driven by a performance based outcome expectation, with a demand for measured results. That will change your paradigm! We must help prepare the others.

Information technology will be the basis and media of trade as was land, labor, and money before it. Artificial Intelligence and your Expert Systems represent a strategic component of that synergistic change of paradigm.

"Corporate" values are changing. The value of knowledge will be recognized as strategic. Tools in support of knowledge, creativity, flexibility, intuition, and experimentation will change the application of knowledge by a factor of twenty. The nodal or Tinker Toy model will predominate. Smaller organizations, autonomous management, group projects, and very short completion times will be the norm. The pain will be lessened by the application of your growing skills and knowledge through Expert Systems and their brother and sister tools of Information Technologies.

We have been telling each other that the "traditional" leadership style and tactics are fading in the cycle of things. We have been telling each other that a "new paradigm" of leadership is emerging to nurture and empower us as involved teams. We are asking for early warning about high and low performance before it becomes a problem.

So what's lacking at the action level? Awareness!

People don't know there's a problem. They don't know there's an opportunity. They don't know the solution. They don't know they don't know. They don't know they need to know. They don't want to take the risk to know. They may not really want the unknowns exposed. Or, perhaps, they don't want others involved in their elusion of control.

You have heard some of this many times before, but it has never been so important to our future. It has never been so important to the great work you are doing now.

To leverage Information Technologies and tools such as Expert Systems we must rethink and act within an enterprise wide plan which contains each of these components. (Values, Business Plan, Operational Plan, Technology Plan, Financial Plan, and a progress review plan of action).

We must see clearly. We must know who our customers are. We must know what is driving them and therefore what is driving us. We must know and feel that linkage between us as one. Then we must know what tools and techniques will enable all of us, as teams, to realize our collective vision and mission. We must create it, integrate it, lead it, sell it, and help manage IT.

Information Technology is no longer about technology as water is not about plumbing. Water is the basis of body survival. The network of pipes, the pumps, the motors are simply the means not the outcome. Knowledge is the basis of our economic survival. Information Technology is its means not the outcome.

Look at what's happened. In the 70s we were able to capture data (symbols) and put it into a box (computer). We had it there but we didn't know what to do with it. In the 80s we learned how to arrange, sort, and summarize data within the box and called it information. We were able to duplicate the status quo electronically. In the 90s we can now add complex assumptions, rules, relationships, presumptions, and conclusions into the box for instant, accurate application. Now we can build intelligent "advisors", "assistants", and "helpers" to enable each of us to be "expert like" in one tenth the time it traditionally takes to learn a particular piece of expertise. Like humans, the box can now trace its reasoning process, debate issues, show evidence, and change its outcomes based upon new inputs. Just as in the case of water, the basis does not change. What changes is how and what we do with the data to enhance access, integration, flexibility, accuracy, and ultimately the quality of productivity.

Intelligent symbolic processing is at the heart of this way of thinking. IT demands a changed way of thinking. A paradigm shift. A second order change.

Symbolic processing is therefore at the heart of IT. It is supported by many techniques. It has many tools between the techniques and the application areas. Tools that help simulate the thinking and reasoning process of we humans. Tools that add relentlessness, predictability, speed, and accuracy through more than 1500 Expert Systems (ES) at E. I. Dupont and more than 12,000 in the USA. (We could count about 96 ES in operation in 1987).

"Knowledge based systems" (KBS) is a phrase which simply represents a computing concept two paradigms above a "database system". The KBS implies an ability to intelligently integrate

information so as to extract and apply knowledge through the use
of IT tools and techniques such as an ES. It implies intelligent
capabilities in model-based reasoning and process understanding.
It implies an ability to integrate education (passing on
knowledge) and training (passing on skills) into the job process
at the exact point of need on the job. It implies the reality of
a "virtual system" --- a system which virtually replicates what a
human does and in direct support of that human's effort.

That, in itself, demands a new paradigm. It suggests that all of
us must be prepared for a *virtual system* integration by 1995.
That system will not just be boxes. It will contain the human
system, the information system, and the computer system working
either in greater harmony enabling our vision and mission or in
greater self-centeredness and subsequent greater chaos and
isolation. We will make the choice deliberately or by
abdication.

Ted Swindle (Texas Employment Commission) likened it to poetry
and Robert Frost's theory of poetry. Ted said "Building an
expert system is like making a poem in Frost's theory of poetry.
The end result is often as much a surprise for the experts and
the builders as it is for the users. The knowledge engineer
captures the expert's thoughts in midair, freezes them, breaks
them apart in the laboratory of Artificial Intelligence software,
and presents them in their machine form ..... for non-experts to
become expert at the task being knowledgized. Techmation (rather
than automation) takes place as the knowledge of the task
(process) is wrapped so firmly in the technology that the two
have become one."

You are leaders risking to challenge assumptions. You're asking
yourselves and those you are helping in the work place: What
requires assessment? What requires change? What requires
action? For what outcome? Asking those questions puts you at
the leadership leading edge.

The concerns of 1991 are about the future. The need for leverage
acquired through synergy, teamwork, and partnerships is endemic.
To say "We can do it alone." or "The way I've been doing it is
just fine." is in the first order change paradigm --- and it's
not good enough.

The questions are the answer. How can I do more with less? Can
I effectively redeploy my financial and labor assets? Is
executive management getting what they want? Is system
fragmentation limiting my success? Are my service providers
getting what they want? Do they really know what they want?
How can I help them discover what they want?

IT requires a strategy. But, that strategy must be based upon
THE enterprise not wires, plugs, boxes, and such. The need for
strategy suggests more questions. How do I leverage data,
information, and knowledge for better "customer" services? Who

are the "customers"? What questions do I need to answer to
better manage? How does IT affect quality performance? How can
I optimize assets? How do I introduce elements of change? IT
will prove itself through the customer's improved outcomes not
through the proof of the value of a box. How does one "prove"
the value of a water faucet? Better to prove the value of water!
Then the faucet becomes a given.

IT requires knowing your assets. The need for that knowledge
suggests questions. How can I maximize what I have? How can I
help the service providers? How can I manage administrative
costs rather than just replicate a process? How can I contain
costs, reduce backlog, and distribute expertise simultaneously?
How can I increase cash flow, work flow, and information flow
(and now knowledge flow) within budget?

IT will provide the tools and techniques to maximize our new
basis of value --- knowledge. That means IT professionals will
need an abundance of skills beyond bits and bytes. Strategy,
planning, creating, listening, selling, leading, and managing.
Think about that! We are within a frame of choice.

Are we going to participate in leadership or take the easy road
and continue to follow? Are we going to help the "customer"
discover their real solutions?

We must provide "professional services". Professional services
of the second order kind. A new paradigm. We will create a tool
box containing knowledge tools which help us behave
"expert-like".

Why now? Our collective needs and the multiple components and
capabilities of IT are now reaching a critical mass. Look at
what is coming from MCC (Micro-electronics and Computer
Technology Corporation) here in Austin. One of Craig Fields
(CEO) exciting activities includes something I characterize by
this sentence. SCAN LUCY for SHOW & TELL CYC HITS. Each is a
"research" program dedicated to creating human interface tools.
SCAN represents a full text conceptual matching and retrieval
tool. LUCY constructs English sentences based upon common
knowledge --- meaning semantic and pragmatic processing of a
knowledge base. SHOW is a navigation tool for use in large
knowledge bases. TELL exploits the knowledge base for systematic
relationships between linguistic structures and knowledge
structures. CYC is a common sense knowledge base which can
currently replicate the "reasoning" of a 6 year old human with
the goal of reaching adulthood. HITS represents the intuitive
user interface activity --- multimedia, graphics, color, etc ---
which are contextually, syntactically, and semantically
sensitive.

How do we prepare for such opportunities that will be available
in the late 90s? We must see IT as strategic. We must act as
calculated, risk taking leaders. We must intelligently deal with

the issues of resistance to change. We must deal with chaos,
vision, focus, coordination, fragmentation, accountability, and
the need for continual leaning in this dynamic paradigm of
change.

What are we going to invest in? The goose or the golden eggs?
The future or the status quo?

Are we going to fight over the myth of "control" or drive as a
team toward fulfillment of our predetermined vision guided by our
strategy and empowered by our intelligence with the help of IT
tools and techniques?

I suggest to you that success is a journey --- a process and not
an end. Should that be true --- then in strategy there is unity,
in unity there is strength, in strength there is focus, and in
focus there is success.

You and your leadership have demonstrated SUCCESS.....and the
active beginning of a paradigm shift.   Thank you!

STATE EXPERT SYSTEMS

KANSAS EXPERT SYSTEM PROJECT

PREVIEW

The U.S. Department of Labor's first sponsored expert system project involved the State of Kansas with contractor support provided by ERC, Inc. This project started in 1987 and was completed in 1990. However, Kansas continued its expert system development using UI Automation Support Account funds.

In the original Kansas project, the Department's purposes were twofold: (1) to determine whether a nonmonetary expert system could be built to assist in adjudicating voluntary quit issues; and (2) to conduct a statistically reliable evaluation of the functions performed by the expert system. The results were positive, and the Department of Labor proceeded with projects in Maine, Missouri, Oregon and Texas. The Kansas Division of Employment Security developed its expert system using EXSYS PROFESSIONAL expert system shell.

At the Colloquium, Kansas's "Nonmonetary Expert System" team was represented by:

Bill Clawson -- Chief of Benefits

Dorothe Wettstein -- Domain Expert

Geoffrey Hopwood (ERC, Inc.) -- Knowledge Engineer

KANSAS NONMONETARY EXPERT SYSTEM

KANSAS OVERVIEW

Kansas agreed on August 17, 1987, to participate with Evaluation Research Corporation (ERC) in a pilot project for the development of an automated nonmonetary expert system prototype.

Kansas became involved because: Kansas law contains 11 well-defined exceptions to a disqualification for voluntary leaving; it has an established automated nonmonetary system and a decentralized issuance of nonmonetary determination; and it had the willingness to assign individuals familiar with Kansas law and the nonmonetary process to the project.

Copies of the Kansas Employment Security Law, the automated nonmonetary message file, voluntary leaving training guide, guide cards and procedures manual were provided to ERC.

Kansas staff viewed the first demonstration on March 1, 1988. The demo used "voluntary leaving for better work" which is specifically stated in K.S.A. 44-706(a)(8). After this demonstration, Kansas staff became actively involved in the development and testing of the prototype.

Kansas demonstrated the prototype at the following events:

May 1988 - National UI Directors' Meeting -- Washington, D.C.
May 1989 - AUTOCON -- Chicago
June 1989 - National UI Directors' Meeting -- San Diego
      (update on status -- no demo)
October 1989 - Region VII Meeting -- Topeka
January 1990 - Adjudication Workshop -- Denver

As a result of the demonstrations, other states have contacted Kansas to express interest in the development of an expert

system.

Kansas was pleased with the final results of the prototype and was successful in receiving an automation grant to expand the prototype to include misconduct issues. Together, Kansas and ERC are currently developing this expansion.

BACKGROUND

Upon learning of the Employment and Training interest in expert systems and reading of the advantages of such a system, Kansas was very enthusiastic to participate in the development of a nonmonetary expert system.

Kansas is not alone in the problem of uniformity and quality performance levels in the nonmonetary process.

Unemployment insurance offices are staffed on the basis of workload. When the workload increases, additional staff is needed. The new claimstakers do not have the advantage of prior U.I. knowledge or the experience to immediately conduct a complete factfinding interview which is the basis for a nonmonetary determination. This is where an expert system is beneficial to all concerned.

An expert system reduces the training time. Also, it ensures uniform and complete factfinding statements for a specific situation. The factfinding interview is more controlled and the adjudicator will have a statement that is complete and legible. This allows additional time for the adjudicator to concentrate on the more difficult cases or when a rebuttal statement is needed.

In determining the success of the Kansas project, each claim, using the expert system for the factfinding, was tracked and measured from the nonmonetary determination through the appeals process. The results were very encouraging. A full report is contained in Unemployment Insurance Occasional Paper 90-1.

Although Kansas has developed training methods and resource material for claimstakers and adjudicators, the desired results have not been achieved. Funds are not always available to conduct formal training sessions and scheduling creates staffing problems.

An expert system brings statewide uniformity to the factfinding interview and in the resulting nonmonetary determination.

During the development of the prototype expert system, the physical distance between the Kansas and ERC necessitated most exchanges of information by telephone or mail. Now, using a modem, transmissions are timely and the contractor does not need to be on site.

Thus while some states have the "doubting Thomas" about expert system technology, Kansas is fortunate to have leadership that foresees the benefits of an expert system.

GOAL OF THE FULL EXPERT SYSTEM

Kansas' goal is to have a nonmonetary expert system installed on the mainframe and accessible statewide to each claimstaker for the factfinding process. A complete system would encompass all of the statutory issues. Currently the plan is to install the system statewide beginning with the voluntary quit and misconduct issues.

PROBLEM CHARACTERISTICS

The first problem that surfaced form the voluntary quit prototype was to put to rest fears of insecurity for their jobs among a group of claimstakers and adjudicators. An expert system does not replace workers. Instead, it enhances the work process by enabling the claimstaker to obtain the necessary facts for a given issue. It eliminates a claimstaker's frustration, i.e., "Did I ask all the necessary questions?"

END USER PARTICIPATION

Initial testing of the expert system prototype was conducted
during the summer of 1988 in our Topeka claims office with Kansas
and National Office Staff as observers. Consent to participate
was obtained from each claimant since the individual was twice
subjected to the factfinding interview: the normal written
interview, then the expert system interview with another
claimstaker. No claimant declined to participate. One claimant
remarked that the automated interview was accomplished in less
time.

In November, 1988, the system was tested for a two-week period in
our Overland Park claims office. The purpose was to gather input
from the users and to correct any deficiencies in the system.

Then, during the period January through March of 1989, the system
was tested and modified daily in the Kansas City and Overland
Park claims offices. At the end of the test period, the
prototype was complete except for the addition of enhancements.

Skepticism turned into anticipation for an opportunity to use the
system. The users and claimants were very cooperative.

Following the three months of testing, the claimstakers and the
adjudicators from both offices were individually surveyed. Each
response was a positive one for the system.

Kansas will test the voluntary quit conversion (EXSYS to AION)
and the new misconduct system in the Kansas City Office. Testing
is scheduled for the fourth quarter of 1991.

ERC OVERVIEW

Rising administrative costs have become a serious concern for the
U.S. Department of Labor (DOL) and the State Employment Security
Agencies (SESAs) alike, and generating nonmonetary determinations
under present conditions is labor-intensive, time-consuming, and
costly. The Adjudicator requires special training, and that
training must be made current from time to time, as new laws
become effective and court cases determine new precedents. Also,
producing the nonmonetary determination document itself has
become costly and time-consuming.

Because of these increasing costs and decreasing funding for
SESAs across the country, the Employment and Training
Administration (ETA) of the DOL has become very involved with
automation efforts to streamline operations of State agencies.
To support this involvement, the DOL issued, in August of 1987, a
Request for Proposals (RFP) to design, build, test and evaluate a
demonstration model of an expert system for rendering nonmonetary
determinations.

Of special importance to this project was to ascertain whether
expert system technology could reduce costs and time required to
generate and produce nonmonetary determinations, reduce the
number of incorrect decisions, and continue to protect claimant
rights, employer rights, and the UI Trust Fund itself. Incorrect
nonmonetary determinations arise from any one of a number of
reasons (adjudicating the wrong issue or an issue not potentially
disqualifying, inadequate factfinding, lack of sufficient
reasoning, or ignorance of changes in State or Federal law) and
it was DOL's desire to see how an expert system might address
these problem areas. These incorrect nonmonetary determinations
also arise as an unintended effect of the funding formula: when
budgeting is linked to workload, a downturn in that workload can
result in the layoff of experienced UI staff. Then, with a
sudden surge of the workload, the agency brings on temporary or
part-time staff, who are less experienced and who can adversely

affect the quality of adjudications.

The contract to demonstrate these issues was awarded to Ogden/ERC System Engineering Group's Human Services Center ("ERC") of Fairfax, Virginia. ERC teamed with the State of Kansas for this project, for several reasons: Kansas already had in place the decentralized issuance of "canned" nonmonetary determinations, a highly automated system, a distributed processing network, and features of State law shared by many other SESAs. All these factors were important in selecting a test site because they all influence the transferability of the system, which was one of the requirements of the solicitation, and is also a desirable feature in itself.

In choosing its technical approach, the ERC/Kansas team had two general considerations. The hardware considerations involved our development tool: whether to use a mainframe or a microcomputer. Whereas the State mainframe was already in position with its Statewide network and was available for use, the cost of development software varied greatly between mainframe and microcomputer software - $80,000 vs. $1-7,000. The ERC/Kansas team selected the latter as the more fiscally sound in light of the fact that this was a demonstration project and that the premise had not yet been tested at this level of complexity. Software considerations involved choosing between an existing off-the-shelf expert system "shell" and custom programming. A shell was chosen: even though custom programming could provide a design unique to the Kansas situation, it was felt that the expert system shells were adequate to our application needs, and that time and cost factors outweighed any advantage that custom programming might provide. The expert system shell chosen was EXSYS (later, EXSYS Professional, an upgrade, when that became available). CLIPPER was also selected at this time. CLIPPER was used as a database manager that handled storage and retrieval functions for the system. The prototype could have been demonstrated with EXSYS alone, but the team felt that CLIPPER provided additional capabilities useful to the project.

THE DEVELOPMENT PROCESS

In building the Kansas Nonmonetary Expert System, there were three groups of people, who contributed complementary skills to the knowledge acquisition. They were the domain experts, the knowledge engineers, and the end users. The <u>domain experts</u> were chosen from the Kansas staff as being particularly expert in State law pertaining to nonmonetary determinations. ERC also provided domain experts in the nonmonetary area, as well as the <u>knowledge engineers</u>, who actually built the system from the EXSYS Professional shell. Also, ERC trained Kansas staff in the knowledge engineering aspects of the expert system.

A third group was also designated. When designing any sort of automated system, the contribution of the <u>end users</u> is often ignored. The team felt that the users of the expert system would have valuable insights into how the local offices actually functioned - what the procedures were and how the procedures functioned in real-life situations. The end users also tested the system throughout the entire development cycle for user friendliness and consistency.

The project was divided into four processes: Phase I, Phase II, Testing, and Evaluation. <u>Phase I</u> involved selection of hardware and software (as explained above) and establishment of the separation issues to consider. The team selected the eleven exceptions to Kansas' Voluntary Quit (VQ) laws since these laws are structured and discrete, and have ample supporting documentation. Also, the allow-denial rate for determinations for the 11 exceptions was 51%-49%, which would enhance the statistical validity.

There was one minor processing procedure altered in the two local office sites to accommodate the PCs used to generate the nonmonetary expert system decisions:

● The claimstaker took the statement from the claimant.

If the claimant stated that he had quit voluntarily, the claimstaker brought the claimant and his statement to the expert system workstation to gather and print the necessary information. Then the normal adjudication process was resumed.

The ERC/Kansas team then developed Prototype I to test the basic premise - that an expert system could produce valid nonmonetary decisions. Two of the 11 exceptions - VQ for Better Job, and VQ for Delayed or Rejected Entry into the Military - were selected, because they were relatively easy to define and were well-documented. The Kansas domain experts gathered information about these two exceptions, and the ERC knowledge engineers wrote a simple expert system with 18 rules.

There were four prototypes developed in Phase I, during which the 11 Voluntary Quit exceptions were developed and tested incrementally. Each prototype was built on lessons learned during the previous prototype, and whether the system:

- Displayed user friendliness. This led to the development of a main menu and revisions to the decision screen

- Addressed the majority of questions necessary for that particular VQ exception

- Would promote consistency and continuity

- Would render a proper decision.

Phase II provided a statistical basis for the demonstration. One hundred cases were collected for later comparison with the test cases, and a sample size was established, considering population size, population error rates, and a confidence factor. During Phase II, the system was "pre-tested" under field conditions, and documentation was prepared, consisting of a software development

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guide, the logic files (rules), and attribute hierarchy charts.

With the procedures, the expert system itself, the statistical basis, and documentation all in place, the Testing could begin. The team had selected one urban and one suburban site for taking claims (Kansas City and Overland Park, respectively).

One hundred claimants were interviewed at the two sites. The ERC/Kansas team had previously decided that the system would not make a decision when the facts were in dispute (i.e., when the employer disagreed substantially in part or in whole with the claimant's statement), since the expert system is designed to judge the facts presented, and not the validity of the facts. In this fashion, 36 cases were eliminated, which left us with 64 cases with which to evaluate the system. This was fewer than had been anticipated, although the number was sufficient to assure statistical reliability.

The Evaluation phase applied rigorous statistical analysis to the raw data gathered during the Testing. Variables used during evaluation included Statewide, comparison (control) data, and test figures for cases per exception issue, appeal activity by issue, and claimant interview time by issue.

Of course, the most important statistic of all was comparing the decisions rendered by the Kansas Nonmonetary Expert System with the determinations issued by the Deputy Examiner. And when there was a disagreement between the two, a special panel of experts called the Kansas Evaluation Review Panel determined the correct decision. The team also tracked those four cases that were appealed, where the expert system and the Kansas Evaluation Review Panel disagreed.

The finding were very encouraging. Of the sixty-four cases adjudicated, we found:

●   In 52 cases, the expert system and the Deputy Examiners

agreed outright

- Of the 12 remaining cases where the expert system and the Deputy Examiners disagreed, the Kansas Evaluation Review Panel agreed with the expert system decision in eight of the cases, and with the Deputy Examiners in four cases

- Of the 4 remaining cases where the Kansas Evaluation Review Panel agreed with the Deputy Examiners and disagreed with the expert system, the Appeals Referee agreed with the expert system twice and with the Kansas Panel twice.

DEPLOYMENT STATUS

The Kansas Nonmonetary Expert System has been a success. It did what it set out to do, and it provided a level of agreement well beyond initial expectations.

The State of Kansas applied for and received a Federal Automation Grant to expand the expert system. ERC bid on and won the solicitation. The main thrust of this effort was threefold: to finish the last coding for the Voluntary Quit module; to convert the development shell from EXSYS Professional to a shell called AION; and, to expand the scope (using AION) of the expert system to include misconduct issues. Work continues on the development of this misconduct module, which will require a more extensive set of rules than the VQ module.

BENEFITS

The Kansas Nonmonetary Expert System demonstrated several advantages. Among the benefits cited in the Final Report: Kansas Nonmonetary Expert System Prototype (Unemployment Insurance Occasional Paper 90-1, U.S. DOL/ETA) are:

- Providing consistent, in-depth factfinding specific to potentially disqualifying issues

- Structuring interviews so that only information necessary for the determination of eligibility is collected, thus excluding extraneous information

- Meeting State and Federal requirements for factfinding documentation that is complete and accurate

- Ensuring that decisions reached are consistent with State law

- Operating by relatively inexperienced personnel

- Use as a training aid.

THE FUTURE

Based on the results of the Kansas Nonmonetary Expert System, the future of computers to aid in the nonmonetary determination process is encouraging.

There were three major recommendations made as a result of the study.

- There is much interest in seeing expert system technology expanded into other unemployment areas, such as DUA (Disaster Unemployment Assistance) and TAA (Trade Adjustment Assistance). Since these are Federal programs, their application is truly nationwide, rather than state-specific, like nonmonetary expert systems are

- Expert system technology is a great training aid. It

can use the collected knowledge and experience of the
domain experts to train new personnel. It can train
personnel in their local offices, and the training can
be made interactive. Changes in State or Federal law
can be easily incorporated into the expert system

- Additional analyses of the usefulness of expert systems
in other nonmonetary areas should be addressed,
including UI functional areas (cost, promptness, and
performance [QPI]), and operational areas, such as tax
and Benefit Payment Control activities.

MAINE EXPERT SYSTEM PROJECT

PREVIEW

From the U.S. Department of Labor perspective, the purpose of sponsoring Maine's expert system project was to build upon the knowledge developed from the Kansas Nonmonetary Expert System Prototype. Of particular interest was Maine's proposal to explore employer-claimant fact-finding in nonmonetary decision making. In addition, the use of a different expert system software shell—KES—offered the prospect of obtaining expanded software knowledge and experience.

The Maine Department of Labor's expert system team that presented and demonstrated their "Nonmonetary Determination Expert System Prototype" at the Colloquium consisted of:

    John Costello -- Project Manager

    Peter McMann -- Domain Expert

    Pamela Christman -- Knowledge Engineer

    Catherine Squires -- Knowledge Engineer

John R. McKernan, Jr.
Governor

DEPARTMENT OF LABOR
BUREAU OF EMPLOYMENT SECURITY

Charles A. Morrison
Commissioner

Mary Lou Dyer
Executive Director

TO: Colloquium Organizers, Attendees, and Other Interested
           Parties
FROM: The Maine Expert Systems Project Team

SUBJECT: Responses to the Expert Systems Colloquium
DATE: July 23, 1991

First, the Maine Expert Systems Project Team would like to thank
the Organizers of the Colloquium for their successful efforts
toward an informative, cooperative, and interesting conference.
The conference was a great opportunity to share ideas, problems,
etc. with others who are going through the expert systems
development process.   It was also an opportunity to have
knowledgeable people look at and comment on our expert systems at
their then current stage of development.

Secondly, the Expert Systems Project Team would like to update
everyone on the current status of our system as it pertains to
issues brought up at the Colloquium.   The State of Maine's
experience at the Expert Systems Colloquium was extremely
beneficial to us and to our system. We feel that the design and
workings of the system were received in a very positive light. But
the best things to come out of the Colloquium, for us, had more to
do with Expert Systems philosophy as applied to the Unemployment
Insurance field.

As a direct outgrowth of some of the lively debates (and sometimes
heated discussions) that occurred at the Expert Systems Colloquium
(and after hours), we have incorporated a few changes in our system
that bear pointing out. It should be noted that our Expert System
has been designed to render a decision and serve only secondarily
as a training tool for new Claims Adjudicators.   Owing to this
fact, a great subject of debate seemed to focus on how far the
system should probe into fact finding and how much should still be
left to the Claims Adjudicator. In other words, should we require
the Claims Adjudicator to answer many, many questions in minute
detail?   Or should we phrase our questions in broader terms
allowing the Claims Adjudicator to ask a few questions of the
claimant to get at the answer to one question in the Expert System?

After many discussions amongst our staff, we have expanded some of
our questions so that they are composed of a number of more
detailed questions. We have also expanded some questions that only
allowed yes/no answers to accept a number of answers. For example,

the following attributes (or questions) in the illness knowledge base were expanded as described above: JOB_RELATED, SERIOUS_ILL, OTHER_ARRANGE, and A_A_FAMILY. Refer to Attachment A of Maine's Report to see the questions as they were phrased before this expansion. We have tried to limit our level of detail to that which the Claims Adjudicator normally investigates. If we design expert systems that go beyond that level of detail in even the most clear-cut cases, the system will become cumbersome and cease to be used.

We are still wrestling with another of those philosophical issues discussed at the Colloquium. That is the issue of asking Claims Adjudicators to draw conclusions. We have taken some of the obviously "conclusory" attributes (or questions) and broken them down further into a series of fact finding questions, and required the system to make a decision. Yet, there are still many potentially "conclusory" questions that seem to require the Claims Adjudicator to draw a conclusion. It seems that this will always be a problem where the law is not specific (i.e. How much is "reasonable?" What is it to do something "in good faith?" When is an extenuating circumstance considered "good cause?"). These are conclusions drawn each day by people, yet we want our expert system to decide purely on the basis of "facts" without drawing any conclusions. These are interesting problems that we do not yet have concrete answers to. Continued development and discussions in the area of expert systems, as applied in the UI environment, should begin to give us clearer answers to these questions.

Again, we would like to thank both the Colloquium's organizers and attendees.

Maine Department
of Labor
Unemployment
Insurance

Nonmonetary
Determination
Expert System
Prototype

**Artificial Intelligence
Colloquium**

**June 12, 13, and 14, 1991
Austin, TX**

Project Team:

John Costello - Project Manager
Peter McMann - Domain Expert
Pamela Christman - Knowledge Engineer
Catherine Squires - Knowledge Engineer

DEVELOPMENT OF THE MAINE NONMONETARY EXPERT SYSTEM PROTOTYPE

Project History

This project received its impetus from the difficult nature of nonmonetary decision making. The goals of development of a nonmonetary decision making expert system were to decrease the average three year learning curve of new Claims Adjudicators, to increase the consistency of nonmonetary determinations and to allow Claims Adjudicators to spend more time on the more complex decisions by taking care of the more mundane cases. The prototype was subsequently designed with help screens attached to the questions asked by the Non-Monetary Expert (NoME) system. UI staff has noted that the NoME could be an excellent training tool for the above mentioned reasons.

Once Department of Labor staff decided to submit grant proposals for a NonMonetary Expert system, the staff began to research nonmonetary decision making more thoroughly. The voluntary leaving issue was chosen to be prototyped because of its frequency of occurence in Unemployment Insurance claims, and because the issue seemed to offer a serious challenge, yet was not beyond what is normally expected of a prototype system.

The next phase of preparation for the submittal of a proposal was product research. Maine Department of Labor staff reviewed and evaluated many inference engines with which to develop the proposed expert system. KES II was finally chosen for several reasons. It is a backward chaining, rule-based engine; it runs on a myriad of disparate operating systems; and it is seamlessly embeddable in C code. This embedding allows any level of integration with communication modules, databases, custom-designed user interfaces, and other flexibilities to be discussed in the body of this report.

Grant proposals were submitted three times, and on the third attempt, Maine entered into a contract with the U.S. Department of Labor to produce a Non-Monetary Voluntary Quit Expert System (the NoME).

The Procedure

The data modeling procedure and general approach for the Maine Department of Labor's Expert System Prototype can be broken into seven basic areas. They are as follows: 1) Sub-issues, 2) Fact Finding, 3) Decision Trees, 4) Rule Coding, 5) Embedding the Knowledge Bases, 6) Report Generation, and 7) Integration into the Nonmonetary Determination Decision Writing Program.

Sub-Issues

For the purposes of structure and organization, the voluntary quit issue was divided into sixteen sub-issues. This technique allowed the knowledge engineer and the domain expert to explore each aspect of the voluntary quit issue in greater depth and with more attention to detail than if the issue were dealt with as a whole. Refer to Figure 1 for a list of the sub-issues and their associated knowledge bases. At this point, any overlap between the sub-issues is merely noted.

Fact Finding

The preliminary fact finding stage consisted of extensive and intensive "brainstorming" sessions between the UI nonmonetary decision making expert and the knowledge engineer . These sessions involved the domain expert's explaining the fact finding procedure actually involved in making a nonmonetary determination. The expert then broke the voluntary quit issue into the sixteen sub-issues mentioned above. These sub-issues were discussed at length by the expert and the knowledge engineer. When the knowledge engineer was thoroughly comfortable with each issue, she was allowed to observe a number of fact finding interviews to understand the flow of information between the claimant and the Claims Adjudicator.

Decision Trees

Upon completion of the preliminary fact finding sessions, true data modeling began. The knowledge engineer, working closely with the expert, mapped out the lines of questioning that would be used by a Claims Adjudicator in an actual interview. Figure 2 is an example of a decision tree for the voluntary quit sub-issue "Illness of self or family member." Figure 2 shows the line of questioning that would be followed once it has been established that we are dealing with the voluntary quit issue and the "Illness" sub-issue. Once the "line of questioning (decision tree)" is well-formulated, thorough, and complete and once it covers all possible paths, rule coding can begin.

Attribute Creation and Rule Coding

The process of rule coding follows directly from the paths outlined by the decision trees. The knowledge engineer begins by translating each decision point on the tree into an attribute, or fact that must be ascertained. These attributes each have associated questions that will be asked of the user should the expert system require the information. Most of the attributes also have explanations that act as context sensitive help in the form of pop-up help screens.

Once the attributes have been created, they are arranged into rules according to the dictates of the decision tree where their ultimate goal is to obtain a value for BENEFITS. The value of BENEFITS will determine whether an Unemployment Insurance claimant is deemed eligible to receive benefits. For example, the first and most simple rule in the illness knowledge base, as seen below, corresponds to the denial point at the upper right corner of the illness decision tree map (Figure 2).

```
    OTHER_SICK:
if
  status(EMPLOYER_PRESENT) = known
  WHO_SICK = OTHER and
  status (WHO) = known
then
  BENEFITS = DENIED.
endif.
```

Example: Sample Rule from the
Illness Knowledge Base

Attachment A consists of the complete code for the illness knowledge base. It contains rules that govern all outcomes of the decision tree.

Each of the sixteen sub-issues were mapped out and coded in this manner. In order to create a cohesive voluntary quit decision making system, the knowledge bases were then embedded in a controlling C language program.

Embedding

The C program acts as an umbrella to the sixteen, individual knowledge bases (see Figure 3). In addition to providing a user interface (written in C using curses libraries), the C program performs the following functions: 1) the opening and closing of knowledge bases, 2) the communication of facts from one knowledge base to another, 3) the "freezing" and "thawing" of knowledge bases, and 4) the generation of final reports.

Once embedded, the knowledge bases no longer appear to be separately coded entities, but function as one, integrated expert system. The C program handles the opening and closing of the knowledge bases according to the user's response to the question "Why did the claimant separate from his/her job?" (see Figure 4). The opening and closing of knowledge bases is completely transparent to the user.

There are situations in many of the sub-issues where the line of questioning does not lead to a definitive value of BENEFITS, but rather it leads into a different sub-issue. The C program allows the user to pass from one knowledge base into another, although the user does not see this occur. Furthermore, to avoid asking repetitive questions of the user in the second knowledge base, the C program carries the relevant facts collected in the first knowledge base to the second, the result being a very smooth and natural transition from one sub-issue to another. This process is referred to as "attribute passing".

An example of knowledge base transitions and attribute passing may be seen in the illness, on-the-job illness, and health and safety sub-issues. Because these sub-issues are closely related, there are various points within each of them that logically transition the user from one sub-issue to the next. The decision trees for each of these sub-issues (Figures 2, 5, and 6) clarify the relationships among these particular knowledge bases. Figure 7 illustrates one possible path the user may take through the three knowledge bases. Keep in mind that this transistion is transparent to the user.

Through illness, the first issue explored in this case, the user establishes the following facts: 1) the claimant is or has been ill; 2) the specific complaint is an illness, as opposed to an injury, drug/ alcohol dependency, or pregnancy; and 3) the illness is directly attributable to the claimant's employment. At this point, the sub-issue changes from illness to on-

the-job illness in order to pursue the proper line of questioning. The C program begins execution of the on-the-job illness knowledge base. Having initiated the questioning under the illness sub-issue, the user has already determined some facts relevant to the on-the-job illness sub-issue. In order to avoid re-ascertaining these facts, the C program passes the pertinent information to the on-the-job illness knowledge base (now the current knowledge base). Figure 7 indicates which attributes in the on-the-job illness knowledge base correspond to which attributes collected in the illness knowledge base. These common attributes represent those questions that will not be asked again within the successive knowledge base.

The path through on-the-job illness ascertains the following additional information: 1) the claimant's illness was not stress; 2) the actual free form text explaining the illness; 3) the illness did not require the claimant to lose time from work. This last fact distinguishes the on-the-job illness sub-issue from the health and safety sub-issue. The C program subsequently begins the health and safety knowledge base. Again, the system already "knows" some of the facts relevant in the health and safety sub-issue, so these are passed along in the transition (See Figure 7). The health and safety sub-issue gleans the last two facts necessary before assigning a value to BENEFITS: 1) the claimant's situation is not likely to recur; and 2) the claimant does not have any additional health and safety concerns. At this point, the system gives BENEFITS a value of DENIED, basing the decision ultimately on the health and safety sub-issue.

As illustrated in the previous example, the user can advance freely and transparently from knowledge base to knowledge base as warranted by the case, while never having a sense of awkward and confusing transitions.

Due to the nature of some of the sub-issues, the C program also handles functions referred to as "freezing" and "thawing" knowledge bases. The process entails the saving, or "freezing", of all the facts collected in a knowledge base when the user either exits the system to wait for more information or transitions out of the current knowledge base into the harassment issue.

The first of these situations may be seen in the illness sub-issue in a case where the user cannot answer a question until he/she has a note from the claimant's doctor. Where relevant, the user is given the option of exiting and saving the information until a doctor's note is available. The "freeze/thaw" module of the C program then saves this information and will subsequently "thaw" it (if so directed by the user) the next time he/she enters the system with the same claimant Social Security number.

The second situation in which the "freeze/thaw" module is used is the case where one sub-issue leads into the harassment sub-issue. Due to the nature of the harassment issue, the user may want to abandon the harassment approach and return to the point in the system at which he/she left off before entering harassment. In other words, the user may want to change his/her mind about using the harassment approach, and the "freeze/thaw" module allows that choice. When the harassment knowledge base is called from another knowledge base, the C program "freezes" the information and enters the harassment issue. Each question in the harass-

ment knowledge base includes an option that will allow the user to go back to the issue immediately preceding the harassment issue. When the user chooses this option, the C program "thaws" the saved file and returns to the initial knowledge base to pick up where the user left off.

Once the system reaches a decision on the value of BENEFITS, the C program handles the printing of a report, summarizing the information collected in the case, the reasoning used in making the decision, and the conclusion reached by the expert system. Refer to Attachments B (blank report form) and C (report form merged with data). The report includes the claimant's name, Social Security Number, and address.

By embedding the knowledge bases in C, the user is provided with a cohesive, user-friendly, flexible decision making system. In addition, the embedding process allows for each issue to be its own independent knowledge base, which provides an ideal environment for future maintainance and modifications due to changes in and interpretation of the UI law.

Integration

By embedding the expert system, we have already allowed ourselves maximum flexibility. The "freeze-thaw" module, "attribute passing," and report writing, as well as the user interface were all accomplished or developed using the C programming language (Refer to figure 8). The system now asks the end user (Claims adjudicator) to enter the claimant's biographical information, yet because the system is embedded in C, we can easily communicate with the UI mainframe database to obtain this information. Beside expanding the sys-

tem to include the other issues in non-monetary determinations, other possible extensions of this project include allowing much more opportunity for free form text, expanding on report writing, and even ending an expert system session by establishing a link with word processing, allowing for text editing of a non-monetary report.

Summary and Conclusion

The Maine Nonmonetary Determination Expert System prototype presently consists of sixteen independent knowledge bases embedded in a controlling C program. Because the knowledge bases are embedded, the system functions as a cohesive expert system where the transfering in and out of the individual knowledge bases is transparent to the user. From the standpoint of maintenance and future development of the expert system, the sixteen knowledge bases act as distinct program modules that may be individually modified without disturbing the C program shell. In addition, the C program provides the flexibility of future integration into a larger UI Nonmonetary Decision Making System. The possibilities for such a system include communication capabilities to the UI mainframe database and development of a word processing module for an expanded report writing facility.

Currently the Maine Department of Labor staff is in the process of conducting an initial evaluation of the NoME. The strategy for evaluating the system con-

sists of both alpha testing using 250 actual documented Voluntary Quit cases and future beta testing in a Department of Labor local office. The expected results of the alpha test, at this point, include minor changes to the content and phrasing of questions. The evaluation to this point has not suggested a need for substantial structural changes. The NoMe has maintained a 90% - 95% rate of agreement with the Claims Adjudicators' decisions throughout the testing. Presently, 175 cases have been run through the system and the current rate of agreement is 94%. It should be noted that the alpha testing has relied entirely on the Claims Adjudicator's documented fact finding, which has biased the fact finding entered toward the decision made by the Claims Adjudicator. The beta testing will involve significant changes in the testing manner, since the testing will be interactive as opposed to after-the-fact.

Sub Issues of the Voluntary Quit Issue

Sub Issue	Associated Knowledge Base
1) To accompany, follow, or join spouse	spouse.kb
2) Illness of self or family member	illness.kb
3) To accept a new position	newpos.kb
4) To retire	retire.kb
5) Moved to a new area	moved.kb
6) On-the-job illness or injury	ojill.kb
7) To become self-employed	selfemp.kb
8) To take an unpaid leave or sabbatical	sabbat.kb
9) Health and safety concerns	hsafe.kb
10) Wages and/or hours	wandh.kb
11) Harassment	harass.kb (inithar.kb)
12) Imminent layoff	layoff.kb
13) Religious reasons	religion.kb
14) Personal reasons	personal.kb
15) Working conditions	workcond.kb
16) Other reason not listed above	other.kb

Figure 1

Figure 2

-40-
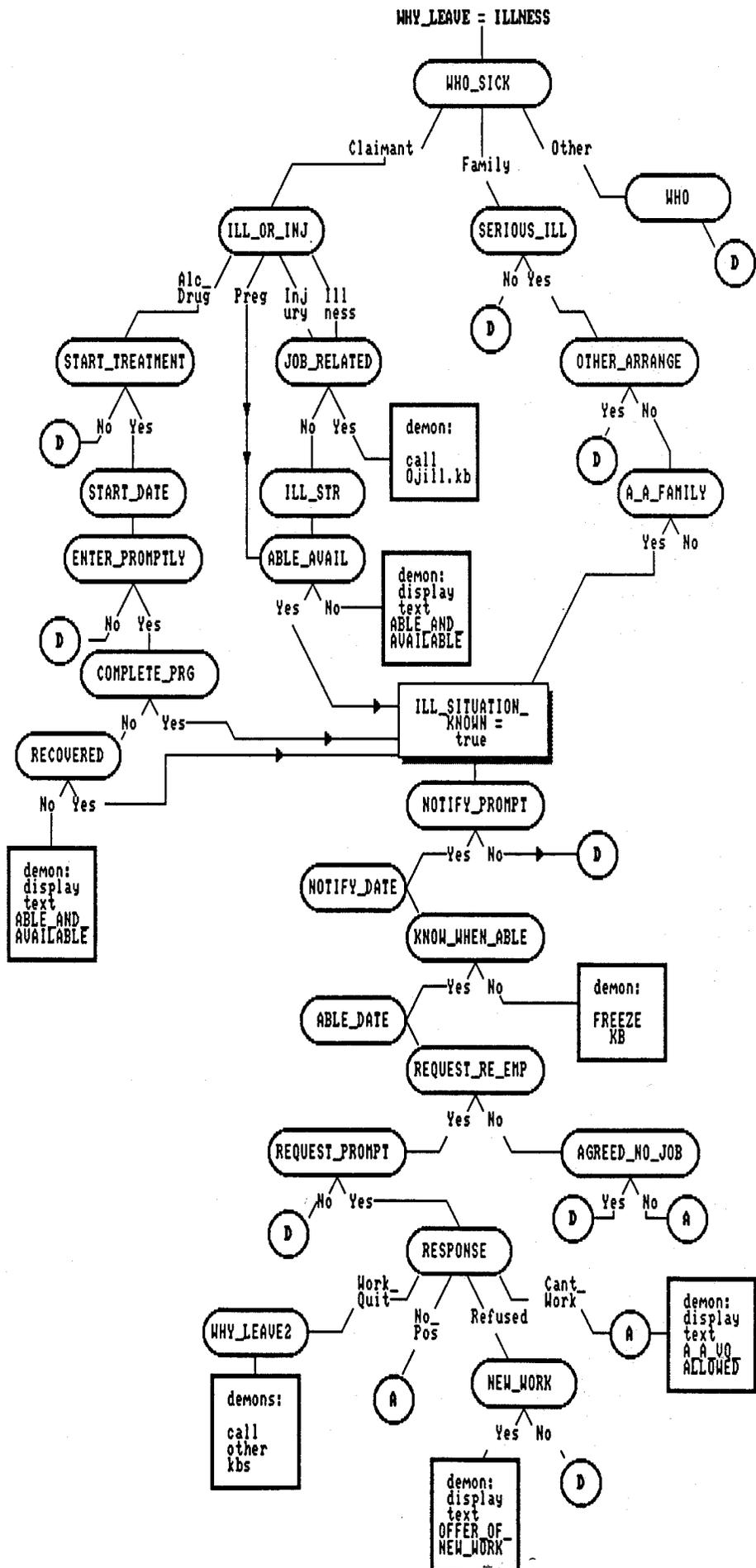
```
constants:
    RPT_TXT:
        "The claimant left his/her regular employment voluntarily on ".
%

text:

  {ABLE_AND_AVAILABLE: " ",
"Since the claimant left his/her job due to an off-the-job illness/injury",
"and is not yet recovered and able to work, a Claims Adjudicator's decision",
"on the Voluntary Quit issue will be 'deferred'.  A decision will be written",
"to deny benefits on the Able and Available issue.  In that decision, the",
"Adjudicator should include a statement that the Voluntary Quit issue is",
"being 'deferred' until the claimant is able to work."}

  {A_A_VQ_ALLOWED: " ",
"The claimant should be allowed benefits on the Voluntary Quit issue because",
"he/she is able to do some work.  However, the Able and Available issue must",
"be thoroughly explored."}

  {OFFER_OF_NEW_WORK: " ",
"This is not a Voluntary Quit issue.  It should be explored as an Offer of",
"New Work issue."}

  {BAD_DATE: "Please re-enter date in the correct format (mm/dd/yy)."}

%

patterns:

DIGIT: [0-9].

YRS:   ("90" | "91").

ZERO: ("0"<0-1>).

ONE_TO_9: (ZERO & [1-9]).

TEN_TO_29: ([12] & DIGIT).

TEN_TO_19: ([1] & DIGIT).

TWENTY_TO_28: ([2] & [0-8]).

DATE_FORMAT_31:
  \months 1,3,5,7,8,10, and 12 have 31 days
  MONTH = ( ZERO & [13578] | "10" | "12") &
      "/" &
  DAY  = ( ONE_TO_9 | TEN_TO_29 | "30" | "31") &
      "/" &
  YEAR = YRS.

DATE_FORMAT_30:
  \months 4,6,9, and 11 have 30 days
  MONTH = (( ZERO & [469]) | "11") &
```

Attachment A - 1

```
         "/" &
DAY  = (ONE_TO_9 | TEN_TO_29 | "30") &
         "/" &
YEAR  = YRS .


DATE_FORMAT_28:
 \month 2 has 28 days in '90 and '91
 MONTH = ( ZERO & "2") &
         "/" &
 DAY  = (ONE_TO_9 | TEN_TO_19 | TWENTY_TO_28 ) &
         "/" &
 YEAR  = YRS.


DATE_FORMAT:
 \matches any month - use on strings which have already passed stricter
 \tests
 MONTH = DIGIT<1-2> &
      "/" &
 DAY  = DIGIT<1-2> &
       "/" &
 YEAR  = YRS.


TWO_DIGITS:
\This pattern is used to find a 2-digit DAY
 TENS  = DIGIT &
 ONES  = DIGIT .



%

types:

yn:sgl
 (YES
 {question:"yes"},
 NO
 {question:"no"}).

yni: sgl
  (YES
    {question: "yes"},
   NO
    {question: "no"},
   IRRELEVANT
    {question: "not addressed by employer"}).

yndr:sgl
 (YES
 {question:"yes"},
 NO
 {question:"no"},
 NEED_DR_NOTE
 {question: "exit and save information until a doctor's note is available"}).

%

attributes:
```

Attachment A - 2

```
KB_NUM: int [default: 2]
  {COM: "true"}
  {RPT: "false"}.

WHEN_LEAVE: str
  {question: "When did the claimant separate from his/her job?"}
  {COM: "true"}
  {RPT: "false"}.

\\\\Report attributes:

FORM: str
  {COM: "false"}
  {RPT: "true"}.

FACTS: str
  {COM: "false"}
  {RPT: "true"}.


\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
\\ Illness input attributes
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

EMP_PRES:yn
  {question:
"Is the employer present (or do you have a statement from the employer)?"}
  {COM: "false"}
  {RPT: "false"}.


EMPLOYER_PRESENT: truth
  {COM: "true"}
  {RPT: "false"}.
WHO_SICK:sgl
  (CLAIMANT
    {question:"the claimant"},
  FAMILY
    {question:"a member of the claimant's immediate family"},
  OTHER
    {question: "a member of the claimant's extended family or a friend"})
  {question:
"Who has or had the illness or injury causing this determination to",
"be made?  [e]"}
  {explain: " ",
"According to Commission Rule 1.1(P), 'Immediate family' consists of 'the",
"claimant's spouse, children, step-parents, brothers or sisters, or relatives",
"who have been acting in the capacity of a parent of either the claimant or",
"spouse.'  Note that the children, parents, step-parents, brothers and",
"sisters of both the claimant and his/her spouse are covered by this",
"definition as well as relatives who have been acting in the capacity of a",
"parent."}
  {COM: "true"}
  {RPT: "false"}.

WHO: str
  {question:
"Please enter the claimant's relationship to the person who was sick:"}
  {COM: "true"}
  {RPT: "false"}.
```

Attachment A - 3

```
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
\illness - self attributes
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

ILL_OR_INJ:sgl
 (ILL
  {question:"an illness"},
  INJ
  {question:"an injury"},
  ALC_DRUG
  {question:"alcohol and/or drug addiction"},
  PREG
  {question:"pregnancy, including complications before or after delivery",
          "    and involving the mother or the child"})
 {question:"This situation involves:"}
 {COM: "true"}
  {RPT: "false"}.

ABLE_AVAIL:yndr
 {question:"Is the claimant currently able to work?"}
 {COM: "true"}
  {RPT: "false"}.

ILL_STR:str
 {question:
"Please briefly explain the illness or injury (in one line or less): "}
 {COM: "true"}
  {RPT: "false"}.

JOB_RELATED:yndr
 {question:
 "May this illness or injury be attributed to the claimant's",
 "employment?"}
 {COM: "true"}
  {RPT: "false"}.

START_TREATMENT_PRG: yn
 {question:
"Did the claimant enter a treatment program?"}
 {COM: "true"}
  {RPT: "false"}.

START_DATE: str
  {question:
"Please enter the date that the claimant entered into treatment.",
"(MM/DD/YY)"}
  {COM: "true"}
  {RPT: "false"}.

ENTER_PROMPTLY: yn
  {question:
"Did the claimant promptly enter the treatment program?  [e]"}
  {explain: " ",
"In order to be considered to have left work to promptly enter a treatment",
"program, the claimant should enter the treatment program within one week",
"of his/her last day of work."}
  {COM: "true"}
```

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Attachment A - 4

{RPT: "false"}.

COMPLETE_PRG: yn
  {question:
"Did the claimant complete the program? [e]"}
  {explain: " ",
"If the claimant has successfully completed the program, it is assumed that",
"he/she is recovered and fully able to resume work."}
  {COM: "true"}
  {RPT: "false"}.

RECOVERED: yndr
  {question:
"Despite the fact that he/she did not complete the treatment program,",
"is the claimant in fact able to return to work? [e]"}
  {explain: " ",
"'Recovery', for purposes of determining when the claimant should request",
"re-employment would be when the claimant was released from the treatment",
"program or when the person or organization operating the treatment program",
"determined that the claimant was again able to work."}
  {COM: "true"}
  {RPT: "false"}.

\\\
\illness - family attributes
\\\

SERIOUS_ILL:yndr
  {question:
"Was the illness serious enough to warrant the claimant's absence",
"from work? [e]"}
  {explain: " ",
"In evaluating whether or not the immediate family member's illness was",
"serious enough to warrant the claimant's absence from work, it may be",
"helpful to obtain a note from the immediate family member's doctor.",
"However, since the immediate family member could not be required to",
"obtain that note, the Adjudicator may have to evaluate the seriousness",
"of the condition based on the claimant's statements."}
  {COM: "true"}
  {RPT: "false"}.

OTHER_ARRANGE:yn
  {question:
"Are there other arrangements that could easily have been made by the",
"claimant to avoid his/her absence from work?"}
  {COM: "true"}
  {RPT: "false"}.

A_A_FAMILY: yn
  {question:
"Has the family member recovered to the point where it is reasonable",
"for the claimant to return to work?"}
  {COM: "true"}
  {RPT: "false"}.

\\\
\illness - generic attributes

Attachment A - 5

```
KNOW_WHEN_ABLE: sgl
  (YES
    {question: "yes"},
   NEED_DR_NOTE
    {question:
"no -- exit and save information until doctor's note is a available"})
  {question:
 "Do you know what date the claimant was able to return to work?"}
   {COM: "false"}
   {RPT: "false"}.


ABLE_DATE: str
  {question:
"Please enter the date that the claimant was able to return to work.",
"(MM/DD/YY)"}
   {COM: "false"}
   {RPT: "false"}.


NOTIFY_DATE: str
  {question:
"Please enter the date that the claimant notified the employer of his/her",
"absence.  (MM/DD/YY)"}
   {COM: "true"}
   {RPT: "false"}.


REQUEST_DATE: str
  {question:
"Please enter the date that the claimant requested re-employment.",
"(MM/DD/YY)"}
   {COM: "false"}
   {RPT: "false"}.


NOTIFY_PROMPT_CLMT:yn
 {question:
"Does the claimant state that he/she notified the employer of the reason",
"for his/her absence promptly and in accordance with the employer's rules",
"and regulations?"}
  {COM: "true"}
  {RPT: "false"}.


NOTIFY_PROMPT_EMP:yni
 {question:
"Does the employer confirm that the claimant notified him/her of the reason",
"for the absence promptly and in accordance with the employer's rules",
"and regulations?"}
  {COM: "true"}
  {RPT: "false"}.


NOTIFY_PROMPT:yn
 {question:
"Did the claimant notify the employer of the reason for his/her",
"absence promptly and in accordance with the employer's rules and",
"regulations? [e]"}
   {explain: " ",
"The claimant needs to make a reasonable effort to promptly notify his/her",
"supervisor (or other person whom, according to the employer's policy,",
```

Attachment A - 6

"employees are supposed to notify when absent) as to the reason for absence."}
 {COM: "true"}
 {RPT: "false"}.

REQUEST_RE_EMP: yn
 {question:
"Did the claimant request re-employment?"}
 {COM: "false"}
 {RPT: "false"}.

REQUEST_PROMPT_CLMT:yn
 {question:
"Does the claimant state that he/she requested re-employment promptly after",
"the absence and in accordance with the employer's rules and regulations?"}
 {COM: "false"}
 {RPT: "false"}.

REQUEST_PROMPT_EMP:yni
 {question:
"Does the employer confirm that the claimant requested re-employment promptly",
"after the absence and in accordance with the employer's rules and",
"regulations?"}
 {COM: "false"}
 {RPT: "false"}.

REQUEST_PROMPT:yn
 {question:
"Comparing the date on which the claimant was able to work and the date",
"on which the claimant requested re-employment, did the claimant meet the",
"requirement that he/she promptly request re-employment? [e]"}
 {explain: " ",
"To meet the requirement that he/she 'promptly' request re-employment as",
"soon as he/she is able to work, the claimant should contact the employer",
"as soon as is practical after he/she recovers. For example, if a claimant",
"had a doctor's appointment on a Friday, and requested re-employment on the",
"following Monday, that would be a 'prompt' request for re-employment. On",
"the other hand, if a claimant recovered on a Monday, but did not request",
"re-employment until the following week, that would NOT be a 'prompt' request",
"for re-employment, unless there were some extenuating circumstances, such as",
"a plant shut-down."}
 {COM: "false"}
 {RPT: "false"}.

AGREED_NO_JOB:yn
 {question:
"Do the claimant and the employer agree that there was no job for the",
"claimant to return to after his/her absence?"}
 {COM: "false"}
 {RPT: "false"}.

RESPONSE_CLMT:sgl
 (WORK_QUIT
   {question: "The claimant returned to work and then quit"},
 NO_POS
   {question: "There was no longer any position available for the claimant"},
 REFUSED
   {question: "The employer offered the claimant a different position and",
   "   the claimant refused"},

Attachment A - 7

```
CANT_WORK
    {question: "The claimant could not physically perform his/her old job"})
 {question:
"According to the claimant, what happened after he/she requested",
"re-employment?"}
 {COM: "false"}
 {RPT: "false"}.
RESPONSE_EMP:sgl
 (WORK_QUIT
   {question: "The claimant returned to work and then quit"},
 NO_POS
   {question: "There was no longer any position available for the claimant"},
 REFUSED
   {question: "The employer offered the claimant a different position and",
          "    the claimant refused"},
 CANT_WORK
   {question: "The claimant could not physically perform his/her old job"},
 IRRELEVANT
   {question: "Not addressed by employer"})
 {question:
"According to the employer, what happened after the claimant requested",
"re-employment?"}
 {COM: "false"}
 {RPT: "false"}.


RESPONSE:sgl
 (WORK_QUIT
   {question: "The claimant returned to work and then quit"},
 NO_POS
   {question: "There was no longer any position available for the claimant"},
 REFUSED
   {question: "The employer offered the claimant a different position and",
          "    the claimant refused"},
 CANT_WORK
   {question: "The claimant could not physically perform his/her old job"})
 {question:
"What happened after the claimant requested re-employment?"}
 {COM: "false"}
 {RPT: "false"}.


WHY_LEAVE2:sgl
 (SPOUSE
   {question:"to accompany, follow, or join spouse  [e 1]"}
   {explain:"This situation would occur when the claimant separates in order",
        "to accompany, follow, or join his/her spouse to a new place of",
        "residence.  Choose this option if the new place of residence",
        "requires a commute beyond normal commuting distance.  Otherwise",
        "choose the option 'other'.",
        ""},
 ILLNESS
   {question:"illness of self or family member  [e 2]"}
   {explain:"This situation includes illness of the claimant or a member of",
        "his/her immediate family.  Distinguish this option from an",
        "on-the-job illness or injury.",
        "Immediate family is defined in Commission Rule 1.1.P to include",
        "\"the claimant's  spouse, children, parents, step-parents,",
        "brothers or sisters, or relatives who have been acting in the",
        "capacity of a parent of either the claimant or spouse.\"",
```

Attachment A - 8

""},
NEW_POSITION
{question:"to accept a new position [e 3]"}
{explain:" Choose this option if the claimant \"left employment in",
        "good faith and accepted new employment on a permanent full-time",
        "basis.\" Employment Security Law 1193.1A",
        "\"The claimant does not actually have to commence work",
        "with the new employer if the employer has either postponed or",
        "withdrawn the job offer. However, it must be shown that a bona",
        "fide offer of work did exist at the time the claimant separated",
        "from employment.\" Commission Rules 17.7A2",
        ""},
RETIRE
{question:"to retire [e 4]"}
{explain:"This situation includes both voluntary and mandatory",
        "retirement, and retirees receiving pensions and those who are",
        "not recieving pensions.",
        ""},
MOVED
{question:"moved to a new area [e 5]"}
{explain:"Choose this option if the claimant separated from the job",
        "to move to a new area. If the claimant moved to accompany,",
        "follow, or join his/her spouse, choose option 'to accompany,",
        "follow, or join spouse'. If the claimant moved to accept a new",
        "position, choose option 'to accept a new position'.",
        ""},
OJ_ILLNESS_INJURY
{question:"on-the-job illness or injury [e 6]"}
{explain:"Distinguish this option from an off-the-job illness or injury.",
        "The claimant need not have filed a claim for workers",
        "compensation to be determined under this option.",
        ""},
SELF_EMP
{question:"to become self-employed [e 7]"}
{explain:"Choose this option if the claimant separated to become",
        "self-employed. Make sure the claimant's situation falls under",
        "the definition of self-employed as defined by section 1043,11,E",
        "of the Maine Employment Security Law. If you have any question",
        "about this, check with a Field Advisor and Examiner.",
        ""},
SABBATICAL
{question:"to take an unpaid leave or sabbatical [e 8]"}
{explain:"Choose this option if the claimant is currently on an",
        "\"unpaid voluntary leave of absence or sabbatical leave that",
        "has been mutually agreed to by the employee and the employer.\"",
        "The leave of absence and sabbatical leave implies that the",
        "claimant intends to return to work at the end of the leave.",
        "Consequently, those claimants receiving severance pay and salary",
        "continuation of any sort should be considered under the",
        "appropriate option.",
        ""},
HEALTH_SAFETY
{question:"health and safety concerns [e 9]"}
{explain:"Choose this option if the claimant separated due to",
        "on-the-job health and safety concerns. If an on-the-job",
        "injury has occured to cause separation, choose option on-the-job",
        "illness or injury'.",
        ""},

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WAGES_HOURS
 {question:"wages and/or hours [e 10]"}
 {explain:"Choose this option if hours and/or wages have caused",
        "the claimant to separate from the job."},
HARASSMENT
 {question:"harassment [e 11]"}
 {explain:"This situation includes all types of harassment and is",
        "not limited to alleged sexual harassment. The claimant need",
        "not have filed a complaint with the Maine Human Rights",
        "Commission to be determined under this option.",
        ""},
IMMINENT_LAYOFF
 {question:"imminent layoff [e 12]"}
 {explain:"This situation occurs when the claimant separates",
        "because he/she believes that he/she will be laid off in the very",
        "near future.",
        ""},
RELIGIOUS
 {question:"religious reasons [e 13]"}
 {explain:"Choose this option if the claimant separated due to religious",
        "beliefs. The claimant need not belong to an established",
        "religion, but must hold a sincere religious belief to be",
        "determined under this option. It does not matter whether the",
        "claimant possessed the religious belief at hire or if the belief",
        "was acquired after hire",
        ""},
PERSONAL
 {question:"personal reasons [e 14]"}
 {explain:"Choose this option if the claimant's reason for separation",
        "was completely unrelated to the job and cannot be",
        "considered under one of the other available options",
        ""},
WORKING_COND
 {question:"working conditions [e 15]"}
 {explain:"Choose this option only if the reason for separation was",
        "work-related and cannot be considered under any other option.",
        ""},
OTHER
 {question:"other reason not listed above [e 16]"}
 {explain:" Choose this option only if the claimant's separation",
        "cannot be considered under any of the other options listed.",
        ""})
{question:
"What was the specific reason the claimant separated after returning to",
"work?"}
{COM: "false"}
 {RPT: "false"}.

NEW_WORK:yn
 {question:
"Was the position offered so significantly different from the claimant's",
"original position that it could be considered an offer of new work?"}
 {COM: "false"}
 {RPT: "false"}.

\\
\inferred attributes
\\

Attachment A - 10

```
FAM_ILL:truth
  {COM: "false"}
  {RPT: "false"}.

ILL_SITUATION_KNOWN: truth
  {COM: "false"}
  {RPT: "false"}.

PROPER_STEPS:sgl
 (NOT_YET_KNOWN,
  NOT_TAKEN,
  NOT_NOTIFY,
  FUTILE,
  TAKEN)
  {COM: "false"}
  {RPT: "false"}.

  \\The NOT_NOTIFY value of PROPER_STEPS is necessary so that
  \\REQUEST_RE_EMP info is collected even if claimant is denied for not
  \\notifying employer  (the REQUEST info is needed for reports).

BENEFITS:sgl
 (ALLOWED,
  DENIED,
  UNDECIDED,
  FRZ_HAR,
  NOT_VQ)
  {COM: "false"}
  {RPT: "false"}.

DATE_OK: truth
       [default: false]
  {COM: "false"}
  {RPT: "false"}.

%

rules:

\The first two rules give a value to EMPLOYER_PRESENT
EMPLOYER1:
if
 EMP_PRES = YES
then
 EMPLOYER_PRESENT = true.
endif.

EMPLOYER2:
if
 EMP_PRES = NO
then
 EMPLOYER_PRESENT = false.
endif.

OTHER_SICK:
if
 status(EMPLOYER_PRESENT) = known and
```

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```
  WHO_SICK = OTHER and
  status(WHO) = known
then
  BENEFITS = DENIED.
endif.

FAMILY_ILL:
if
  status(EMPLOYER_PRESENT) = known and
  WHO_SICK = FAMILY
then
  FAM_ILL = true.
endif.

SELF_ILL:
if
  status(EMPLOYER_PRESENT) = known and
  WHO_SICK = CLAIMANT
then
  FAM_ILL = false.
endif.

FREEZE_ABLE_DATE:
if

  (EMPLOYER_PRESENT = false and
   NOTIFY_PROMPT = YES and
   status(NOTIFY_DATE) = known and
   KNOW_WHEN_ABLE = NEED_DR_NOTE) or

  (EMPLOYER_PRESENT = true and
   status(NOTIFY_PROMPT_CLMT) = known and
   status(NOTIFY_PROMPT_EMP) = known and
   NOTIFY_PROMPT = YES and
   status(NOTIFY_DATE) = known and
   KNOW_WHEN_ABLE = NEED_DR_NOTE)

then
  PROPER_STEPS = NOT_YET_KNOWN.
endif.

NOT_PROPER_STEPS1:
if

  (EMPLOYER_PRESENT = false and
   (NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
    KNOW_WHEN_ABLE = YES and
    status(ABLE_DATE) = known and
    REQUEST_RE_EMP = NO and
    AGREED_NO_JOB = NO)) or

  (EMPLOYER_PRESENT = true and
   status(NOTIFY_PROMPT_CLMT) = known and status(NOTIFY_PROMPT_EMP) = known and
   (NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
    KNOW_WHEN_ABLE = YES and
    status(ABLE_DATE) = known and
    REQUEST_RE_EMP = NO and
    AGREED_NO_JOB = NO))
```

```
then
  PROPER_STEPS = NOT_TAKEN.
endif.

NOT_PROPER_STEPS2:
if

 (EMPLOYER_PRESENT = false and
  NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
  KNOW_WHEN_ABLE = YES and
  status(ABLE_DATE) = known and
  REQUEST_RE_EMP = YES and
  status(REQUEST_DATE) = known and
  REQUEST_PROMPT = NO) or

 (EMPLOYER_PRESENT = true and
  status(NOTIFY_PROMPT_CLMT) = known and status(NOTIFY_PROMPT_EMP) = known
  NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
  KNOW_WHEN_ABLE = YES and
  status(ABLE_DATE) = known and
  REQUEST_RE_EMP = YES and
  status(REQUEST_DATE) = known and
  status(REQUEST_PROMPT_CLMT) = known and status(REQUEST_PROMPT_EMP) = kno
  REQUEST_PROMPT = NO)
then
  PROPER_STEPS = NOT_TAKEN.
endif.

NOT_PROPER_NOTIFY:
if
 (EMPLOYER_PRESENT = false and
  NOTIFY_PROMPT = NO and
  REQUEST_RE_EMP = NO or
  (REQUEST_RE_EMP = YES and
   status(REQUEST_DATE) = known and
   status(REQUEST_PROMPT) = known)) or

 (EMPLOYER_PRESENT = true and
  status(NOTIFY_PROMPT_CLMT) = known and
  status(NOTIFY_PROMPT_EMP) = known and
  NOTIFY_PROMPT = NO and
  REQUEST_RE_EMP = NO or
  (REQUEST_RE_EMP = YES and
   status(REQUEST_DATE) = known and
   status(REQUEST_PROMPT) = known))

then
  PROPER_STEPS = NOT_NOTIFY.
endif.

PROPER_STEPS_FUTILE:
if

 (EMPLOYER_PRESENT = false and
  NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
  KNOW_WHEN_ABLE = YES and
  status(ABLE_DATE) = known and
  REQUEST_RE_EMP = NO and
```

```
      AGREED_NO_JOB = YES) or

  (EMPLOYER_PRESENT = true and
   status(NOTIFY_PROMPT_CLMT) = known and status(NOTIFY_PROMPT_EMP) = known and
   NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
   KNOW_WHEN_ABLE = YES and
   status(ABLE_DATE) = known and
   REQUEST_RE_EMP = NO and
   AGREED_NO_JOB = YES)
then
  PROPER_STEPS = FUTILE.
endif.

PROPER_STEPS_OK:
if

  (EMPLOYER_PRESENT = false and
   NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
   KNOW_WHEN_ABLE = YES and
   status(ABLE_DATE) = known and
   REQUEST_RE_EMP = YES and
   REQUEST_PROMPT = YES and status(REQUEST_DATE) = known) or

  (EMPLOYER_PRESENT = true and
   status(NOTIFY_PROMPT_CLMT) = known and status(NOTIFY_PROMPT_EMP) = known and
   NOTIFY_PROMPT = YES and status(NOTIFY_DATE) = known and
   KNOW_WHEN_ABLE = YES and
   status(ABLE_DATE) = known and
   REQUEST_RE_EMP = YES and
   status(REQUEST_PROMPT_CLMT) = known and status(REQUEST_PROMPT_EMP) = known an
   REQUEST_PROMPT = YES and status(REQUEST_DATE) = known)
then
  PROPER_STEPS = TAKEN.
endif.


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\illness - self rules
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

FREEZE_SELF_ILL_INJ:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  ILL_OR_INJ = ILL | INJ and
  JOB_RELATED = NEED_DR_NOTE or
  (JOB_RELATED = NO and
   status(ILL_STR) = known and
   ABLE_AVAIL = NEED_DR_NOTE)
then
  BENEFITS = UNDECIDED.
endif.

SELF_ILL_INJ_RULE:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  (ILL_OR_INJ = ILL | INJ and
```

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```
    JOB_RELATED = NO and status(ILL_STR) = known) or
    ILL_OR_INJ = PREG and
    ABLE_AVAIL = YES
then
  ILL_SITUATION_KNOWN = true.
endif.

NOT_A_A:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  (ILL_OR_INJ = ILL | INJ and
   JOB_RELATED = NO and status(ILL_STR) = known) or
   ILL_OR_INJ = PREG and
   ABLE_AVAIL = NO
then
  BENEFITS = NOT_VQ.
endif.

PRG_NOT_STARTED:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  ILL_OR_INJ = ALC_DRUG and
  START_TREATMENT_PRG = NO or
  (START_TREATMENT_PRG = YES and
   status(START_DATE) = known and
   ENTER_PROMPTLY = NO)
then
  BENEFITS = DENIED.
endif.

FREEZE_SELF_ADDICTION:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  ILL_OR_INJ = ALC_DRUG and
  START_TREATMENT_PRG = YES and
  status(START_DATE) = known and
  ENTER_PROMPTLY = YES and
  COMPLETE_PRG = NO and
  RECOVERED = NEED_DR_NOTE
then
  BENEFITS = UNDECIDED.
endif.

ADDICTION_NOT_CURED:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  ILL_OR_INJ = ALC_DRUG and
  START_TREATMENT_PRG = YES and
  status(START_DATE) = known and
  ENTER_PROMPTLY = YES and
  COMPLETE_PRG = NO and
  RECOVERED = NO
then
  BENEFITS = NOT_VQ.
```

Attachment A - 15

```
endif.

ADDICTION_CURED:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL = false and
  ILL_OR_INJ = ALC_DRUG and
  START_TREATMENT_PRG = YES and
  status(START_DATE) = known and
  ENTER_PROMPTLY = YES and
  COMPLETE_PRG = YES or
  (COMPLETE_PRG = NO and
   RECOVERED = YES)
then
  ILL_SITUATION_KNOWN = true.
endif.


\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
\illness - family rules
\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

FREEZE_FAM:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL and
  SERIOUS_ILL = NEED_DR_NOTE
then
  BENEFITS = UNDECIDED.
endif.

ARRANGE_OR_NOT_ILL:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL and
  SERIOUS_ILL = NO or
  (SERIOUS_ILL = YES and OTHER_ARRANGE = YES)
then
  BENEFITS = DENIED.
endif.

FAMILY_RULE:
if
  status(EMPLOYER_PRESENT) = known and
  FAM_ILL and
  SERIOUS_ILL = YES and
  OTHER_ARRANGE = NO and
  A_A_FAMILY = YES
then
  ILL_SITUATION_KNOWN = true.
endif.

\\\\\\\\\\\\\\\\\\\\\\\\\PROPER_STEPS_RULES:\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

BENEFITS_UNDECIDED:
if
  ILL_SITUATION_KNOWN = true and
  PROPER_STEPS = NOT_YET_KNOWN
```

Attachment A - 16

```
then
 BENEFITS = UNDECIDED.
endif.


BENEFITS_DENIED1:
if
 ILL_SITUATION_KNOWN = true and
 PROPER_STEPS = NOT_NOTIFY
then
 BENEFITS = DENIED.
endif.


BENEFITS_DENIED2:
if
 ILL_SITUATION_KNOWN = true and
 PROPER_STEPS = NOT_TAKEN
then
 BENEFITS = DENIED.
endif.


BENEFITS_ALLOWED:
if
 ILL_SITUATION_KNOWN = true and
 PROPER_STEPS = FUTILE
then
 BENEFITS = ALLOWED.
endif.

\\\\\\\\\\\\\\\\\\\\\\\\\RESPONSE rules\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\

RESPONSE_RULE1:
if
 status(EMPLOYER_PRESENT) = known and
 ILL_SITUATION_KNOWN = true and
 PROPER_STEPS = TAKEN and

 (EMPLOYER_PRESENT = false and
  RESPONSE = WORK_QUIT and
  status(WHY_LEAVE2) = known) or

 (EMPLOYER_PRESENT = true and
  status(RESPONSE_CLMT) = known and status(RESPONSE_EMP) = known and
  RESPONSE = WORK_QUIT and
  status(WHY_LEAVE2) = known)
 then
 BENEFITS = unknown.
endif.


RESPONSE_RULE2:
if
 status(EMPLOYER_PRESENT) = known and
 ILL_SITUATION_KNOWN = true and
 PROPER_STEPS = TAKEN and

 (EMPLOYER_PRESENT = false and
  RESPONSE = NO_POS) or

 (EMPLOYER_PRESENT = true and
```

Attachment A - 17

```
    status(RESPONSE_CLMT) = known and
    status(RESPONSE_EMP) = known and
    RESPONSE = NO_POS)
then
  BENEFITS = ALLOWED.
endif.

RESPONSE_RULE3:
if
  status(EMPLOYER_PRESENT) = known and
  ILL_SITUATION_KNOWN = true and
  PROPER_STEPS = TAKEN and

  (EMPLOYER_PRESENT = false and
   RESPONSE = REFUSED and
   NEW_WORK = YES) or

  (EMPLOYER_PRESENT = true and
   status(RESPONSE_CLMT) = known and status(RESPONSE_EMP) = known and
   RESPONSE = REFUSED and
   NEW_WORK = YES)
then
  BENEFITS = NOT_VQ.
endif.

RESPONSE_RULE4:
if
  status(EMPLOYER_PRESENT) = known and
  ILL_SITUATION_KNOWN = true and
  PROPER_STEPS = TAKEN and

  (EMPLOYER_PRESENT = false and
   RESPONSE = REFUSED and
   NEW_WORK = NO) or

  (EMPLOYER_PRESENT = true and
   status(RESPONSE_CLMT) = known and status(RESPONSE_EMP) = known and
   RESPONSE = REFUSED and
   NEW_WORK = NO)
then
  BENEFITS = DENIED.
endif.

RESPONSE_RULE5:
if
  status(EMPLOYER_PRESENT) = known and
  ILL_SITUATION_KNOWN = true and
  PROPER_STEPS = TAKEN and
  (EMPLOYER_PRESENT = false and
   RESPONSE = CANT_WORK) or
  (EMPLOYER_PRESENT = true and
   status(RESPONSE_CLMT) = known and status(RESPONSE_EMP) = known and
   RESPONSE = CANT_WORK)
then
  BENEFITS = ALLOWED.
endif.

%
```

Attachment A - 18

demons:

\the next demons check for valid dates:

```
START_DATE_DEMON:
when
  determined(START_DATE)
then
  if match(DATE_FORMAT_31, START_DATE) or
    match(DATE_FORMAT_30, START_DATE) or
    match(DATE_FORMAT_28, START_DATE)
 then
    reassert DATE_OK = true.
  else
    erase START_DATE.
    display attach BAD_DATE of kb.
    askfor START_DATE.
  endif.
endwhen.

ABLE_DATE_DEMON:
when
  determined(ABLE_DATE)
then
  if match(DATE_FORMAT_31, ABLE_DATE) or
    match(DATE_FORMAT_30, ABLE_DATE) or
    match(DATE_FORMAT_28, ABLE_DATE)
 then
    reassert DATE_OK = true.
  else
    erase ABLE_DATE.
    display attach BAD_DATE of kb.
    askfor ABLE_DATE.
  endif.
endwhen.

NOTIFY_DATE_DEMON:
when
  determined(NOTIFY_DATE)
then
  if match(DATE_FORMAT_31, NOTIFY_DATE) or
    match(DATE_FORMAT_30, NOTIFY_DATE) or
    match(DATE_FORMAT_28, NOTIFY_DATE)
 then
    reassert DATE_OK = true.
  else
    erase NOTIFY_DATE.
    display attach BAD_DATE of kb.
    askfor NOTIFY_DATE.
  endif.
endwhen.

REQUEST_DATE_DEMON:
when
  determined(REQUEST_DATE)
then
  if match(DATE_FORMAT_31, REQUEST_DATE) or
```

```
        match(DATE_FORMAT_30, REQUEST_DATE) or
        match(DATE_FORMAT_28, REQUEST_DATE)
    then
        reassert DATE_OK = true.
    else
        erase REQUEST_DATE.
        display attach BAD_DATE of kb.
        askfor REQUEST_DATE.
    endif.
endwhen.


FREEZE_DEMON1:
when
    JOB_RELATED = NEED_DR_NOTE and
    BENEFITS = UNDECIDED
then
    erase JOB_RELATED.
endwhen.


FREEZE_DEMON2:
when
    ABLE_AVAIL = NEED_DR_NOTE and
    BENEFITS = UNDECIDED
then
    erase ABLE_AVAIL.
endwhen.


FREEZE_DEMON3:
when
    SERIOUS_ILL = NEED_DR_NOTE and
    BENEFITS = UNDECIDED
then
    erase SERIOUS_ILL.
endwhen.


FREEZE_DEMON4:
when
    KNOW_WHEN_ABLE = NEED_DR_NOTE and
    BENEFITS = UNDECIDED
then
    erase KNOW_WHEN_ABLE.
endwhen.


EMPISSUE1:
when
    NOTIFY_PROMPT_CLMT = YES and
    NOTIFY_PROMPT_EMP = YES
then
    NOTIFY_PROMPT = YES.
endwhen.


EMPISSU2:
when
    NOTIFY_PROMPT_CLMT = NO
then
    NOTIFY_PROMPT_EMP = IRRELEVANT.
    NOTIFY_PROMPT = NO.
endwhen.
```

```
EMPISSUE3:
when
  REQUEST_PROMPT_CLMT = YES and
  REQUEST_PROMPT_EMP = YES
then
  REQUEST_PROMPT = YES.
endwhen.

EMPISSUE4:
when
  REQUEST_PROMPT_CLMT = NO
then
  REQUEST_PROMPT_EMP = IRRELEVANT.
  REQUEST_PROMPT = NO.
endwhen.

EMPISSUE5:
when
  RESPONSE_CLMT = WORK_QUIT and
  RESPONSE_EMP = WORK_QUIT
then
  RESPONSE = WORK_QUIT.
endwhen.

EMPISSUE6:
when
  RESPONSE_CLMT = NO_POS and
  RESPONSE_EMP = NO_POS
then
  RESPONSE = NO_POS.
endwhen.

EMPISSUE7:
when
  RESPONSE_CLMT = REFUSED and
  RESPONSE_EMP = REFUSED
then
  RESPONSE = REFUSED.
endwhen.

EMPISSUE8:
when
  RESPONSE_CLMT = CANT_WORK
then
  RESPONSE_EMP = IRRELEVANT.
  RESPONSE = CANT_WORK.
endwhen.

A_A_DEMON1:
when
 ABLE_AVAIL = NO or
 A_A_FAMILY = NO or
 RECOVERED = NO
then
 display attach ABLE_AND_AVAILABLE of kb.
endwhen.
```

```
NEW_WORK_DEMON:
when
 NEW_WORK = YES
then
 display attach OFFER_OF_NEW_WORK of kb.
endwhen.

AA_DEMON2:
when
 RESPONSE = CANT_WORK
then
 display attach A_A_VQ_ALLOWED of kb.
endwhen.

CALL_SPOUSE:
when
 WHY_LEAVE2 = SPOUSE
then
 message "1".
endwhen.

CALL_ILLNESS:
when
 WHY_LEAVE2 = ILLNESS
then
 if EMPLOYER_PRESENT = true then
   message "2,EMPLOYER_PRESENT=true".
 else
   message "2,EMPLOYER_PRESENT=false".
 endif.

endwhen.

CALL_RETIRE:
when
 WHY_LEAVE2 = RETIRE
then
 if EMPLOYER_PRESENT = true then
   message "4,EMPLOYER_PRESENT=true".
 else
   message "4,EMPLOYER_PRESENT=false".
 endif.

endwhen.

CALL_MOVED:
when
 WHY_LEAVE2 = MOVED
then
 message "5".
endwhen.

CALL_OJILL:
when
 WHY_LEAVE2 = OJ_ILLNESS_INJURY
then
 message "6".
endwhen.
```

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```
CALL_HSAFE:
when
 WHY_LEAVE2 = HEALTH_SAFETY
then
  if EMPLOYER_PRESENT = true then
    message "9,EMPLOYER_PRESENT=true".
  else
    message "9,EMPLOYER_PRESENT=false".
  endif.
endwhen.

CALL_WANDH:
when
 WHY_LEAVE2 = WAGES_HOURS
then
if EMPLOYER_PRESENT = true then
    message "10,EMPLOYER_PRESENT=true".
  else
    message "10,EMPLOYER_PRESENT=false".
  endif.
endwhen.

CALL_HARASS:
when
 WHY_LEAVE2 = HARASSMENT
then
  if EMPLOYER_PRESENT = true then
    message "11,EMPLOYER_PRESENT=true".
  else
    message "11,EMPLOYER_PRESENT=false".
  endif.
endwhen.

CALL_LAYOFF:
when
 WHY_LEAVE2 = IMMINENT_LAYOFF
then
  message "12".
endwhen.

CALL_RELIGION:
when
 WHY_LEAVE2 = RELIGIOUS
then
  if EMPLOYER_PRESENT = true then
    message "13,EMPLOYER_PRESENT=true".
  else
    message "13,EMPLOYER_PRESENT=false".
  endif.
endwhen.

CALL_PERSONAL:
when
 WHY_LEAVE2 = PERSONAL
then
  message "14".
endwhen.
```

```
CALL_WORKCOND:
when
 WHY_LEAVE2 = WORKING_COND
then
 message "15".
endwhen.

CALL_SELFEMP:
when
 WHY_LEAVE2 = SELF_EMP
then
 message "7".
endwhen.

CALL_SABBAT:
when
 WHY_LEAVE2 = SABBATICAL
then
  if EMPLOYER_PRESENT = true then
    message "8,EMPLOYER_PRESENT=true".
  else
    message "8,EMPLOYER_PRESENT=false".
  endif.
endwhen.

CALL_OTHER:
when
 WHY_LEAVE2 = OTHER
then
 message "16".
endwhen.

CALL_OJILL2:
when
 JOB_RELATED = YES
then
 if ILL_OR_INJ = INJ then
  message combine("6,EMPLOYER_PRESENT=",EMPLOYER_PRESENT,",STRESS=NO,ILL_OR
_INJ=",ILL_OR_INJ,",ON_THE_JOB=YES").
 else
  message combine("6,EMPLOYER_PRESENT=",EMPLOYER_PRESENT,",ILL_OR_INJ=",ILL
_OR_INJ,",ON_THE_JOB=YES,PRIMARY_CAUSE_JOB=YES").
 endif.
endwhen.

RPT_DEMON1:
when
  AGREED_NO_JOB = YES or
  RESPONSE = NO_POS
then
  FORM = "V02A01".
  FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and notified his/her employer of the reason for his/her
absence.  He/she was able to resume work on ",ABLE_DATE," but
he/she and the employer agree that there was no longer any position
available for him/her.").
endwhen.
```

```
RPT_DEMON2:
when
  RESPONSE = CANT_WORK
then
  FORM = "V02A01".
  FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and notified his/her employer of the reason for his/her
absence.  He/she contacted his/her former employer for reemployment
on ",REQUEST_DATE," but was unable to resume work because he/she
could not physically perform the job.").
endwhen.

RPT_DEMON3:
when
  SERIOUS_ILL = NO or
  OTHER_ARRANGE = YES
then
  FORM = "V03D01".
  FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability of a family member.  The illness was not serious enough
to warrant the claimant's absence or other arrangements could have
been made to prevent the claimant's absence.").
endwhen.

RPT_DEMON4:
when
  START_TREATMENT_PRG = NO
then
  FORM = "V03D01".
  FACTS = combine(RPT_TXT,WHEN_LEAVE," due to an alcohol or drug
addiction.  He/she did not enter a treatment program.").
endwhen.

RPT_DEMON5:
when
  ENTER_PROMPTLY = NO
then
  FORM = "V03D01".
  FACTS = combine(RPT_TXT,WHEN_LEAVE," due to an alcohol or drug
addiction.  He/she did not enter a treatment program until
",START_DATE,".").
endwhen.

RPT_DEMON6:
when
  NOTIFY_PROMPT = NO and
  REQUEST_PROMPT = YES
then
  FORM = "V02D01".
  FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability, but he/she did not notify his/her employer of the
reason for his/her absence in accordance with the employer's rules
and regulations.").
endwhen.

RPT_DEMON7:
when
```

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```
    AGREED_NO_JOB = NO
then
    FORM = "V02D02".
    FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and notified his/her employer of the reason for his/her
absence.  He/she was able to resume work on ",ABLE_DATE," but did
not contact his/her former employer for reemployment.").
endwhen.


RPT_DEMON8:
when
    NOTIFY_PROMPT = NO and
    REQUEST_RE_EMP = NO
then
    FORM = "V02D04".
    FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and did not notify his/her employer of the reason for
his/her absence.  The claimant did not request re-employment with
the employer.").
endwhen.


RPT_DEMON9:
when
    NOTIFY_PROMPT = YES and
    REQUEST_PROMPT = NO
then
    FORM = "V02D03".
    FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and notified his/her employer of the reason for his/her
absence.  He/she was able to resume work on ",ABLE_DATE," but did
not contact his/her former employer for reemployment until
",REQUEST_DATE,".").
endwhen.


RPT_DEMON10:
when
    NOTIFY_PROMPT = NO and
    REQUEST_PROMPT = NO
then
    FORM = "V02D05".
    FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and did not notify his/her employer of the reason for
his/her absence.  He/she did not contact his/her employer promptly
to request re-employment.").
endwhen.


RPT_DEMON11:
when
    NEW_WORK = NO
then
    FORM = "V03D01".
    FACTS = combine(RPT_TXT,WHEN_LEAVE," due to illness or
disability and notified his/her employer of the reason for his/her
absence.  He/she was able to resume work on ",ABLE_DATE," and
contacted his/her former employer for reemployment on
",REQUEST_DATE,", but refused the opportunity for employment
offered by his/her former employer.").
endwhen.
```

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```
RPT_DEMON12:
when
   status(WHO) = known
then
   FORM = "V03D01".
   FACTS = combine(RPT_TXT,WHEN_LEAVE, " due to illness or
disability of a friend or extended family member.").
endwhen.


%
actions:

obtain BENEFITS.
\display value of BENEFITS.
\display value of FORM.
\display value of FACTS.

%
```

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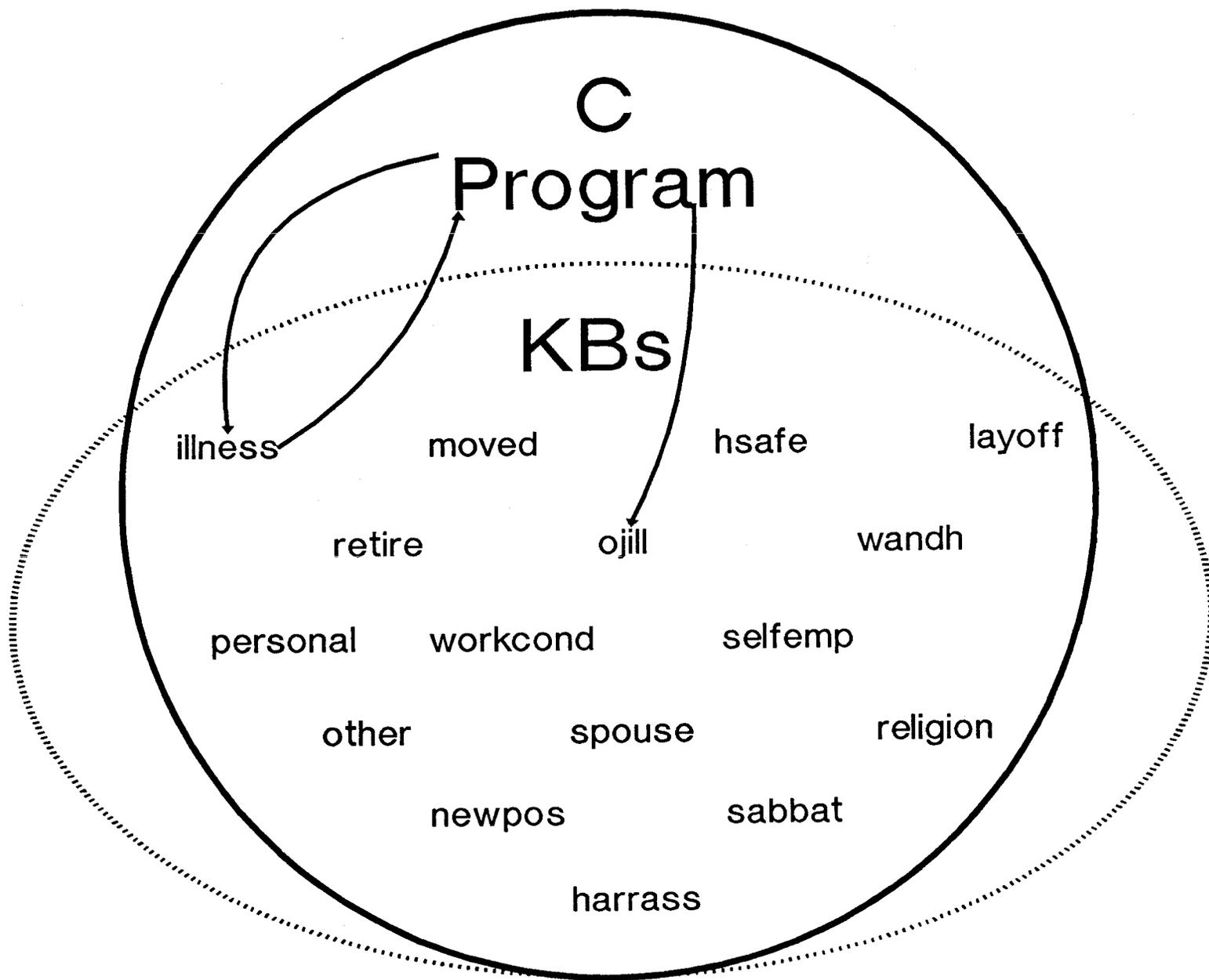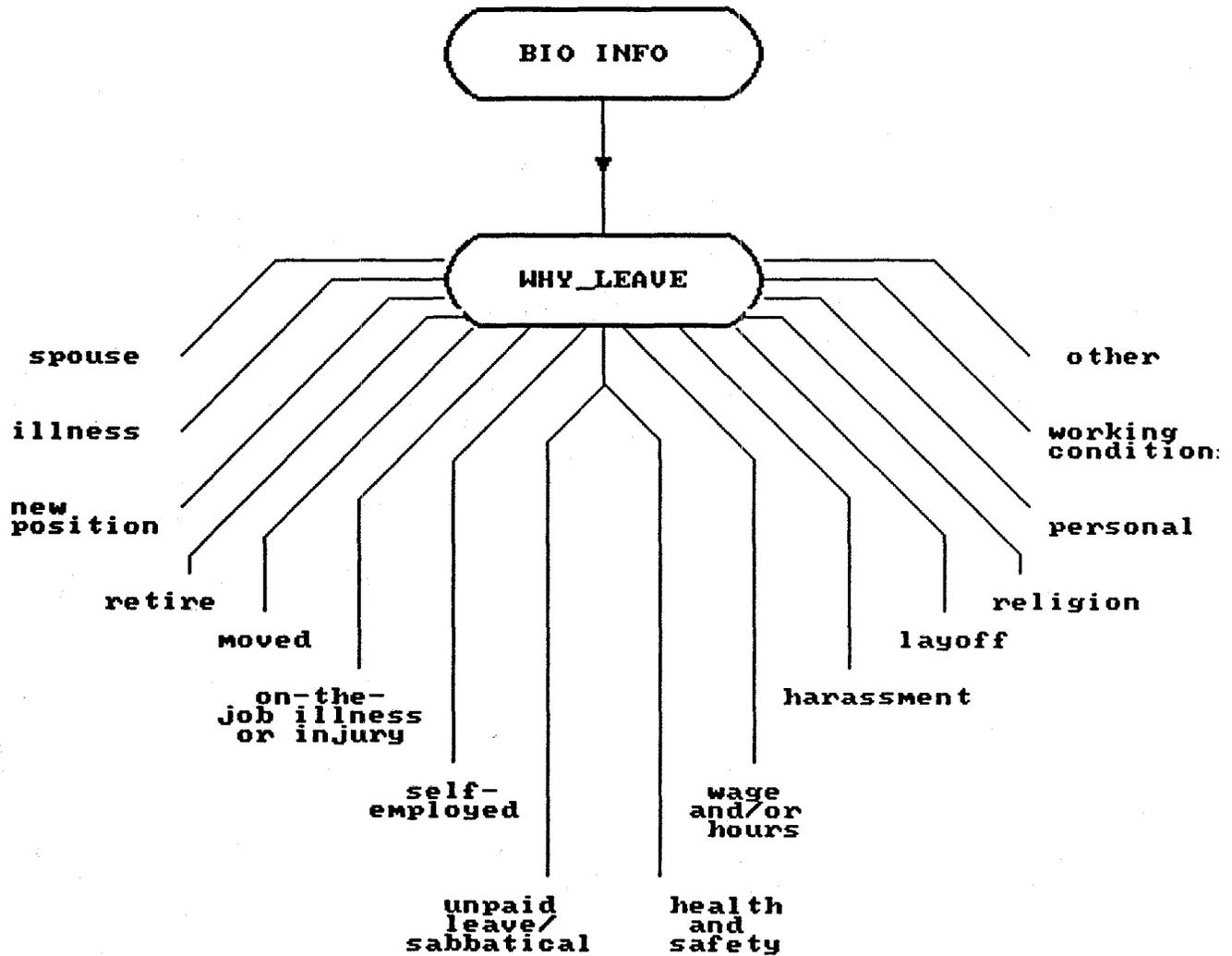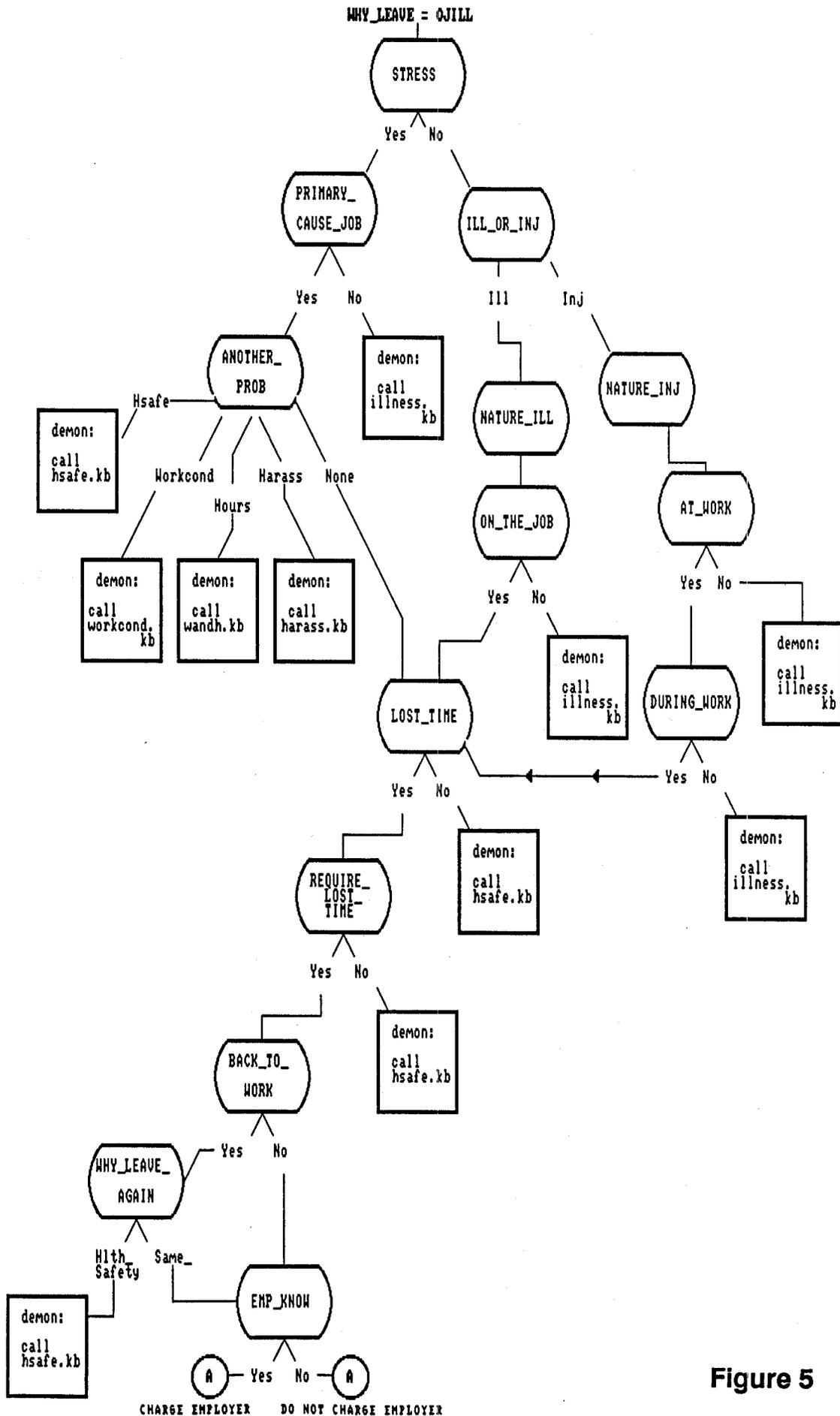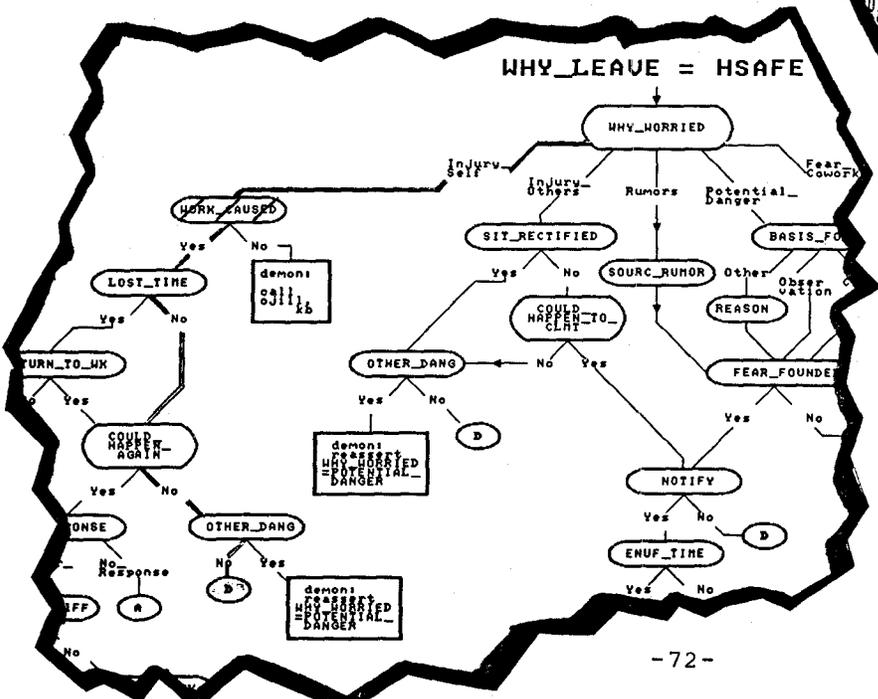
Figure 3
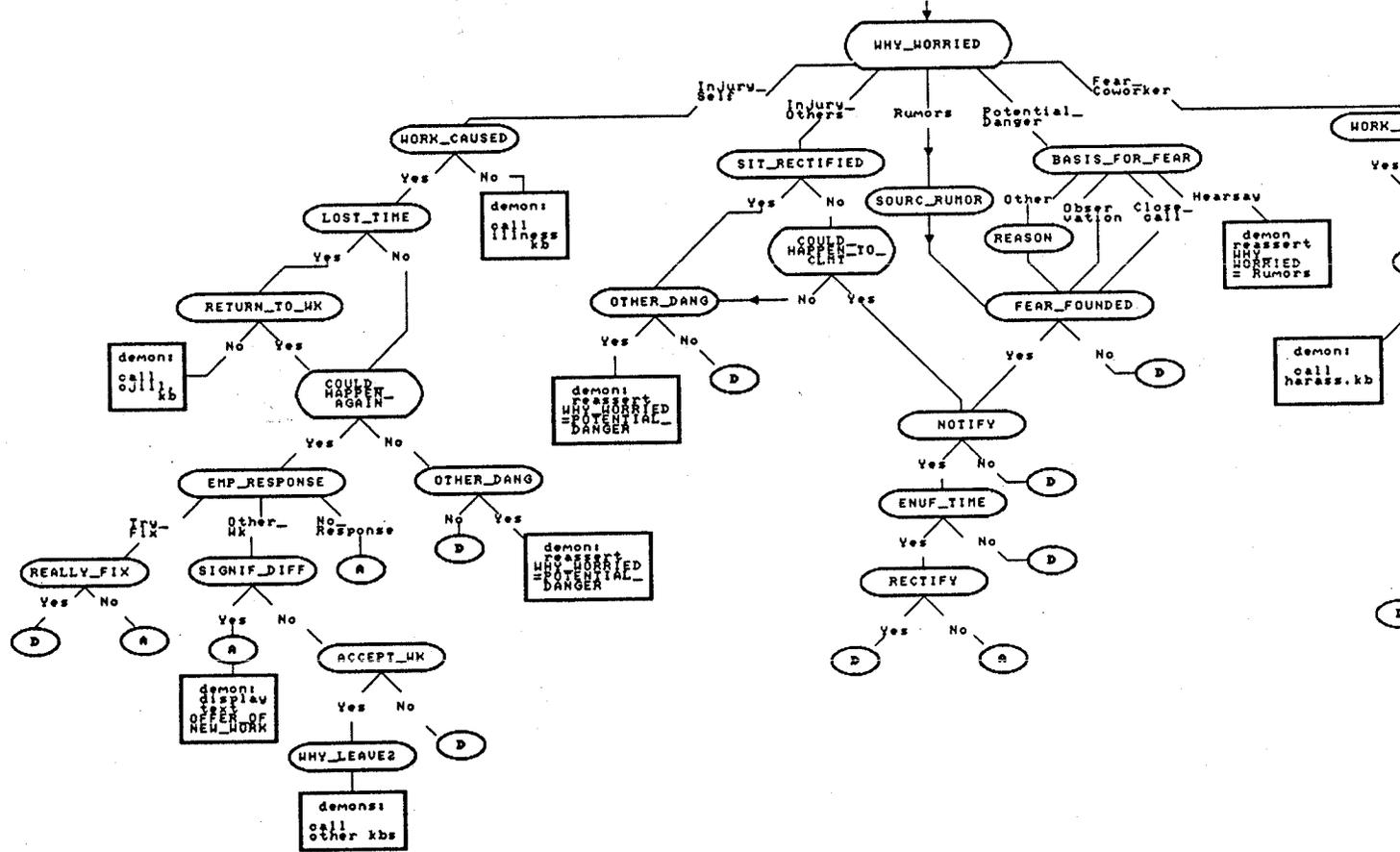
Figure 4
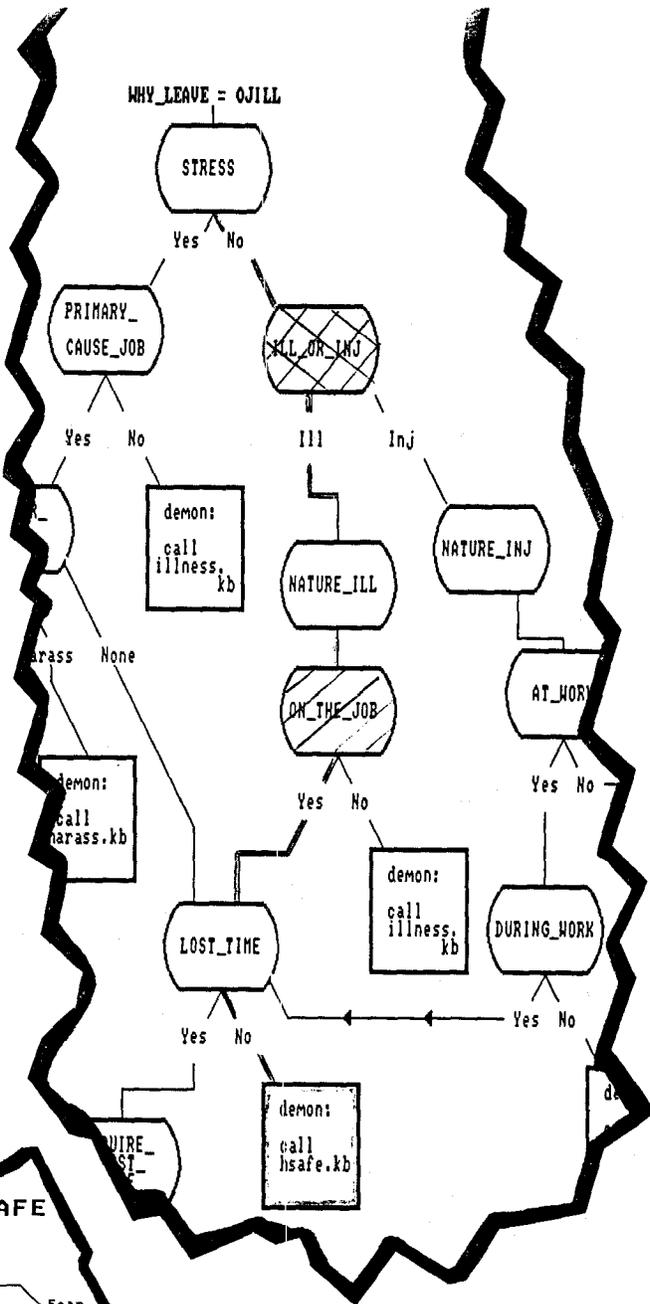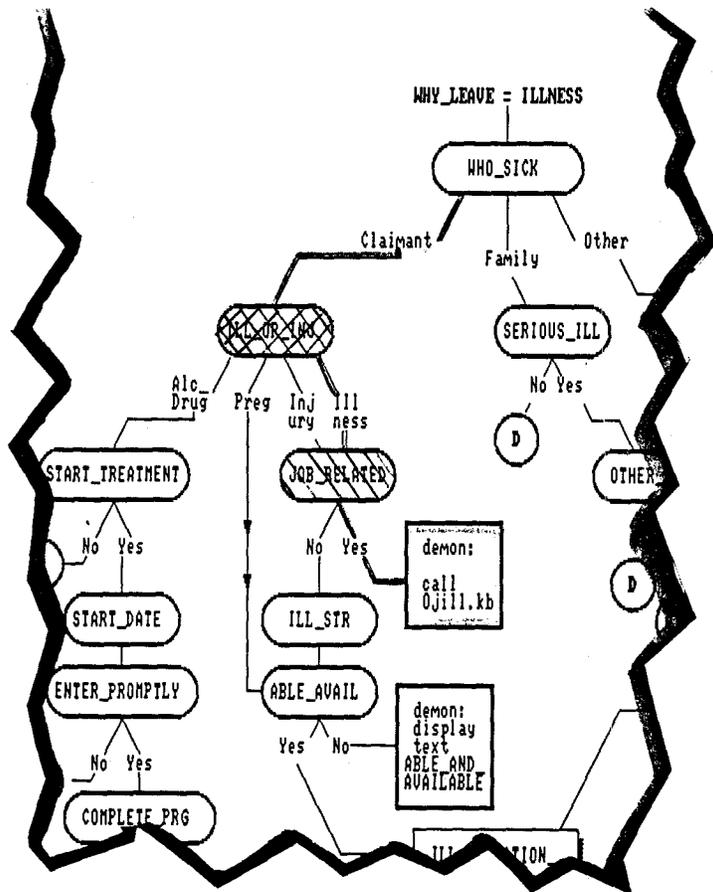
Figure 5
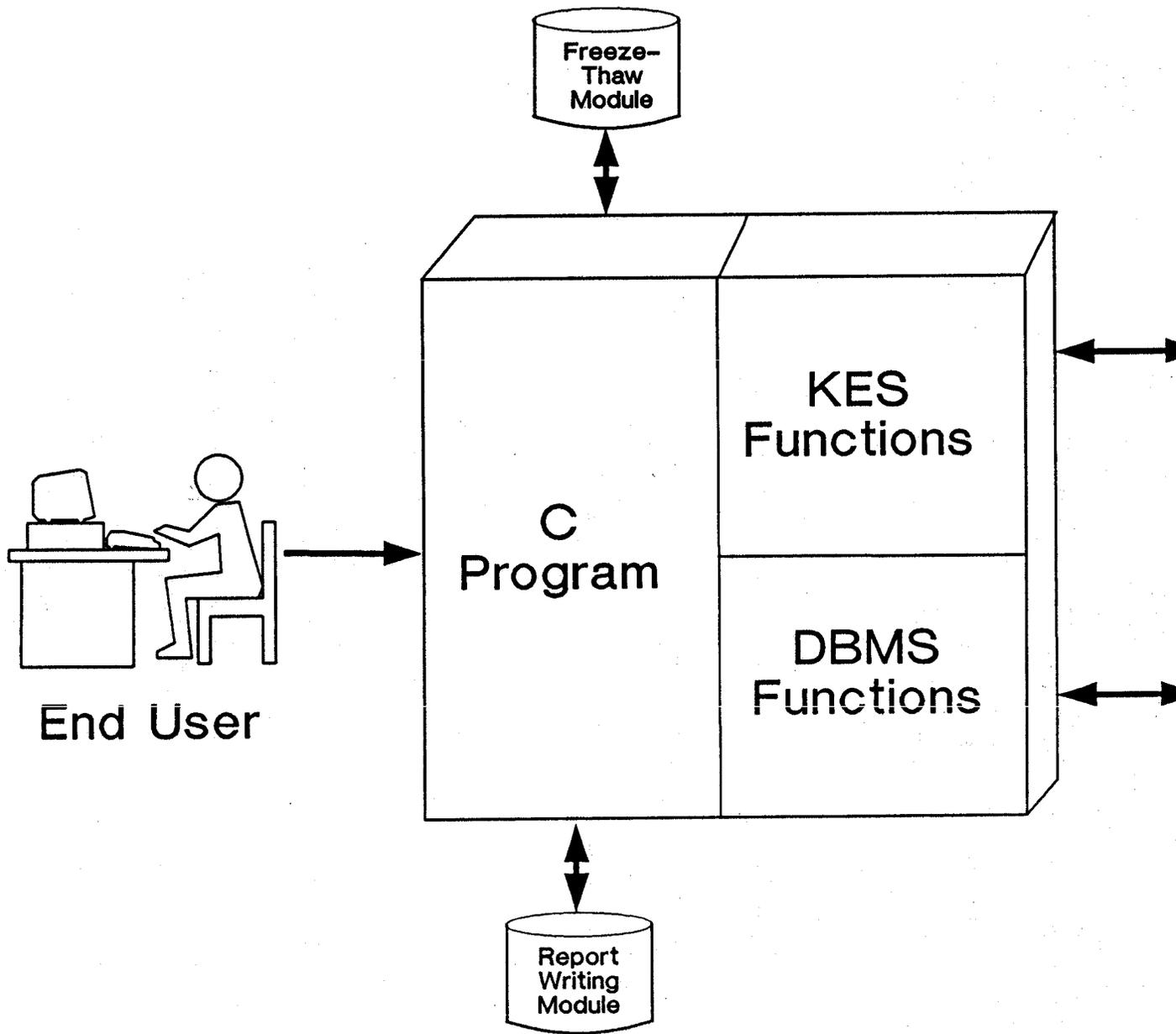
Figure 6

Figure 7

Figure 8

§ 11931V04D01

FINDINGS OF FACT:

REASONING:

Section 1193,1,B of the Maine Employment Security Law provides, in part, that an individual shall be disqualified for benefits for the duration of his/her unemployment period subsequent to his/her having retired; or having been retired from his/her regular employment as a result of a recognized employer policy or program, under which he/she is entitled to receive pension payments.

CONCLUSION:

The claimant left his/her regular employment voluntarily on _____A_____ to retire. He/She is disqualified from _____3_____ and until he/she has earned $_____B_____ in employment by an employer.

If applicable, eligibility issues regarding availability for work and the receipt of pension payments will be resolved in separate decisions.

Attachment B

§ 11931V04D01

Abigail Normal
RFD #3 Box 100
Wiscasset, ME 04578

FINDINGS OF FACT:

The claimant left his/her regular employment voluntarily on 05/01/91 in order to retire. His/her retirement was voluntary.

REASONING:

Section 1193,1,B of the Maine Employment Security Law provides, in part, that an individual shall be disqualified for benefits for the duration of his/her unemployment period subsequent to his/her having retired; or having been retired from his/her regular employment as a result of a recognized employer policy or program, under which he/she is entitled to receive pension payments.

CONCLUSION:

The claimant left his/her regular employment voluntarily on _____A_____ to retire. He/She is disqualified from _____3_____ and until he/she has earned $_____B_____ in employment by an employer.

If applicable, eligibility issues regarding availability for work and the receipt of pension payments will be resolved in separate decisions.

Attachment C

MISSOURI EXPERT SYSTEM PROJECT

PREVIEW

Missouri's expert system represents a different application of expert system technology. Issues surrounding covered employment were chosen by Missouri as being amendable for use of an expert system. Essentially, the primary problem in this area is determining, usually during a field audit of an employer, whether a particular individual is an employee of the firm or, as often claimed by the employer, an independent contractor. Such a judgment involves many complex factors and is of major interest to all parties concerned. In addition to the unique application, the Missouri expert system project used the AION expert system shell, which provided additional information on the capabilities of expert system software.

The Missouri Division of Employment Security's "AIDE --Advisor in Determining Employment" expert system team consisted of:

    James Grazier -- Project Manager

    Don Anderson -- Domain Expert

    Bill Dorge -- Knowledge Engineer

    Judy Stegeman -- Knowledge Engineer

AIDE
(Advisor in Determining Employment)
MISSOURI
EXPERT SYSTEM PROJECT

A. Introduction

The following is a description of the expert system developed
by the Missouri Division of Employment Security with funds
provided by the United States Department of Labor.

The project began in November 1989 with the notice of funding
and the submission of written agreements and spending
authority. An original project proposal was submitted in
1988, but due to the fact that funds were unavailable, the
project was held in abeyance until the following year.

The project Missouri was funded to develop is an expert
system to assist with the determination of independent
contractor and employee relationships which exist between
employers and workers.

B. Problem Background

The issue of independent contractor has been one of some
consternation for the Division for some time. It is popular
for employers to maintain that their workers are independent
contractors and therefore not subject to taxation under the
FUTA Act. Workers likewise have difficulty if they are told
they are not covered workers, when attempting to file claims
for unemployment benefits, when laid off from their jobs.

Determinations made by technicians and auditors tend to take
various factors into consideration when making determinations
and may consider different factors and issues in the same
cases. This interpretation of facts leads to confusion and
disagreement over the conclusions in many cases. There has
been an apparent lack of consistency in the matters to be
considered in determinations and how important they are in
the determination of employment.

These problems led to the desire to develop a common
methodology for staff to apply to the factors provided in the
law in making determinations of employment.

In the annual session of the Missouri General Assembly in 1989 the legislature changed the law pertaining to how the Division is to apply the independent contractor test. As a result of this law change the Division began applying the 20 common points of law. The Division previously applied the three point test in determination.

Transition to the twenty factor common law test was perceived as being difficult to articulate to the staff who needed to be trained in the application of the tests. An expert system developed for this purpose was thought to be very desirable.

An Expert System would bring consistency and completeness to the determination process. It would be easier to train staff in the use of an expert system than it might be to explain the kinds of information they should obtain in determining how the factors in the common law test should be applied.

The number of people affected by the determination of employment include the field auditors, consisting of about eighty five in number, as well as about twenty technicians in our Employer Contributions Section. In addition, Appeals Referees and Lawyers are affected by determinations which are made if appeals or litigation result from a determination.

The consequences of providing the expert system to assist in gathering the facts for the determination and preparing the report is a significant reduction in the time it takes to conduct the interview, make the determination and prepare the report of findings. It is felt that as little as two hours to as much as eight hours can be reduced in the time this takes to do this. Moreover the improved quality and consistency is likely to reduce the number of appealed determinations.

It is only possible to estimate the amount of savings resulting from reduced time by taking a factor of reduction and multiplying the factor by the number of determinations which are made. The actual time spent in conducting determinations in questions of employment are not kept. Consequently, time charging comparisons are not available to measure the reductions we will actually experience as a result of implementing the expert system methodology.

The problem could have been solved using conventional software on the agency mainframe computer. It appeared it was desirable to develop it on PC's due to the fact that PC's were available to the Field Auditors and they are about eighty percent of the staff that are involved in making fact finding investigations. Moreover, they conduct interviews in most cases in the employers businesses during regular audit sessions with the employers. The PC lends itself to this process, instead of manually gathering and documenting the facts, the Auditor is interactively conducting the interview and can then produce a report on site.

It is anticipated on implementation of the expert system the quality of the determinations will improve. It is expected the determinations will be more consistent among the auditors and technicians and the amount of time it takes to conduct the interviews, perform the determination, and prepare the report of findings will be significantly reduced.

C. PROBLEM CHARACTERISTICS

Perhaps our worst problem was lack of experience with a new law which was effective July 1, 1989. For years prior to that date we had the same three part test for determining independent contractors. We had several court cases we could use as a basis for our determinations.

The independent contractor issue has many problems. More and more employers are wanting to have independent contractors. While it is possible to have legitimate independent contractors, most are really employees. The employer decides to have his attorney prepare a written contract for the worker to sign. It usually includes the following statement: "I agree that I am an independent contractor and that I am responsible for all taxes."

Because more and more employers are claiming to have independent contractors, we are dealing with an ever increasing number of occupations. So what questions do we ask the employer? Do the questions vary based on the type of service performed? If so, how many different sets of questions or versions are needed? Would it be possible to develop one set of generic questions for all types of service?

D. SOLUTION CHARACTERISTICS

Before a baby can run, he must learn to crawl and then walk. So our plan was to try to develop a generic set of questions that would work for most types of independent contractor investigations.

E. TECHNICAL APPROACH

Prior to working on the Expert System a team of four persons had been assigned to study the 20 common law factors. The team leader was a Division attorney. There were two team members who were supervisors over persons issuing official written determinations. The fourth team member was a supervisor over Field Auditors who made independent contractor investigations.

Three members of this team were assigned to assist in developing the Expert System. The Division attorney was not involved in the day to day development. However he did offer periodic suggestions. For example, yes and no answers aren't enough--gather supporting facts and information even if you do not apply any weighting to this information.

F. DEVELOPMENT PROCESS AND RESULTS

1. Problem Being Addressed: The expert system is designed to aide the Field Auditor in gathering consistent and complete information about the worker's relationship to a firm. It is also designed to assist the Technician in making a determination, using the information gathered by the Field Auditor, about whether the worker should be an independent contractor or an employee.

2. Hardware: The AIDE system was developed on an IBM PS/2 Model-70. It will be deployed on Compaq Lte 286 computers in the field and various personal computers in the central office.

3. Software: The AIDE program is written using the AION Expert System Shell.

4. How it solves the problem: A determination is made based on the 20 common points of law. The system fires sets of if-then rules during the process. These if-then rules are grouped under 20 common points of law which define areas in which an employer is potentially exercising control over the worker. The system increments contractor and employee scores for each point of the law. Weights are then applied to these scores and the system then recommends a determination.

<u>5.</u> <u>What</u> <u>the</u> <u>system</u> <u>accomplishes:</u> The AIDE system is designed to:
- standardize the way the determinations are made;
- help Field Auditor gather facts;
- serve as a training tool;
- decrease the time needed processing and analyzing information;
- create field report.

G. END-USER PARTICIPATION

Once we had a working model--a prototype if you will, we entered our first validation period. This was a frustrating time for most of us. The biggest problem was that many people showed no interest in the Expert System. They wouldn't take time to even look at the system much less consider whether it had potential value. Some said it would cause humans to act like robots, etc. Others wanted to change a word here and there or wanted every word rewritten.

H. KNOWLEDGE ACQUISITION PROCESS AND RESULTS

Our team of three met with EDP staff, Jim Grazier, Judy Stegeman, Randy Wilkerson, Bill Dorge, and others. We tried to determine the best method for us, the users, to provide information to EDP. Finally we decided flow charts was a good way to develop questions, multiple choice answers, and follow-up questions to those answers. Developing these questions and answers to cover the universe of possibilities was not an easy task. However determining the weighting factors was tremendously more difficult. We tried +1.0 as 100% employee. -1.0 was 100% independent contractor. Later we switched to a points system. Each of the 20 factors has the potential for 100 points. In a few cases it is possible to score more than 100 points.

I. METHODS USED ENSURE ACCURACY OF RECOMMENDATIONS

Our team would take a given independent contractor case and individually give our opinion as to whether the worker was an employee, an independent contractor, or if additional information was needed. Also each member was asked how confident they were in their determination. An Experts' table was developed. 100%=employee without a doubt and if appealed to the U. S. Supreme Court, the Division should win on every level. 90%=almost certain employee. 80%=just barely an employee. There are some doubts and weaknesses. We should win in the appeals process but something could cause the Division to lose. 70%=50-50 toss-up. 60%=just barely an independent contractor. 50%=almost certain an independent contractor. 40%or less=independent contractor without a doubt.

Then we reran those same cases thru the IBM Expert System prototype. We compared the results. I guess we were lucky because the Expert System very closely mimicked the averages of the so called experts' opinion.

Later we bid and purchased Aion software. Some middle management tax and legal personnel felt we should add places for additional comments and incorporate federal form SS8 questions into the Expert System. The team did this.

However new software and the merging of new questions and comments caused EDP to do a rewrite. Also the team had to revise the weighting factors.

J. DEPLOYMENT STATUS AND RESULTS

In May 1991 the Aion Expert System was ready for initial testing. We ran 20 or 30 old cases on the newly developed system. A telephone interview with a claimant was also conducted. It took 30 minutes on the telephone and 3 hours to write the narrative report. Subsequently, seven Field Auditors were nominated to test the Expert System. One Field Auditor had less than a month's experience as a Field Auditor. The software was loaded on their Compaq 286 LTE laptop PC's. It was apparent to us that the Expert System would be of no value to Field Auditors unless an automatic field report could be generated.

These auditors are still testing the Expert System which now includes the automatic creation of a field report.

K. CONCLUSIONS AND RECOMMENDATIONS

1. NEGATIVE LESSONS LEARNED

a. Failing to determine exactly what the needs of the end-user are. If used only to gather information then generation of a field report is mandatory. On the other hand someone who only reviews information and issues an official written determination might only be interested in the weighting data as an AIDE. (Aide In Determining Employment)

b. Continuing to be responsible for all of your regular duties plus development of an Expert System is too much. Something has to give--probably development of the Expert System will be delayed. Even after you have a working model, it may take months and years to fine tune the system.

2. POSITIVE LESSONS LEARNED

    a. Support and assistance from end-users is essential. They'll tell you what they think, what is needed to make it better, and what is bad.

3. RECOMMENDATIONS

    a. Obtain an agency commitment from top management to end-user.

    b. Plan, organize, develop, test, evaluate, modify, revise, test, implement, and continue to evaluate.

    c. Close coordination between Knowledge Engineers and Domain Experts.

STATE OF MISSOURI
DIVISION OF EMPLOYMENT SECURITY

FIELD AUDITORS REPORT

FIELD DISTRICT NO. 01-730 FIELD AUDITOR: Terry Evans DATE: 4-22-91

EMPLOYING UNIT: Mr. McVey & claimant

CLAIMANT: claimant

ACCOUNT No.: 121212-1   SSN: 999-99-9999

TYPE OF   TYPE OF   DATE OF
REPORT: interim   ASSIGNMENT: B10   ASSIGNMENT: 4-22-91

1. PERSONS FURNISHING INFORMATION
Mr. McVey, Partner

2. METHOD OF CONTACT
personal

3. CHANGE DIVISION MAILING ADDRESS

4. ATTACHMENTS
Modes 2699, Modes 3030 & 2808

5. NARRATIVE
Please issue a written determination.

ANSWERS TO THE 20 COMMON LAW FACTORS

INTEGRATION

Does the success of the employer's business depend on the service performed by the worker? yes

Does the employer provide the same type of service as the worker performs? yes

If these workers were not used, who would perform these services? owner and/or employees

SERVICES PERFORMED PERSONNALY

Must worker personally perform service? yes

MANNER OF PAYMENT

What type of pay does the worker receive? hourly wage

Does firm guarantee a mininum amount of pay to worker? no

Does the firm allow the worker a drawing account or advances against pay? no

Is the worker eligible for a pension, bonuses, paid vacations, sick pay, etc.? no

Does the firm carry worker's compensation insurance on the worker? no

How is the rate or payment amount determined? hourly, weekly, monthly, etc.

How often are workers paid? regular intervals (weekly, bi-weekly, monthly, etc.)

Is worker required to be bonded? no

BUSINESS EXPENSE

Does worker incur work-related expenses other than travel to and from work or job site? yes

Does worker incur work-related expenses other than travel to and from work or job site? tools and tool repairs such as saw blades.

Does worker's expenses continue when worker is not performing services for this employer? no

Is worker reimbursed for any expenses? no

MAJOR INVESTMENT

Does the worker furnish anything other than handtools, light equipment, transportation to and from work, and material that an employee normally furnishes? no

Whose office does the worker use? worker never uses an office

Whose shop does the worker use? worker never uses a shop

Whose store does the workeruse? worker never uses a store

Whose warehouse does the worker use? worker never uses a warehouse

Whose business location does the worker use? employer's

Whose vehicle does the worker use? (Exclude vehicles also used for personal use, commuting to and from work, etc.) worker's

Whose heavy equipment does the worker use? employer's

PROFIT OR LOSS

Could the employer lose money besides not getting paid? yes

Does the employer have a monetary investment in facilities and/or other continuing and recurring liabilities? yes

Other than the costs of commuting to and from work and meals, could the worker lose money besides not getting paid? yes

Does the worker hire workers, have a monetary investment in facilities and equipment and/or other continuing and recurring liabilities? no

Can the employer do anything to increase income and/or reduce loss? yes

Does it depend upon the relation of the employer's receipts to his expenditures? yes

Can the worker do anything to increase income and/or reduce loss? no

RIGHT TO DISCHARGE

Has anyone ever been terminated or laid off? yes

Why? other

Explain why terminated or laid off? Partnership entered into a
management agreement with a management company.

Did worker have legal recourse? no

Can worker be terminated before job completed? not known

RIGHT TO QUIT

Has anyone ever quit before job completed? no

If someone should quit, would employer pay worker for work
completed at time of quit? based on wages due up to time of quit

Does the employer require workers to return keys, uniforms,
samples, sales literature, forms, equipment, etc.? yes

How much notice of leaving must the worker give? none required

INSTRUCTION

Does employer provide oral instructions, manuals, or written
procedures? no

How do workers know how andwhat to do? licensed
journeyman/trained/experienced worker

TRAINING

How does employer verify the worker's skills? other

Does employer instruct and/or provide manuals, orientation, etc?
no

Is the worker's job so routine that no instructions are needed?
yes

Does employer or agent haveorientation, staff, sales, or training
meetings, etc.? no

How does the employer keep workers abreast of changes, etc? other

HIRE AND PAY ASSISTANTS

Does the job require the use of coworkers or assistants? no

Explain and verify how job can be performed without help. one person repair jobs.

CONTINUING RELATIONSHIP

Explain what percent of worker's services are performed for this employer? unknown--depends on amount of repairs.

What percent of the worker's services are performed for this employer? other

How often does the worker work? only when there is work available

Please list the names of those employers, contractors, or clients for whichthe workder does work when not working for this employer. two other apartment complexes in Bismark and Farmington.

Does the employer use the same workers when work is available? yes

You indicated worker is paid at regular intervals and that the average job takes less that a week to complete, please explain? several jobs are usually completed within a week.

Are services performed by this class of worker used on a continuing basis? yes

How are the workers paid? weekly, monthly, etc.

When not working for this employer, how is the worker otherwise occupied? working for other employers or contractors

How long does it take to complete the average job? less than weekly

SET HOURS OF WORK

Explain why worker does not need to advise employer when unavailable. Worker is on call when not at apartment complex.

Explain how employer schedules his work without knowing if worker would be available? He goes to apartment complex office to see if there are any repair jobs to be done.

FULL TIME REQUIRED

Does this job require fulltime work? no

How many hours per week does the worker work? 21-29 hours

How many days per week does the worker work? 3-4 days

Any minimum quotas or production requirements? no

Explain why no minimum quotas or productions requirements? Amount of work required depends on amount of repairs required.

DOING WORK ON EMPLOYERS PREMISES

Are any services performed on the employer's premises? yes

Does nature of job require that service be performed at a locatic other than employer's premises? no

ORDER OR SEQUENCE SET

Is there a schedule, order or sequence the worker must follow? nc

Must the worker obtain permission to change the schedule, order, or sequence of jobs? (Decide which jobs will get finished first. no

Would the worker be subject to discipline by the employer if the worker changes the schedule, order, or sequence of work without the employer's permission? no

ORAL OR WRITTEN REPORTS

Does the employer require reports on time, expenses, progress on job, etc.? (oral or written) no

Does the worker submit a report when the job has been completed? yes

Does the report list the amount of time or expenses? yes

FURNISHING OF TOOLS

Does worker furnish tools and light equipment, not used for personal use, other than what employees customarily provide? no

Does the employer furnish any tools and light equipment? yes

State kind of tools employer furnishes and estimated value. Ridir lawn mower--valued at $6-800.

Who has the greater cost for tools and light equipment for this type of service? employer

Does worker furnish any material for which he is not reimbursed?

no

Does the employer furnish any materials? yes

Describe materials employer provides. all materials needed for repairs.

Who has the greater cost for materials for this type of service? employer

WORK FOR A NUMBER OF PEOPLE

Does worker perform service for more than one person or firm at a time?   yes

Is it the same type of service?   yes

Is the worker treated as anemployee by the other firms?   yes

SERVES GENERAL PUBLIC

How does worker make his service available to customers?   word of mouth

How did employer become aware of this worker's availability?   job application or resume

Does worker maintain office, shop, warehouse or other business location which is available to the public?   no

Does worker hold a business license?   no

Under whose name does the worker do business?   not known

Does firm represent worker as employee to its customers?   not known

Is a permit necessary?   no

OREGON EXPERT SYSTEM PROJECTS

PREVIEW

The Oregon Employment Division's two expert systems prototypes were developed through funds provided for by the Department of Labor's UI automation support account. Oregon's expert system "Nonmonetary Separation Training Tool" was designed as a training aid. Oregon's expert system "Initial Claim Options for Filing" (ICOFF) is an operational aid for claims filing. The ICOFF expert system was designed to assist employment security staff in exploring claims filing options for claimants with base period wages available in more than one state. The Oregon Employment Division developed its expert systems using AION's expert system shell.

The Oregon Employment Division's Colloquium presentation team consisted of:

John Young -- Domain Expert

Curt Barnes -- Knowledge Engineer

State of Oregon
EMPLOYMENT DIVISION
Department of Human Resources

OREGON EXPERT SYSTEMS

Nonmonetary Separations Training Tool

and

ICOFF
(Initial Claim Options for Filing)

John Young and Curt Barnes
Oregon Expert Systems Team

OREGON EXPERT SYSTEMS

Oregon waded into expert systems in early 1988, when we had an opportunity to "get our feet wet" in this new technology as part of a four state project. When the four state project fell through, Oregon offered to attempt an expert systems application for the nonmonetary separations process.

Grant Request

We spent a couple of months preparing a grant request for the UI/ADP Automation Support Account. Fortunately, those with the voice of approval deemed our expert systems proposal a favorable idea. While we proposed putting nonmonetary separations into a PC application, the even larger potential of other expert systems applications later became evident.

We asked for $165,390 and received the entire amount. The figure breaks down into components of $25,293 for hardware/software (2 PCs and expert systems software), $135,297 for staff for one full year, and the remaining amount for training/travel.

Expert Systems Product

Oregon ended up with a PC based expert systems tool. However, it is not our role to recommend any products for other states to use.

Team Approach

Two people were appointed to the expert systems team. Curt Barnes was named the knowledge engineer. At the time, Curt had worked in the Employment Division Data Processing shop for several years. He had experience with Unemployment Insurance (UI) programs from the data processing side and showed a genuine interest in new technology. That interest, accompanied by a desire to learn new things, is an essential attribute for a knowledge engineer in such a new field.

John Young was selected as the domain expert. John works in the UI Programs section and has worked on the development of several other systems in UI, including major work in Benefit Charge Back and Tax.

The team's background led to a unique approach, not usually recommended by the expert systems texts. Curt and John both attended the expert systems training, which is generally designed for knowledge engineers.

OREGON EXPERT SYSTEMS

When creating an expert system, the knowledge engineer usually interviews the domain expert and then develops the system. Of course, this leads to the common "trial and error" situation where the user, or in this case domain expert, looks at the new system and then wants something different. That situation forces redevelopment and delays.

Instead, Curt and John worked side-by-side, talking in the same language because they had the same training. When John formed the rules for Curt, it was in a way he knew Curt would want them. When Curt had questions, he could ask them in a way that he wanted and knew they would be understood (within reason).

We formed our own definitions of knowledge engineer and domain expert and assigned our own responsibilities. Curt was responsible for the system and John for providing the expert subject knowledge. Other staff were used as resources, but the decision-making was left to Curt and John.

As expected, there are often differing opinions on what is the correct domain knowledge. Sometimes John consulted with others, but he always made the final decisions and the development proceeded. Some models of expert systems have the knowledge engineer interviewing several domain experts and then putting in the "correct" knowledge. This forces the knowledge engineer (not a domain expert) to determine the domain. We find this an incorrect approach, as we do the process of trying to include several viewpoints in the system when the experts disagree.

While we've seen other system development stall because key decisions were referred to committee, we gained a reputation as a "Just Do It" state because our domain expert would make decisions, so the knowledge engineer could decide how to design and program. We took risks and the development "moved along".

This is also part of the beauty of using expert systems. It allows such a method because knowledge bases can be modified with reasonable ease. With conventional programming, a change might mean severe delays while the entire system is restructured. Not so with expert systems.

None of this would have been possible without administrative backing. From the Administrator on down, it was understood that this was an important Employment Division project. We were given the reins, the responsibility and the trust of the Agency. It was a necessary ingredient for our success.

Nonmonetary Separations Application

The idea or subject matter was cast for our first application. The initial stages of development posed a problem for us. Should we attempt a true nonmon production tool or was a training tool more appropriate?

Oregon has adjudicators complete the entire nonmon process. They do the factfinding and make the decision. These people are experts in their domain. We have very little turnover in this position. They generally don't refer to support materials and, when the nonmon decision is made, there are a variety of "canned" wordprocessing formats to assist in printing the decision. That is not to say that "canned" decisions are produced. Quite the contrary. We insist on clear findings of fact and reasoned conclusions that tie in the facts. The formats merely allow for common phrases and law cites to increase production speed of the printed decision.

Our situation meant that a production tool walking the adjudicator through the steps of determining whether there was a separation, characterizing the separation, and deciding good cause or misconduct would in reality not get used. An experienced adjudicator makes those decisions rapidly. The machine, operating as fast as possible, still couldn't keep up. We might get more consistency and accuracy, but the time factor is too much.

Therefore, we focused on a training tool. It asks the user to complete the factfinding first, including rebuttal and credibility assessments. The system forces adjudicators to do their jobs determining what are the facts. If the expert systems asks a question and the answer is unknown, the user must do more factfinding or make that determination. If the consultation ends and the user has additional facts, it's a lesson to hone down facts to the essential ones.

We find the experienced adjudicator using the system to walk through difficult cases or ones with uncommon issues. It also helps as a check for using the correct phrasing of the laws and administrative rules.

Inexperienced adjudicators use the nonmon application to consult with the machine rather than bother another adjudicator. Others use it to see if they might like adjudication and for learning interstate factfinding techniques on common situations like quit to move, where the nonadjudication claimstaker takes the statement.

OREGON EXPERT SYSTEMS

ICOFF Start

We recognized the limitations of the nonmon application for Oregon. While working on that project, the expert systems team had another idea. We toyed with the concept of an application taking full advantage of expert systems. It was an idea for an application where the user understands the process, but cannot know all the rules or knowledge. Additionally, there are several qualification steps and calculations requiring considerable manual effort.

Our idea was for a production tool to help the *claimstaker*. When a claimant has wages in more than one state the claimstaker must determine and explain the claim filing options. The claimant might file against either state or file a combined wage claim using the wages from all states in a single claim. Thus, the Initial Claim Options for Filing (ICOFF) application was born.

Some states just file the claim the claimant asks for or whatever "looks right". In Oregon the options process is a manual mandatory task requiring use of a worksheet, the Interstate Handbook, a calculator, and considerable time. It is a difficult job that may average 30 minutes or more depending on the states involved. An example of the worksheet is attached (Form 359-W).

ICOFF Grant

Again we had administrative support. The decision was made to proceed with ICOFF as a PC version and to apply for a grant to put it on the mainframe in a true production environment.

The ICOFF grant was approved for $364,989. This included $195,650 for hardware and software, $147,339 for staff for one year and $22,000 for training.

ICOFF Development Process

We didn't start by immediately creating a project outline with time frames. It seemed more appropriate to jump right in to high level design first. This gave us a chance to have a big picture look at the project before committing to a direction and duration that may have been incorrect. Once the basics were identified, we formed our project schedule on a more informed basis.

We decided to build a four state prototype, with Oregon and three bordering states. They each had some varying criteria which would help in developing the future states. Our plan was to create a complete system for each of the prototype states and fully test it. That way, once we were satisfied with the application methodology and performance of the consultation, the remaining states would reasonably fall into place.

State of Oregon - EMPLOYMENT DIVISION - Department of Human Resources

OREGON EXPERT SYSTEMS

After the high level design determined how the system would perform and function, we tackled the detailed specifications for each state. This turned out to be more difficult than first thought. In all we used four different sources for the state criteria and occasionally had to call the other state to verify our conclusions.

Programming took considerably more time than with the nommon application. Part of the reason was our decision to use a higher level of expert systems programming (object oriented processing) because it was more efficient and partly because of the complexity of the project. We received additional training from the vendor at this stage.

Testing was one of our keys to success. Curt initially tested the program while creating it. Then John tested to see if it met the desired goals. If changes were needed, they were possible immediately because of the working side-by-side relationship. By making an immediate change it often saved additional work later. Key staff in our technical shop took the next turn at testing.

When the prototype system seemed ready we took it to our offices for the all-important testing. Most of the comments resulted in minor changes. Yet, this part was valuable and essential because we included hands-on training with the testing so they came to know ICOFF and felt some ownership by being an actual part of the process. This also made them more anxious to get the final product.

The remainder of the development was smoother because of the thorough efforts in prototype development and testing. However, we did run over our original aggressive time estimate of ten months because of more difficult states than anticipated, especially the "last 52 week" base period states. Our help screens were also more extensive than planned. Yet, the fifteen month completion was not overly excessive and the results were worth it!

ICOFF Knowledge Base Characteristics

The ICOFF knowledge base is huge. It is over 10 MB. With such a large
knowledge base we looked for and were successful in streamlining wherever
possible. The following is a recent print of the breakdown on rules, classes,
states, etc..

Object Stats

			Memory Stats	
27	Types	30041	Memory now in use	7346738
1707	Parameters	876080	Swapper-Threshold	8388608
713	Rules	6083174	Free Memory	41664
546	Messages	622793		
1	Reports	140		
166	Functions	1178050		
145	Groups	54891		
239	Displays	63835		
185	Slots	121791		
22	Methods	6902		
1331	Instances	757532		
11	Classes	23690		
1	Vocabularies	55		
59	States	697089		
5153	Total	10516063		

Object oriented processing and pattern matching rules make the system
function. ICOFF reasons its way through the process of examining all
available claim options completely and efficiently. Only necessary questions
are asked. If the system can make decisions, it does, and if it can avoid
inquiries, it does. It takes the most direct route.

Exportability

ICOFF is designed to be exported to other states. What this means is that
during development we considered other users besides Oregon and tried to build
code that lends itself to later conversions for other state UI agencies. We
have not tried it yet, but believe that ICOFF could be made to operate for
another state as their own within a reasonably short time period.

Our understanding is that the product becomes public domain and can be shared
with other states. Other states need to operate with the same expert systems
software, however.

OREGON EXPERT SYSTEMS

We believe that looking to export during the development stage is desireable for all and the best use of federal dollars. We intend to keep this in mind for other projects of this nature.

ICOFF Features

As mentioned previously, Oregon explores the options for claim filing to give the claimant an informed choice. When completed manually, the process may take 30 minutes or longer, depending on the states involved. Once a user becomes proficient, which takes only a few consultations, almost any consultation can be done in a production mode in less than five minutes. Obviously this is a considerable time savings. By producing a clear report, the use of the manual worksheet is eliminated. (See attached ICOFF Report.)

ICOFF knows all the base periods for every jurisdiction (the 50 states, District of Columbia, Canada, Puerto Rico, and the Virgin Islands). It even recognizes when a quarter change is this week for one state and next week for another. Base periods of the "last 52 weeks" are also handled.

The requalification, qualification, monetary criteria, and disqualification requirements are all programmed into ICOFF. The system contains help screens for base period extensions, dependence allowance, deductible income and disqualifications.

Additionally, we take advantage of some "screen builder" facilities to display graphics and colors (standardized for user understanding of their location in the system).

ICOFF Solutions - Meeting Needs

ICOFF didn't just speed up a manual process. It solved several other problems. We not only get a fast explanation on the potential claims to file, but the claimant's choice is usually the right one. Of course, this depends on the claimant's information (getting this from the claimant is not a problem solved by ICOFF). By filing the better claim first we also save on the claimant returning to file a different claim when the other state responds. Thus, we save time and effort for the other states, too.

Sometimes the claimstaker is confused on when to explore and/or file the interstate (or "reverse") combined wage claim. ICOFF won't allow an interstate combined wage claim when it shouldn't, and forces an interstate combined wage claim when it should.

OREGON EXPERT SYSTEMS

Several errors are made when using the manual process because of a misunderstanding on base period quarter change. This is especially a problem with California (we have a lot of these) because they change base periods one month later than us and other "first four of the last five completed quarters" states. ICOFF eliminates these problems.

The Interstate Handbook is the only manual tool available to the claimstakers. It is not updated enough due to the clearance process for printing, which is time consuming. The claimstaker doesn't have quality information for an informed claimant choice. ICOFF is updated easily and constantly.

Simple calculation errors are common when claimstakers are dealing with complicated subject matter in stressful situations. ICOFF delivers consistent, accurate results - every time.

Staffing

ICOFF makes the job easier for the claimstakers and saves their time, allowing them to redirect their efforts into other necessary claims activity. ICOFF promotes staff efficiency as well. While ICOFF is not intended for the claimant to operate because of the need to understand UI, it can be used by staff familiar with UI, yet less experienced. Thus, staff in other areas that are UI cross-trained can use ICOFF to assist with peak UI workloads.

In one small Oregon office the manager sometimes helps with UI when they are busy. He said he has worked the options process in the past, but felt uncomfortable and wasn't sure he was completing all the steps and doing so properly. ICOFF allows this manager to help when needed, know he is accurate and not miss any steps.

Integration with Other Systems

Oregon is moving expert systems to the mainframe soon. When ICOFF is on the mainframe we intend to access our mainframe wage records. In so doing, the claimstaker will no longer have to key the wages for Oregon into ICOFF. When that ICOFF keying screen appears, the wages will already be filled in. The claimstaker can add to or delete from those wages as appropriate. This is the most time consuming keying step in an ICOFF consultation, so additional time savings will be realized.

Our intention, once on the mainframe, is to integrate with the Internet IB-4 and IB-1 systems. Then when the options process is completed, any information of use to the IB-4 or IB-1 systems can be gleaned directly from ICOFF and save keystrokes. Only a few additional data requirements would be necessary.

OREGON EXPERT SYSTEMS

Implementation

Oregon progressed beyond the prototype, testing, and research phases. We are implementing right now. Currently, we are running expert systems in two offices. Two other offices already used expert systems and we rotated to two others. The expert systems offices have both the nonmon separations and ICOFF applications. Obviously, ICOFF gets the most use, as it is a true production tool. The offices that use it claim they would "kill to keep it". It is quite effective. Other offices must wait for our expert systems mainframe acquisition.

Results

Staff now perform a tedious, stressful job with confidence. The scratched up worksheets are gone and replaced by a clean report that claimstakers feel comfortable explaining. This confidence is a real morale builder. It means that staff no longer cringe at the thought of a tough claim options job. Some say that they actually look forward to using ICOFF. This attitude carries over into other tasks. These assessments are from staff involved and management observing their increased "good feeling".

Claimants seem to enjoy the process and feel more comfortable about the information they are receiving. We understand that when the word got out about processing the options through a computer, some of the claimants came in better prepared with wage information.

The time savings are confirmed. While no formal time testing was used, the estimate of going from 30 minutes or more to five minutes has been fairly accurate. As previously mentioned, filing the right claim first also saves by reducing the number of claimants returning to file a different claim when the other state responds with the actual potential claim in that state.

Besides the other pluses, we gain accuracy, completeness, and consistency, along with a clear report for documentation. The detail of the report is such that if the claimant returns with questions on why a different claim was not filed, all the reasons are documented and explained so additional research or calculation is unnecessary.

Lessons Learned

The team approach is the best way to operate. We identified our roles and made it happen. Having the ability (responsibility) to make decisions allowed us to "Just Do It".

Administrative support is essential. Yet, we were (and are) still left to do the job without constant review or delays for step-by-step approval. The administration created a "run with it" environment.

The field contact/input/testing not only assisted us, but gave them the crucial ownership. They are anxious for a system that won't be a surprise or something that someone else thought was good for them. They are part of the team.

Get the grants. The federal funding grants made possible what could have been otherwise quite difficult or impossible. Approval is possible.

Future Expert Systems

We already have two ICOFF enhancements in mind. At the stage of the ICOFF consultation where the states with wages must be selected, the choice is not always clear. What about federal wage assignment and wages from working on a vessel? We intend to make a couple of sub-routines to handle these issues, make this choice easier and avoid accessing other materials.

The ICOFF help screens contain information for each state on base period extensions, dependence allowances, deductible income and disqualifications. We intend to make this information available on a separate knowledge base so the user can access it without being in an ICOFF consultation.

The Oregon Employment Division hopes to get into the touch screen technology in the very near future. We expect to set up kiosks in field offices and perhaps shopping malls, etc.. We believe we can use touch screen and expert systems to let the claimant self-file an initial claim. The system would know when additional information was needed for issues like military wages, separations, etc.. Only the necessary questions would be asked, rather than the typical "bedsheet" form asking questions of everyone, when only some need to be asked. The claimstaking staff time savings could be quite dramatic.

OREGON EXPERT SYSTEMS

Colloquium

We were invited to the Expert Systems Colloquium in Texas as observers. However, we decided to bring along our attempts at expert systems on a portable PC in case there was time to share. As it turned out, the agenda was altered to allow us a chance to present ICOFF and demonstrate it in the lab. Subsequent to the Colloquium we were invited to submit these materials for inclusion in the Colloquium package.

Contacts

We are always willing to share our efforts and experiences. Visitors are certainly welcome. However, if you need us to visit your environment, where more of your staff can get a chance to observe and ask questions, we must go through the appropriate approval steps. We already did this in Washington and it was successful for over 50 people. Contact: John Young 378-8232 or Curt Barnes 378-3312.

INTERSTATE – COMBINED WAGE WORKSHEET

SOCIAL SECURITY NUMBER: 1 2 3 - 4 5 - 6 7 8 9

BYE: 2 2 - 9 2

STATE	QTR 4 / YR 90	QTR 3 / YR 90	QTR 2 / YR 90	QTR 1 / YR 90	QTR / YR	QTR / YR	QTR / YR	QTR / YR	OPTIONS	YES	NO
OREGON			3000	1000 / 6000		TOTAL			Monetarily Eligible?		✓
									Dependents Allowance?		
									Deductible Income?		
									Potential Disqualification?		
									If yes, penalty:		
Total Wks.			3	10		13					
Total Qtr. $			3000	7000		10,000			Est. WBA 0 / Est. MBA 0		
CONNECTICUT	7000	3000 / 2000							Monetarily Eligible? MET REQUAL.	✓	
									Dependents Allowance? (50)	✓	
									Deductible Income?		✓
									Potential Disqualification?	✓	
									If yes, penalty: JR = 6×WBA		
Total Wks.	7	7				14					
Total Qtr. $	7000	5000				12,000			Est. WBA 269+50 = (319) / Est. MBA 6994 +1300 (8294)		
OHIO	6000	3000		1500					Monetarily Eligible?	✓	
									Dependents Allowance? INCLUDED	✓	
									Deductible Income?		✓
									Potential Disqualification?		✓
									If yes, penalty:		
Total Wks.	10	6		4		20					
Total Qtr. $	6000	3000		1500		10,500			Est. WBA 262 / Est. MBA 5240		

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Claimant's Choice

The advantages and/or disadvantages of filing an unemployment claim against the state(s) of

OREGON,

CONNECTICUT,

OHIO;

OREGON CWC have been explained to me.
I choose to file a claim against the state of

CONNECTICUT

John Young
Claimant's Signature

6-6-91
Date

C. Barnes
Claimstaker's Signature

* Claimstaker: Use other side if work is in more than 3 states.

Form 359-W (6-87)

STATE OF OREGON • EMPLOYMENT DIVISION • DEPT. OF HUMAN RESOURCES

(OVER)

INTERSTATE – COMBINED WAGE WORKSHEET

STATE	4/90 QTR. YR.	3/90 QTR. YR.	2/90 QTR. YR.	1/90 QTR. YR.	__/__ QTR. YR.	__/__ QTR. YR.	__/__ QTR. YR.	__/__ QTR. YR.	OPTIONS	YES	NO
ORE. CWC						TOTAL			Monetarily Eligible?	✓	
									Dependents Allowance?		✓
									Deductible Income?		✓
									Potential Disqualification?		✓
									If yes, penalty:		
Total Wks.	13	13	3	13		42					
Total Qtr. $	13,000	8000	3000	8500		32,500			Est. WBA 247 Est. MBA 6422		
									Monetarily Eligible?		
									Dependents Allowance?		
									Deductible Income?		
									Potential Disqualification?		
									If yes, penalty:		
Total Wks.											
Total Qtr. $									Est. WBA Est. MBA		
									Monetarily Eligible?		
									Dependents Allowance?		
									Deductible Income?		
									Potential Disqualification?		
									If yes, penalty:		
Total Wks.											
Total Qtr. $									Est. WBA Est. MBA		

Claimant's Choice

The advantages and/o: disadvantages of filing an unemployment clain against the state(s) of

_____

_____

have been explained to r I choose to file a claim against the state of

_____

_____
Claimant's Signature

_____
Date

_____
Claimstaker's Signature

* Claimstaker: Use othe side if work is in more than 3 states.

Form 359-W (6-87)

–105–

STATE OF OREGON • EMPLOYMENT DIVISION • DEPT. OF HUMAN RESOURCES

John Young
123-45-6789
Date of Claim: 6-Jun-91

******************************* Oregon *******************************

90/4	90/3	90/2	90/1
			3000 3	1000 2
			6000 8
—— —	—— —	3000 3	7000 10

Total Wages: $10000   Total Weeks: 13   Deductible Income:
Monetarily Eligible: No (Failed 18 weeks of work)
Potential Disqualification:

Estimated WBA: $ 0   Estimated MBA: $ 0

****************************** Connecticut ******************************

90/4	90/3	90/2	90/1
7000 7	3000 3		
	2000 4		
7000 7	5000 7	—— —	—— —

Total Wages: $12000   Total Weeks: 14   Deductible Income: No
Monetarily Eligible: Yes (Met requalification from a prior claim)
Potential Disqualification: Job Refusal
Penalty: Must earn 6 x WBA

Estimated WBA: $269   Estimated MBA: $6994
Depend. Allow: $ 50 $1300

Total Est WBA: $319   Total Est MBA: $8294

****************************** Ohio ******************************

90/4	90/3	90/2	90/1
6000 10	3000 6		1500 4
6000 10	3000 6	—— —	1500 4

Total Wages: $10500   Total Weeks: 20   Deductible Income: No
Monetarily Eligible: Yes
Potential Disqualification: None

Estimated WBA: $262   Estimated MBA: $5240

****************************** Oregon CWC ******************************

90/4	90/3	90/2	90/1
13000 13	8000 13	3000 3	8500 13

Total Wages: $32500   Total Weeks: 42   Deductible Income: No
Monetarily Eligible: Yes
Potential Disqualification: None

Estimated WBA: $247   Estimated MBA: $6422

I understand that the claim filing options are based on my information, including wages and weeks of work, or information that is accurate to the best of my knowledge. I have been informed of the advantages and/or disadvantages of filing unemployment insurance claims against:

 Oregon   Connecticut   Ohio   Oregon CWC

I choose to file the claim circled above (circle one).

_____   10-Jul-91   _____
    Claimant's Signature   Claimstaker's Signature

****
State Filing Information

State	Emp Notice	IB3 Opt	Key Emp
Connecticut	M7W	1	None
Ohio	P10W	2	Last 2

****

TEXAS EXPERT SYSTEM PROJECTS

PREVIEW

The Texas Employment Commission's two expert systems prototypes were developed to determine whether expert systems software could assist in administering unemployment compensation programs. Texas's "Claims Examiner's Assistant" was designed to assist claims staff in deciding worker separation issues relating to quit and work refusal disputes. Texas's "Disaster Unemployment Assistance (DUA) Determiner's Assistant" was designed to assist claims staff in making monetary determinations of DUA entitlement. The Texas Employment Commission developed its expert systems using AION's expert system shell.

The Texas Employment Commission's Colloquium presentation team consisted of:

Ted Swindle -- Domain Expert

Howard Hagemann -- Knowledge Engineer

TEXAS EMPLOYMENT COMMISSION
UI Expert System Colloquium Presentation

by

Howard Hagemann and Ted Swindle

Overview of Presentation - The DUA Determiner's Assistant

Comments Relating to Parts of Guidelines for State Presentations of UI Expert Systems

- Statement of the Problem and Its Characteristics

- Other Factors Involved

- Goal of the Full Expert System

Demonstration Dealing with the Following:

- Solution Characteristics

- Technical Approach

- Development Process and Results

- End-user Participation

- Knowledge Acquisition Process and Results

- Methods Used to Ensure Accuracy of Recommendations

Deployment Status and Results

Conclusions: Positive and Negative Lessons Learned

COMMENTS RELATING TO PARTS OF GUIDELINES FOR STATE PRESENTATIONS OF UI EXPERT SYSTEMS

Statement of the Problem and Its Characteristics and Other Factors Involved

Comments on Questions from Guidelines:

- What problem led to the investigation of expert systems?
- What other approaches to solving the problem have been used?
- Whose problem is it?
- How many people does it affect?
- What are the consequences of not solving the problem?
- What are the benefits of solving the problem?
- Can the benefits be tracked and measured?
- What factors blocked solution of the problem prior to expert systems?
- Why couldn't the problem be solved using some other approach such as training, manuals, video or conventional software?
- Why was it necessary to use an expert system?
- How were expert systems seen as the remedy?

The involvement of TEC in developing an expert system to help determine monetary entitlement to Disaster Unemployment Assistance (DUA) benefits came from our willingness to continue the efforts begun in the state of Oklahoma. Consequently, the service we provided was demonstrated in the ongoing development of our nonmonetary determination expert system and grounded in our interest in seeking a use of the technology that could be exported to other states. Our own insight from previous work with expert systems told us that the DUA expert system held a high potential for immediate use, and we realized quickly that its development would take a much different path with a greater emphasis on legislation and on the authoritative interpretations provided by the Department of Labor (DOL) personnel with whom we were working. From our awareness of DOL reasons for selecting expert system technology, we could see how such a system would help overcome deficiencies identified in our agency operations. Following an economically devastating freeze in December 1989 in the Texas Rio Grande Valley and the subsequent filing of DUA claims by more than 10,000 individuals, problems with inadequate documentation and variances among employees in the interpretation of law provisions, particularly in the area of determining monetary entitlement to benefits, were found by DOL auditors. The development of an expert system was seen as a remedy that would be beneficial to both DOL and TEC.

Goal of the Full Expert System

Our understanding of the overall goal of the DUA expert system was an exportable version that improved operational efficiency and comprehension of DOL directives and guidelines, but as the project progressed, we began to speak most often of developing an expert system that helps those who use it to make consistent and accurate decisions when they determine DUA monetary eligibility.

Preliminary discussions that resulted in DOL contract modifications encouraged a synergistic working relationship between project personnel at DOL and TEC that built on their experience, training, knowledge, and expertise. That cooperative relationship became a workshop for constructing an expert system that could cope with difficulties associated with a Federal program that is called to action infrequently and that requires a rapid and expert response from employees (sometimes temporaries) who are unfamiliar with complex laws containing factors that are easily overlooked. The need was for a mechanism that would bring state employees up to speed quickly following a disaster while measuring all the right criteria contained in the legislation and in DOL directives.

The goal, then, has been to create a dynamic instrument that contains the desired consistency and accuracy in making monetary determinations of entitlement to DUA benefits.

DEMONSTRATION - DUA DETERMINER'S ASSISTANT

Opening Remarks

To set the stage for our presentation of how we developed the DUA Determiner's Assistant, we are distributing a floor plan that came from preliminary discussions of the role of an expert system in determining monetary entitlement to DUA benefits. This model provided several hours for interchanging knowledge about the problems that needed resolving and for seeking ways an expert system could help improve operational efficiency. We experimented with locating the expert system among the people, paper, computers, and determinations.

Picture with us, if you will, a line of clients (applicants) who have responded to state agency newspaper, television, and other public media notices of the availability of Disaster Unemployment Assistance (DUA) benefits to those who qualify after filing claims. The location may be an actual Disaster Area Center on site in a tent or a barn, possibly without any electricity or telephones, or the location could be in a state employment security local office with access to a mainframe computer through teleprocessing network terminals. Previously, the governor has viewed the disaster area following the flood, hurricane, or tornado (to name only a few possibilities), and the President of the United States has responded to that governor's request by declaring the area a disaster. We are facing our customers who have come to us for help in the aftermath of a devastating catastrophe with its damage to jobs, towns, and homes.

The applicant line leads to a receptionist who questions each applicant briefly and provides forms that relate to that individual's classification as an unemployed self-employed individual, unemployed worker, or an individual who has become a breadwinner or major support because the head of the household died as a direct result of the major disaster. The applicant may wait for an interviewer or complete the forms without agency help in the waiting area, or the applicant may be helped with the forms in a group filing area. In turn, each applicant will receive a seated interview during which the interviewer reviews the forms for completeness and secures additional documentation and information with which to determine monetary eligibility for DUA benefits. If only one laptop containing the DUA Determiner's Assistant is available, the paperwork would be routed to the employee operating that equipment to produce a preliminary assessment for DUA benefits (PREMON), a copy of which could be handed to the applicants desiring to wait.

DUA Claims Data Movement

The data from the DUA claims forms is entered on the mainframe either in the state office or in a designated local office. Determination information will be entered on the mainframe from the determination printouts.

The version of the DUA Determiner's Assistant developed thus far includes a way to create "flagging" statements that could contain notes about actions on wages or future continued claims for suspense in the agency offices (local or state) pending some investigative or other actions by the state agency making the determinations of entitlement.

We pictured printing out a list of social security numbers indicating which cases were "flagged" to serve as a cover sheet for transmitting the DUA claim forms to the local or state office where the data on the forms would be entered into the agency mainframe and files placed in suspension to monitor the requirements indicated by the flagged documents. An example of a "flag" might be the need to question a claimant about receiving pension benefits that might be deducted from the monetary entitlement before paying a continued claim sometime in the future.

DUA Time Lines

During several weeks of meetings with DOL representatives, we were able to pinpoint the factors on which the decisions of monetary entitlement turned. Some of these factors relate to the time sequence of the events that make payment of disaster unemployment benefits possible.

The actual date of the disaster is, of course, a significant date. That date is the beginning of the incidence period and usually the DUA date of unemployment. The unemployment date would determine the base period and the thirteen weeks used in DUA monetary computations. In addition, the first compensable week for DUA benefits begins on the Sunday (or Monday in some states) immediately following the disaster date. That Sunday (or Monday) then begins the Disaster Assistance Period (DAP) which lasts at least twenty-six weeks.

DUA Time Lines (Continued)

However, the disaster date is not the only important date. After the governor of a state views the disaster area, the governor asks the President of the United States to declare the area a disaster. Following the president's declaration, the state employment security agency (SESA) in the affected state must announce the availability of DUA benefits. That announcement date then begins a 30-day period beyond which the applicant must have good cause for filing late or be determined ineligible for DUA benefits. An applicant who was injured or ill as a result of the disaster would have good cause for filing late. A declaration by the president can be amended to include additional areas, such as in a flood progressing down stream. Announcements of the amendments result in a 30-day filing period for applicants in the newly declared disaster area.

One can easily see how complex these overlapping time periods can be for the individual who is applying for benefits and for the state employee trying to juggle the additional benefit computation information alongside these time periods.

System Structure

The DUA expert system was written using the AION software. It is a ruled based system as well as a system using objects to achieve its goals. Object processing is used for developing the storage of data in files. The class structure is also used to store and accumulate data internally that would be used later in the program. Both backward and forward chaining rules were used in the development of the system. Rather than developing large states in the system, more small states were used. The rules were constructed largely by using functions. This again made the system modular so that it can easily be enhanced and updated.

Throughout the system basic information on the disaster is used repetitively. The disaster incident period, disaster number, declaration date, state specific information as the state minimum and maximum benefit amount and the state average weekly benefit amount are entered by the office manager or person in charge that knows the password. Counties and their announcement date are also entered on a separate screen; the counties can be added as they are announced. This base information is saved into two files; a file containing the administrative information and a file containing the information on the counties. When the consultation is loaded, this base information is read from the files and held in memory throughout the consultation. This saves the user from having to re-enter this basic information each time the consultation is loaded.

System Structure (Continued)

The overall system is composed of one vocabulary, eight classes, one independent state, and thirty-three states. The large number of modules used in this system make it more flexible and easy to update. Data entry screens, menus, and boolean type questions are used to direct the consultation.

Administrative Screens

There are two administrative screens.

One screen contains features for data entry of essential dates, state benefits calculation formula data, and disaster identification data that is entered for each disaster by the agency DUA administrator or other designated official. The data entered in this screen is not likely to change during administration of the disaster to which the data is related. Illustrations of this kind of data are the State Name, the maximum and minimum weekly benefit amounts, the disaster number, and the beginning and ending incident period dates. Although it can be updated, this data is not changed easily.

The other administrative screen, however, represents related data that changes for each county or other geographical area declared as a disaster area. For example, the screen provides for data entry of the name of the disaster area affected and the date the SESA announced availability of DUA benefits. This data is entered for each geographical area declared a disaster.

Data Entry Screen

For each applicant for DUA benefits, the user enters user and applicant identification data and dates relating to that applicant's claim. The expert system makes comparisons with the base data for that disaster to guide the user through an essential path to determine timeliness and if the applicant was in the disaster area.

For example, if the date of unemployment for DUA that is entered is prior to the date of the disaster previously entered in the Administrative Screen, the DUA Determiner's Assistant asks the user, "Is the unemployment date correct?" A YES answer means that the applicant was truly unemployed prior to the disaster date, and the applicant is ineligible for DUA benefits.

Data Entry Screen (Continued)

Also, we ask the user, "What is the county where the applicant resided, worked or commuted through that was affected by the disaster?" If the expert system cannot find a match between the entered area name and the area(s) previously entered in the Administrative Screens that are resident in the expert system files - and if the problem is not one of misspelling the disaster area name - then the applicant will be determined to be ineligible for DUA benefits.

Timeliness

Internally the DUA Determiner's Assistant next compares the SESA announcement date entered in the Administrative Screen for each disaster area with the claim filing date that is entered for each applicant.

If the claim is filed within 30 days after the SESA announcement date of the availability of DUA, the expert system will present a menu with choices of UNEMPLOYED SELF-EMPLOYED INDIVIDUAL, UNEMPLOYED WORKER, and BECAME BREADWINNER OR MAJOR SUPPORT. Selecting either UNEMPLOYED SELF-EMPLOYED INDIVIDUAL or UNEMPLOYED WORKER will produce a second menu with choices of NON-AGRICULTURAL, AGRICULTURAL, or COMMERCIAL FISHING. Selecting BECAME BREADWINNER OR MAJOR SUPPORT will lead the user to a series of questions dealing with that situation, which will be discussed in more detail later in our presentation. If the claim is filed after the 30-day period has ended, the expert system will continue with another internal process.

Next, internally the expert system compares the end of the disaster assistance period, which was computed based on adding 26 weeks to the original declaration date that was entered in the Administrative Screen, with the date claim filed that is entered for each applicant.

If the claim is filed after the end of the disaster assistance period, the claimant must have good cause for filing late - such as illness or injury due to the disaster - or be determined as late and therefore ineligible for DUA. The DUA Determiner's Assistant presents the user with the question, "Does the applicant have good cause for filing late?" to permit a YES or NO answer by the user who will examine claim forms and possibly do additional fact finding before selecting the appropriate answer.

Unemployed Self-employed Individual, Non-Agricultural

After selecting UNEMPLOYED SELF-EMPLOYED INDIVIDUAL from the first menu and then NON-ARGRICULTURAL from the second menu, the DUA Determiner's Assistant presents the user with a series of questions designed to lead the user to two determinations.

Unemployed Self-employed Individual, Non-Agricultural (Continued)

The first determination is whether or not the applicant whose claim is being processed is actually an unemployed self-employed individual. If the applicant did not engage in self-employment in the major disaster area at the time of the major disaster or was not scheduled to engage in such self-employment at that time, the individual is determined ineligible by the expert system as not an unemployed self-employed individual. If the applicant meets one of those criteria but is not dependent upon the performance of services in connection with self-employment for that individuals principal source of income and livelihood, the applicant is determined by the expert system as ineligible for DUA benefits as not an unemployed self-employed individual.

The next determination by the DUA Determiner's Assistant deals with what happened as a direct result of the major disaster. If certain conditions are not met, the unemployed self-employed individual is determined ineligible for DUA since whatever happened did not happen as a direct result of the major disaster. If any one of these certain conditions are met, the unemployed self-employed individual is determined eligible for a DUA monetary.

To be eligible for the DUA monetary, the unemployed self-employed individual - as a direct result of the major disaster - could have her/his ability to perform regular services reduced or eliminated, could be unable to reach the place where services as a self-employed individual are performed, could have been scheduled to commence regular services but did not have a place or was unable to reach the place where regular services where to be performed, or could be prevented from performing services due to illness or injury. Any of these conditions - as a direct result of the major disaster - could result in a determination of the applicant being eligible for a DUA monetary. The computation of that monetary will be discussed shortly.

The expert system presents these questions to the user, and the user must examine claim forms and do any necessary additional fact finding on which to base a YES or NO answer. HELP Screens are provided for the user's necessary guidance, and those screens can be accessed by pressing the F6 key on the PC keyboard.

Unemployed Worker, Non-Agricultural

After selecting UNEMPLOYED WORKER from the first menu and then NON-ARGRICULTURAL from the second menu, the DUA Determiner's Assistant presents the user with a series of questions designed to lead the user to two determinations similar to what the expert system did with the unemployed self-employed individual.

Unemployed Worker, Non-Agricultural (Continued)

The first determination is whether or not the applicant whose claim is being processed is actually an unemployed worker. If the applicant did not work in the major disaster area at the time of the major disaster or was not scheduled to work at that time, the individual is determined ineligible by the expert system as not an unemployed worker. If the applicant meets one of those criteria but is not dependent upon the worker's employment for wages for that individuals principal source of income and livelihood, the applicant is determined by the expert system as ineligible for DUA benefits as not an unemployed worker.

The second determination by the DUA Determiner's Assistant deals with what happened as a direct result of the major disaster. If certain conditions are not met, the unemployed worker is determined ineligible for DUA since whatever happened did not happen as a direct result of the major disaster. If any one of these certain conditions are met, the unemployed worker is determined eligible for a DUA monetary.

To be eligible for that DUA monetary, the unemployed worker - as a direct result of the major disaster - could have her/his employment reduced or no longer have a job, could be unable to reach the place of employment, could have been scheduled to start to work but did not have a the job or was unable to reach the job, or could be prevented from working because of illness or injury. Any of these conditions - as a direct result of the major disaster - could result in a determination of the applicant being eligible for a DUA monetary. The computation of that monetary will be discussed shortly.

The expert system presents these questions to the user, and the user must examine claim forms and do any necessary additional fact finding on which to base a YES or NO answer. HELP Screens are provided for the user's necessary guidance, and those screens can be accessed by pressing the F6 key on the PC keyboard.

Became Breadwinner or Major Support

After selecting BECAME BREADWINNER OR MAJOR SUPPORT from the menu containing that choice, the DUA Determiner's Assistant presents the user with a series of questions designed to guide the user through the considerations on which such an individual might qualify for a monetary determination of DUA benefits.

Became Breadwinner or Major Support (Continued)

The expert system asks the user to answer YES or NO to the question, "Was deceased the head of household?" If the answer is YES, the expert system then asks, "Did head of household die as direct result of major disaster?" and a YES answer will then cause the expert system to ask, "Has applicant entered labor market and begun seeking suitable work?" While a NO answer to any of these questions will result in a determination that the individual is ineligible for DUA because that person is not a breadwinner or major support, a YES answer to that last question will cause the expert system to present a menu choice to the user between an applicant that has wages/earnings and one that does not have them.

The user of the system must examine relevant claim forms and other documents or do fact finding to make the choice of either a YES or a NO answer. HELP screens are available for information and guidance to assist the state employee in developing a basis for an appropriate answer.

If the applicant has wages/earnings, those amounts will be used to compute the DUA weekly benefit amount (WBA). If the applicant does not have wages/earnings, the wages/earnings of the deceased head of household will be used to do that computation. A menu choice between the deceased having wages from employment and having earnings from self-employment will guide the user to use of the appropriate amounts of income with which to compute the applicant's DUA weekly benefit amount.

DUA Weekly Benefit Amount (WBA) Calculation

A calculation of the WBA may not be necessary in the DUA expert system if a precalculated WBA already exists. If a claimant has all his wage records on file with the Texas Employment Commission and has applied for Regular UI benefits a precalculated weekly benefit amount may be available.

If a precalculated WBA is not available the computation of a DUA Weekly Benefit Amount (WBA) involves using the state formula to establish a potential DUA WBA as prescribed in 20 CFR 625.6(a)(1). If the applicant does not qualify for a a weekly benefit amount under the state formula, he may qualify for a WBA using the hourly rate as specified in 20 CFR 625.6(a)(3). If the applicant qualifies for a weekly benefit amount under section (a)(1) but it is less than the state average, a calculation under 20 CFR 625.6(a)(2) using the applicant's weekly wages will be used to compute a higher WBA. The highest WBA computed will be the WBA for the applicant.

DUA Weekly Benefit Amount (WBA) Calculation (Continued)

A weekly amount computed under paragraph (a)(2) or (a)(3) of section 625.6 shall not exceed 70 percent of the individual's average weekly earnings. If the application of this limitation results in a weekly amount less than the minimum weekly amount of regular compensation payable under the State law, the individual shall be ineligible for DUA as prescribed by 20 CFR 625.6(a)(5).

If the claimant is an unemployed self-employed individual and under paragraph (a)(1) or (a)(3) it is not possible to compute a weekly benefit amount, the unemployed self-employed individual will receive the minimum weekly amount payable under the applicable State law.

The wage entry screens are designed for each section of the law as required. For example, a quarterly base period wage entry screen for section (a)(1) will appear on the screen if a precalculated WBA has not been entered. The system calls out the appropriate wage entry screen as the data is needed.

Wage entry for self-employed individuals requires using the annualized wages. Screens for entering net earnings as shown on the IRS returns appear as needed. The applicable sections of the law again determine which screens will be displayed for data entry.

State minimum and maximum benefit requirements apply to the WBA calculations for DUA. This information is held in a file that is read into the program when first loaded and held in memory throughout the consultation.

DEPLOYMENT STATUS AND RESULTS

National DOL Interest in the DUA Determiner's Assistant

While the DUA Determiner's Assistant has been developed for use in Texas with the potential for a nationwide use in mind, some work toward a system for Louisiana has been completed. Since DUA is administered largely by federal legislation, it is an ideal application for exporting to other states with only a minor amount of adjusting for the state specific formula for computing the weekly benefit amount. The major changes would occur in paragraph (a)(1) of 20 CFR 625.6.

We have tested the system in Texas. This testing has resulted in some minor changes in the expert system and some major changes in the collection of data from the applicants. The system has caused the fact finding and collection of wage information to improve. Although the system has not yet been in the field, an awareness of the system and the recognition of the need for complete information to produce a determination using the system has already begun to have an affect on the DUA claims taking process.

Lessons Learned

The positive and negative aspects of the lessons learned from our work on the DUA Determiner's Assistant center around the nature of "legislative knowledge" and in the developing expertise of those who work on a project like this one.

One major - and no doubt obvious - difference between our work with the Claims Examiner's Assistant (CEA) and the DUA Determiner's Assistant lies in the sources for our knowledge base. With the CEA development we took pains to discover just how the domain expert's mind worked, and then we tried to put that process we found into the artificial intelligence expert system shell provided by AION Corporation. There was negotiation, but we conscientiously maintained what we believed was the integrity of the domain expert's mental process in the instance of making a nonmonetary determination when the claimant quit the last work or refused an offer of work. With the development of the DUA expert system, we abandoned that attempt at "knowledge engineering" in favor of a workshop approach in which the group of DOL and TEC project team members wrestled with the complexities of Federal legislation and the directives designed to interpret and implement that legislation. We developed a consensus of what might be called "legislative knowledge" in the case of how to determine and compute monetary entitlement to DUA benefits.

Lessons Learned (Continued)

In the work on both expert systems there was an amazing change process at work. The expert systems were changing us as we changed them. In the case of the CEA expert system the domain experts discovered questions they asked themselves without really being aware of what they had been doing – or not doing consistently. The effect was somehow to change the level of awareness in the experts so that they increased their own expertise. Similarly, those who participated in the workshop atmosphere during the development of the DUA expert system gradually admitted to a deeper appreciation and understanding – a changing perception, in fact – of the legislation that created the DUA program. The debates and various experimental documentation presentations of system structure took on an evolutionary character as we all discovered potentials for making the expert system carry out our ideas of what should be done. While we were descriptive with the CEA expert system, we eventually became prescriptive with the DUA expert system.

Lessons learned, then, were not really negative or positive. The lessons were actually the discoveries that we have just related about working with expert systems. Some applications require rather different approaches, and each project is likely to offer its own peculiar insights.

TEXAS EMPLOYMENT COMMISSION
UI Expert System Colloquium Presentation

by

Howard Hagemann and Ted Swindle

Overview of Presentation - The Claims Examiner's Assistant Expert System

Comments Relating to Parts of Guidelines for State Presentations of UI Expert Systems

- Statement of the Problem and Its Characteristics

- Other Factors Involved

- Goal of the Full Expert System

Slide Presentations Dealing with the Following:

- Solution Characteristics

- Technical Approach

- Development Process and Results

- End-user Participation

- Knowledge Acquisition Process and Results

- Methods Used to Ensure Accuracy of Recommendations

Demonstration of The Claims Examiner's Assistant

- Work Refusals

- Quit the Last Work

Deployment Status and Results

Conclusions: Positive and Negative Lessons Learned

TEXAS EMPLOYMENT COMMISSION
UI Expert System Colloquium Presentation

COMMENTS RELATING TO PARTS OF GUIDELINES FOR STATE PRESENTATIONS OF UI EXPERT SYSTEMS

Statement of the Problem and Its Characteristics and Other Factors Involved

Comments on Questions from Guidelines:

- What problem led to the investigation of expert systems?
- What other approaches to solving the problem have been used?
- Whose problem is it?
- How many people does it affect?
- What are the consequences of not solving the problem?
- What are the benefits of solving the problem?
- Can the benefits be tracked and measured?
- What factors blocked solution of the problem prior to expert systems?
- Why couldn't the problem be solved using some other approach such as training, manuals, video or conventional software?
- Why was it necessary to use an expert system?
- How were expert systems seen as the remedy?

While the Statement of Work background information [Handout.] from the U.S. Department of Labor contract with the Texas Employment Commission signed in September 1989 addresses some of the above questions, the essential reasons for selecting expert systems as a solution for the ongoing problem of improving operational efficiency and effectiveness are not fully detailed. Moreover, tracking and measuring an anticipated benefit such as "employee goodwill" is not easily accomplished, and we have discovered a similar problem with "uniformity in decision-making" because we had no pre-existing measures of just how much or how little uniformity we had before the introduction of expert systems. However, given the conditions of our contract, we believe the use of expert systems is a justified use of technology to solve the problem of improving operational efficiency and effectiveness.

Perhaps two other points are relevant to this series of questions. First, there are various economic pressures on Federal and State agencies to "do more with less". This expert system project is an example of our turning to the latest in computer technology with the hope of discovering a new path to greater efficiency. Second, as with all new technology, we have been changing along with our understanding of the technology. As we observed the Claims Examiner's Assistant in use in a local office and as we saw the consequences of different experts using the developing expert system, we realized unanticipated problems with testing plans. Consensus among experts was not easily obtained, and using a panel of experts evaluation approach or matching decisions done on the expert system with decisions done by other experts did not necessarily produce the "accuracy" we thought it would.

TEXAS EMPLOYMENT COMMISSION
UI Expert System Colloquium Presentation

Statement of Work: Texas Nonmonetary Expert System Demonstration Project

Unemployment Insurance (UI) programs were designed to provide limited monetary compensation to workers who lost their jobs through no fault of their own and who were available for work, desired work, and were actively looking for work. The UI program has operated for over 50 years and is administered by both the Federal Government and the States. The States are responsible for the day-to-day operation of the UI program. SESAs (State Employment Security Agencies) collect taxes from employers, determine claimant eligibility, pay benefits, and perform other program operational functions. The Federal Government role is one of overall administrative oversight on a nationwide basis. Major Federal functions with respect to the UI program include preparation of the national budget, allocation of funds to States to cover UI program administrative costs, establishing national goals and objectives, oversight of general operations, establishment and monitoring of performance goals, and provision of technical assistance to the SESAs.

Both the Federal Government and the States, therefore, are interested in improving operational efficiency and effectiveness of the UI program. Over the years, many cooperative programs and projects have been implemented jointly in order to better meet UI program goals and objectives and better serve UI claimants. Advances in technology, especially computer science, have led to many innovative methods of operating programs at the State level. The areas of artificial intelligence and expert systems are being explored to determine the applicability and costs-benefits to the UI area.

In 1983, UIS experimented with a form of artificial intelligence called expert systems as a means to improve the UI nonmonetary determination process. This early effort was successful in demonstrating that such a system could be created. A second and more extensive project was initiated in September 1987. UIS contracted with Evaluation Research corporation (ERC) and the Kansas Employment Department to demonstrate the feasibility of developing and applying such an expert system to State UI operations. UIS is providing contractor assistance for the expert system part of the effort, while the Kansas Employment Department is providing the UI expertise.

Because Expert Systems may have wider applicability to UI operations than is being tested in the Kansas demonstration, UIS is entering into this cooperative agreement to determine whether expert systems can be applied to other States and/or other UI functions.

TEXAS EMPLOYMENT COMMISSION
AI Expert System Colloquium Presentation

Goal of the Full Expert System

The overall objective of this artificial intelligence demonstration project was to develop, test and evaluate a nonmonetary expert system application in an IT operational environment, but the introduction of an artificial intelligence expert system into the claims adjudication process anticipated the achievement of a number of goals. The expert system, which was eventually named "The Claims Examiner's Assistant", was envisioned as providing the following benefits:

- Documentation of the fact-finding process more efficiently and accurately.
- Reduction of time to gather and analyze information.
- Uniformity in decision-making among offices and individual claims examiners.
- Reduction of the knowledge curve between experienced and new claims examiners.
- Reduction of response time to claims.
- Possible reduction of appeals workload.
- Improvement of claimant and employee goodwill.
- Improvement of quality in decision-making.
- Creation of employee satisfaction.
- Immediate distribution of rules changes to all claims examiners.

These benefits seen as "goals" were, however, subordinate to and a part of four overriding concepts. The key concept involved the belief on the part of those who proposed this project that the unemployment claims eligibility laws, rules, and precedents could be incorporated into a knowledge base. A second concept was that the artificial intelligence expert system developed could be used in an employment security agency local office production environment, and a third concept was that the use of such an application would produce both significant cost reductions and quality improvements. Finally, a fourth concept was that artificial intelligence technology could be transferred to TEC staff at a rapid rate. The benefits of the developing expert system were viewed as proofs of these four concepts.

TEXAS EMPLOYMENT COMMISSION
UI Expert System Colloquium Presentation

SLIDE PRESENTATION - THE CLAIMS EXAMINER'S ASSISTANT

Expert Systems Application in the Public Sector

This slide presentation discusses various aspects of our work on the expert system we have named The Claims Examiner's Assistant (CEA).

Although we have prepared material to tell just basically what we did in developing the system, we hope to address those topics as requested by organizers of the colloquium. Topics such as solution characteristics, technical approach, development process and results, end-user participation, knowledge acquisition process and results, and methods used to ensure accuracy of recommendations have been made a part of our story either directly or indirectly.

The efforts to utilize the benefits of expert systems at the Texas Employment Commission through Department of Labor contractual funding have been an exciting opportunity to participate in the newest edge of technology. We are grateful for this opportunity and hope this presentation of our work will contribute to a better understanding of how this technology can be made a permanent part of activities in the Unemployment Insurance Program area.

Federal-State Partnership

The Texas Employment Commission (TEC) has been a partner with Department of Labor (DOL) in many undertakings through legislation dating back in the 1930's. In the areas of Job Placement, Unemployment Insurance (UI), and Labor Market Information we have forged an employment security system for our nation and our state that has served the employment needs of our citizens and the private and public sectors of our economy for well over fifty years. So, a joint contractual effort in the new technology area of artificial intelligence expert systems is in keeping with these historical precedents.

The offering of an opportunity to be involved in developing an expert system to help adjudicate nonmonetary determinations - with the necessary additional funding - was seen by those of us selected to work on the project at TEC as one of few current chances to enhance the accomplishments of over a decade of automation in the UI Program. Consequently, we have shared our efforts with DOL personnel in both national and regional offices with what we believe are beneficial results for all parties.

Knowledge Engineering and the Expert System

The term "knowledge engineering" represents a metaphorical concept that postulates a capacity of "knowledge" to be engineered - or structured - in such a manner that it can be computer programmed. Our use of the term on this project developing an expert system involves that expectation as well, but we have construed its meaning to be separate from computer program development.

Knowledge engineering as we have used the term has been our efforts to find out how the expert claims examiner's mind works and to design documentation of that process in a format that also represents a record from which the expert system can be programmed. This merging of an approximated mental process in the mind of a domain expert with what develops as a computer program designed to represent that process is the "structuring" of a knowledge base that we have called knowledge engineering.

The graphic you see is more than a cartoon of what we believe we did with developing the Claims Examiner's Assistant. The expectation of knowledge engineering is shown as we saw it - an ability to find a way to see the thoughts of the domain expert in a way that can be programmed in the AION artificial intelligence expert system software.

Development of The Claims Examiner's Assistant

The Claims Examiner's Assistant is a decision support system for the adjudication of unemployment benefits. This expert system assists a claims examiner who is making a decision about paying or denying the payment of unemployment insurance benefits when a claimant has either refused work or quit the last work. The expert system in this case is designed to provide decision support. It is not designed to replace an employee - only to assist an employee do the job of decision-making more efficiently and accurately with consistency.

Where Did We Start?

The Claims Examiner's Assistant development began with a careful review of relevant laws, manuals, and directives. Also, its beginning was part of our visualization of the relationship between computers and the employees who use them.

Where Did We Start? (Continued)

The Texas Unemployment Compensation Act (TUCA) contains mainly two relevant provisions relating to our project. Section 5(a) of the Act deals with a claimant who quit the last work, and Section 5(c) deals with the work refusal situation. Frequently, we refer - in jargon fashion - to these types of cases as either 5(a) or 5(c). The Texas Unemployment Insurance Manual and the Texas Appeals Policy and Precedent Manual were two other resources consulted frequently. Directives and letters from both TEC and DOL were examined for relevant information that eventually became a part of this expert system.

Before getting started on the interviewing of domain experts, we made efforts several times to visualize the relationships between computers and the people who would use them. Claims examiners make determinations in Texas on issues of work refusals and quitting the last work in both local and state offices, and we could see the Claims Examiner's Assistant resident on either PC's or on the mainframe helping them all over the state. We realized, however, that changes as a likely part of routine maintenance of such a system would work best on the mainframe where the changes could be made overnight and made available to hundreds of employees the next day in contrast to mailing instructions on paper or on diskette for altering the many PC's that would otherwise be required.

Whom Did We Interview?

The project director initiated a search for the person many claims examiners sought for help. This individual was to be the person to contact for assistance. Our search took interesting turns, and we found two domain experts with three characteristics.

With the help of both state and field office management personnel, we found two individuals who had a reputation for expertise as a claims examiner that made nonmonetary determinations. These were people to who other claims examiners went for help. They had several years of experience doing this type of work, and they had leadership skills as evidenced by their positions as lead examiners in their respective units. One person was from a field office, and the other individual was from a unit in the interstate liable section in the Benefits Department in the state office. A third characteristic was their willingness to help. This trait was especially important because they took an enthusiastic approach to helping the project succeed.

These two individuals worked with the project knowledge engineer for some 100 hours of interview time, scheduled in two-hour sessions twice each week over a six-month period.

What Did We Develop?

Having every intention of searching out the actual mental process of the two expert claims examiners, we were surprised to discover a process that was quite different from what we expected. While we developed what might be called a diagram of the mind, we discovered something like "chunks" of knowledge that were eventually represented by questions directed inward to the expert.

This discovery of the direction of questions was almost startling because we had expected to find certain questions directed - not to the user of the expert system - but outward, toward the claimants for UI benefits, the employers, and other parties with information about the cases. Since the expert system was not supposed to replace an employee, this direction of YES/NO questions fit both the nature of the decision support expert system and the way we found the domain experts' minds worked.

A chunk of knowledge, we found, could be represented by a fundamental question, such as, "Is the job suitable?" In the diagram we developed, however, there were other questions that the expert claims examiner asked herself/himself that answered the more fundamental question. Once these lower level questions dealing with the factors of suitability of work were answered, the question, "Is the work suitable?" virtually disappeared, since it was answered by having answered questions within the chunk of knowledge that it represented. The fundamental question appears in our diagram of the mind of the expert claims examiner, but it is not always presented on the screen to the user of the expert system.

How Did We Develop It?

If we were to pick a word that describes the mental process we discovered while interviewing the domain experts, we would use the term COMPARTMENTALIZATION because that seemed to be what our experts' minds were doing when they went through the process of adjudication in the instances of work refusals and quitting the last work. Behind each chunk of knowledge was this process which consisted of groups of factors formed into compartments by a process of elimination.

How Did We Develop It? (Continued)

During the interviews of the domain experts, the knowledge engineer would encourage through informal discussions and questions an interesting story-telling by the domain experts of their favorite, common, and unusual cases from their years of experience. As their decision-making factors became evident, the knowledge engineer would record those factors on chalkboard or flip chart pages with phrases representing what seemed to be the most significant elements of those factors. The factors would be grouped and regrouped experimentally until the experts were satisfied that only the most relevant factors were left in considering an issue. The result was a compartment of factors, and that compartment was then focused by the fundamental question that represented the chunk of knowledge thus developed. The chunks of knowledge represented by the fundamental questions where then prioritized and sequenced as we understood the domain experts ordered them mentally when doing their work.

Frequently, in discussing these knowledge engineering sessions with the project director and the computer program developer, the knowledge engineer would encounter a challenge to what was discovered in the sessions. Then, a communication process would take place in which various documentation designs would be developed by the knowledge engineer using desktop publishing software on a Macintosh II computer until the participants were satisfied that the documentation represented a structure that could be programmed without losing the integrity of the domain experts' mental process. The domain experts were consulted, also, until the structure matching their minds was achieved. The agency appeals director ruled when experts disagreed.

Probably the most interesting discovery in the project occurred during these knowledge engineering sessions. As the mind-model of an expert claims examiner gradually took shape, the fundamental questions directed inwardly to the expert became less mysterious, and the domain experts realized they were asking themselves questions of which they were not consciously aware. It was as if they were recognizing their own thoughts in the domain paradigm we were building together. That recognition had a transforming effect - like a training effect in athletic endurance performance. We would get a kind of "second wind" with each discovery. Also, there was some anxiety in that the experts were realizing that they did not always ask themselves these questions - even though they knew they should. The result was a deeper awareness of the process even in the experts we were using to find our knowledge base.

Domain Paradigm

Discussing the mind-model – or domain paradigm – is a lot like talking about concepts of model airplanes. Until you can hold it in your hand – or hold it in your mind – you may have trouble seeing any substance. In fact, what is pictured for you is subject to change with more research and debate among those who would design and program a better expert system in the future.

From the knowledge engineering work we did with the two original domain experts and with two more experts doing testing of our work in two San Antonio local offices, the mind-model of the claims examiner seemed to be a dynamic focusing of the individual's attention on fact-finding questions directed outwardly to claimants, employers, and other parties with relevant information while being guided by procedural questions directed inwardly to the examiner. Simultaneously, decision-making questions, law section selection questions, and statement code selection questions are being directed inwardly by the mind of the examiner somewhere outside the attention span of the examiner except for brief moments of insight that surface into the attention of the examiner.

The questions themselves seem to operate in a holographic manner with a hierarchial relationship in which questions on lower levels answer questions on the higher levels. Thus far in what appears to be an extremely complex process we have tackled only the decision-making questions directed inwardly toward the examiner by the examiner – questions that are usually outside the attention of the examiner and questions of which the examiner is often not consciously aware.

We will look closer at this structure of questions as we examine the flow of the knowledge base during our demonstration of the Claims Examiner's Assistant.

DEMONSTRATION OF THE CLAIMS EXAMINER'S ASSISTANT

Illustration of the Expert System Knowledge Flow

The demonstration of the Claims Examiner's Assistant expert system involves two sections of the Texas Unemployment Compensation Act (TUCA). Section 5(a) deals with quitting the last work, and Section 5(c) involves a refusal of work. The method for demonstrating the Claims Examiner's Assistant is a process of operating the expert system using "generic" cases involving work refusals and quits which are "run" through the system as illustrations of how it works.

The demonstration is essentially an illustration of the expert system knowledge flow, and there are two aspects of the Claims Examiner's Assistant knowledge base that are of significance.

First, the Claims Examiner's Assistant is conceptually only one part of a potentially much larger network of such expert systems. For example, work refusals and quits could easily be joined with discharges, and there are a host of other nonmonetary issues - such as able and available - that could be added in the future. Also, the network could be expanded to include separate systems for making a monetary determination and for taking and processing initial and continued claims.

Second, the work we have done on the Claims Examiner's Assistant is essentially descriptive rather than prescriptive. As previously explained during our slide presentation, our efforts were focused on how the minds of principally two domain experts worked in doing the tasks associated with making decisions about paying or denying unemployment insurance benefits in the instances of quits and work refusals. As will be more obvious in our Lessons Learned comments, we quickly discovered that nonmonetary determination experts do not think exactly alike, and an expert system that emulates the domain experts' mental process may not contain the "prescriptive" intentions of those who act as official authorities to evaluate the work of the experts in terms of quality. Even those who act as official authorities can and do differ on evaluations of quality decisions. Prescriptions, of course, do not always match descriptions of human behavior - mental or otherwise.

Illustration of the Expert System Knowledge Flow (Continued)

These comments are intended, however, to draw attention to an important feature in the Claims Examiner's Assistant that we feel goes a long way to remedy the tension between description and prescription in our expert system. That feature is the very flexible fact-finding statement record that can be added to a case by pressing the appropriate key on the terminal keyboard. On this screen, which can be printed and made a part of the permanent record for nonmonetary determination quality evaluations, the user of the Claims Examiner's Assistant can type a statement for signature (if necessary) by the claimant, employer, or other party with information on the case. If desired, the user can record her/his own notes and fact-finding commentaries to make them a part of the case history.

DEPLOYMENT STATUS AND RESULTS

Need for Additional Work and Mainframe Availability Before Deployment

The Claims Examiner's Assistant is not yet ready for deployment for several reasons.

One reason is the need for additional work on the expert system itself. As indicated previously, there is an excellent potential for what we have developed thus far to be made a part of a much larger network of expert systems dealing with other nonmonetary issues and with different kinds of claims activities, such as monetaries and the taking and processing of different types of claims. Also, the Claims Examiner's Assistant requires more scrutiny by those who would use it and by those who evaluate the quality of nonmonetary determinations. The local office testing of the CEA proved to be of great value in identifying problems that needed resolving and features that would make it more efficient and effective. In fact, a tester of CEA in our Arlington local office was the one who contributed the idea for adding a fact-finding statement feature. During tests in local offices in both the Fort Worth and San Antonio TEC Regions, we had numerous nonmonetary statement codes brought to our attention, and testers in the Fort Worth Region helped us realize that we needed to add a fundamental question dealing with whether or not the claimant had actually refused the work. Sometimes a work referral would be checked with the employer before the claimant had applied for the job, and we needed to add a step in the system to permit a determination of APPLIED NOT HIRED when the fact-finding showed the claimant did report after all but was not hired.

Another reason for further work on the Claims Examiner's Assistant lies in the concept we chose for our work in Texas in contrast with other states. In our efforts to fashion an expert system that works like the minds of our two principal domain experts, we chose to select those self-directed questions the experts ask themselves. Another approach would anticipate the identification of certain questions directed either internally or externally that most experts in most cases would ask when doing fact-finding. The Claims Examiner's Assistant does not contain that structure because we did not find that structure operating in the domain experts from whom we extracted our knowledge base. Further research into how some states' laws and precedent appeals cases contribute to a limiting of the factors to be considered would likely permit the combining of the approach we used with an approach using "fact-finding" questions.

TEXAS EMPLOYMENT COMMISSION
UI Expert System Colloquium Presentation

Need for Additional Work and Mainframe Availability Before Deployment
(continued)

In the instance of the Claims Examiner's Assistant, perhaps the most important point in support of a delayed deployment lies in the availability of the software on the mainframe computer. Distribution of CEA by diskette and individual examiners' PC's would be so costly as to be impractical, especially when considering the cost of several hundred PC's and the problems of distribution and control of updating maintenance changes to the expert system. Availability of CEA on the mainframe computer would permit overnight updates and availability all over the state. The immediate effects of this powerful technology would be virtually instantaneous, and the input from so many users would be felt at once in the development of a better product.

CONCLUSIONS

Positive and Negative Lessons Learned

The intent in these comments is to identify those lessons learned from what we believe we did successfully and from what we can see in hindsight that we might have done differently to produce a better expert system product.

Of those things we believe we did successfully, perhaps the best was separating the tasks of computer program development from what most likely should be called knowledge acquisition. We had a knowledge engineer who was not trained to do expert system computer programming and an expert system computer program developer who was not trained to do knowledge acquisition. During the knowledge engineering sessions involving those two individuals and the project director, we gained the advantage of the knowledge engineer pushing for: the mental process of the domain experts without deciding "it cannot be programmed that way". The program developer did not work with the limits of programming shaping perceptions of how the domain experts had to think. We had some unusual debates, but the outcome was a better match with the mental process of the domain experts we used than we might otherwise have had.

With hindsight we know that one thing we could have done differently would be to have found domain expertise that would better satisfy the standards of quality appraisal. We chose with the recommendation of agency management a person who would serve as "referee" if the two domain experts selected could not agree on the right course of action in deciding issues related to work refusals and to quitting the last work. This person with authority was the agency appeals director. This choice was our concession to the need for prescriptive authority when description of the minds of the domain experts revealed an irreconcilable conflict. What we did not anticipate well enough was the need for including more of the viewpoints of those charged with handling quality appraisal of nonmonetary determinations. While we found an ultimate "authority", the potential for further debate was underestimated since the agency appeals director was not part of the IU Benefits quality appraisal program. Those concerns were viewed in parallel, but different terms. "Quality" meant "legal" to an appeals director instead of the passing or failing score claims examiners achieved on the Quality Performance Index (QPI).

Positive and Negative Lessons Learned (Continued)

Another thing that hindsight tells us is the importance of clarifying how to measure "accuracy" in developing the decision of an expert system. If a decision made by CEA was ruled "inaccurate" because local office testers came to a decision different from our expert system, the value of that information was the clues it gave us for necessary changes. Sometimes we would do further knowledge engineering sessions to determine what we had overlooked. However, the term "different" was better because "inaccurate" meant that our expert system did not match the testers - something we knew already because the testers were not our domain experts. The disagreement among expert claims examiners as to what an "accurate" decision was - and how to make that decision was a problem in measurement which we did not fully resolve.

APPENDIX A   COLLOQUIUM ANNOUNCEMENT

DIRECTIVE :   FIELD MEMORANDUM NO. 41-91

TO   :   ALL REGIONAL ADMINISTRATORS

FROM   :   DONALD J. KULICK
              Administrator
              for Regional Management

SUBJECT   :   Unemployment Insurance (UI) Expert System
              Colloquium of State Agencies' Demonstration
              Projects

1.   Purpose. To announce a UI Expert System Colloquium in
Austin, Texas, June 12 through 14, 1991.

2.   References. FM 26-89 (December 20, 1988); FM 12-90
(November 1, 1989).

3.   Background. The Unemployment Insurance Service (UIS)
has funded a total of five expert system demonstration
projects during the last several years. One project in
the State of Kansas has been completed. The other four
projects are being conducted through cooperative
agreements with State Employment Security Agencies (SESAs)
in Maine, Missouri and Texas (two projects).

The purpose of the expert system demonstration projects is
to determine the feasibility of using expert system
technology in the administration of unemployment insurance
activities. Issues addressed in the demonstration
projects include questions of expert system accuracy,
reliability, ease of use, system maintenance and overall
impact on the efficiency of the activity being conducted.

The Colloquium will provide a means to: a) conduct in-
depth reviews of each State agency's expert system
demonstration project; b) exchange ideas on the technical
aspects of developing expert systems in the unemployment
insurance environment; and c) discuss prototype
development issues and problems with peers and experts who
have knowledge and experience of private industry
applications of expert systems as well as other
governmental agencies' expert system applications and
programs.

4. **Participant Nominations**.

a. **Pilot States**. Participant nominations from the States of Kansas, Maine, Missouri and Texas should be requested. Participants from these States should include the project manager, knowledge engineer and the domain expert.

b. **Other States**. SESAs which are developing UI expert systems using their own resources or UI automation support account funds are invited to nominate an observer to the Colloquium, subject to space availability. Regional Offices with interest in UI expert system development are also invited to send an observer.

c. **Regional Offices**. Regional Office staff in Regions I, VI and VII responsible for monitoring the pilot States' expert systems projects are encouraged to attend. Other Regions are invited to send a representative.

d. A limited number of spaces will be available for those nominees under item b. and will be selected by the National Office.

5. **Agenda**. The Colloquium agenda is attached. Particular attention is directed toward the requirements for each of the four expert system States (Kansas, Maine, Missouri, and Texas) to describe and demonstrate their expert system prototype. A detailed discussion will follow each State's presentation.

6. **Arrangements**. The Colloquium will begin at 8:00 a.m. on June 12, 1991, with registration, and will adjourn at 12:00 noon on June 14, 1991. Participants are requested to make travel arrangements so that early departure will not be necessary.

A block of rooms has been reserved at the Embassy Suites North Hotel, Interstate 35 and Highway 290, Austin, Texas. The daily room rate is $55.00 (single). Participants are responsible for making their own room reservations.

Reservations should be made by May 21, 1991, by calling the Embassy Suites North at 512-454-8004 or (toll free) 1-800-EMBASSY, and requesting the group rate for the DOL Expert System Colloquium.

The hotel provides shuttle service to and from the Austin airport.

There will be a registration fee of $25.00 per individual.

7.   <u>Action Required</u>.   Regional Administrators are
requested to: a) obtain the name, title, address and
telephone number of each participant nominee from the
States of Kansas, Maine, Missouri and Texas and observer
nominee from other interested States; and b) call in this
information to Wayne Zajac at (8) 535-0222.   Information
is requested by May 1, 1991.   The National Office will
make the selection of nominees by May 10, 1991, and
provide the names of those selected to respective Regional
Offices by telephone.

8.   <u>Inquiries</u>.   Questions should be directed to Wayne
Zajac at (8) 535-0222 or David Balducchi, Office of
Regional Management, at (8) 535-0596.

9.   <u>Attachments</u>.

<u>Attachment A:</u>   Colloquium agenda
<u>Attachment B:</u>   Guidelines for State Presentations.

UI Expert System Colloquium
U.S. Department of Labor
Synergistic Solutions Technologies, Inc.
Embassy Suites North
Austin, Texas
June 12-14, 1991

WEDNESDAY
June 12, 1991

8:00 a.m.	Registration and Informal Discussions
8:30 a.m.	Introductions and Welcoming Remarks Wayne Zajac, UIS Project Officer Robert Kenyon, Region VI-RD for UI James Jackson, UI Director-TEC James Ronay, President-SSTI
9:00 a.m.	Overview DOL/UIS Expert System Development - David Balducchi, Wayne Zajac
9:30 a.m.	Keynote Address - James Ronay
10:30 a.m.	Evaluation of UI Expert System Demonstration Projects - Methodology and Criteria - John Sederberg, SSTI
11:30 a.m.	Lunch
1:00 p.m.	Presentation - Demonstration and Discussion of the Kansas Expert System Prototype
2:30 p.m.	Break
3:00 p.m.	Presentation - Demonstration and Discussion of the Maine Expert System Prototype
4:30 p.m.	Summary - John Sederberg, Others

THURSDAY
June 13, 1991

8:00 a.m.   Review Wednesday's Presentations -
                      John Sederberg, Others

8:30 a.m.   Presentation - Demonstration and Discussion
                      of the Missouri Expert System Prototype

10:00 a.m.   Break

10:30 a.m.   Presentation - Demonstration and Discussion
                      of Texas Nonmonetary Expert System Prototype

12:00 p.m.   Lunch

1:00 p.m.   Presentation - Demonstration and Discussion
                      of Texas DUA Expert System Prototype

2:30 p.m.   Break

3:00 p.m.   Open Lab Session (State Expert Systems
                      Available for Testing by Participants)

4:30 p.m.   Summary - John Sederberg, Others

7:00 p.m.   No-Host Dinner

FRIDAY
June 14, 1991

8:00 a.m.   Review of Thursday's Presentations -
                   John Sederberg, Others

8:30 a.m.   Mini-seminar on Topic Developed by
                   Participants Prior to Colloquium

10:00 a.m.   Post-prototype Development - John Sederberg

11:00 a.m.   Use of MIRAGE Programs in Pre-prototype
                   Development of Expert Systems - John Sederberg

11:30 a.m.   Closing Remarks - Wayne Zajak, Others

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ANN W. RICHARDS
GOVERNOR

June 7, 1991

Greetings:

As Governor of the great State of Texas, it is a pleasure for me to welcome you to the Unemployment Insurance Expert System Colloquium.

I know that the work you do benefits a great many people, and I hope that this colloquium provides a valuable opportunity to meet and exchange ideas that will improve the lives of countless individuals.
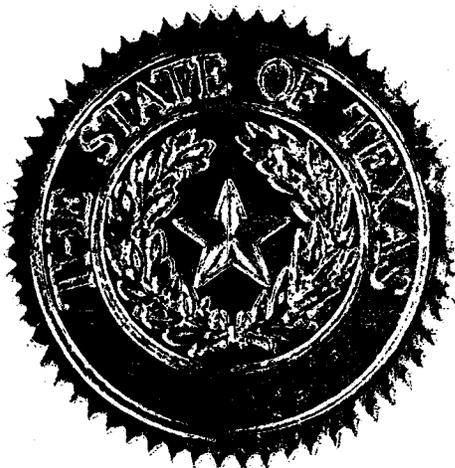
I am proud that you have chosen Austin for this event. It is a beautiful city in a beautiful state, and I am certain you will enjoy your stay here. I hope that this week will inspire many of you from around the nation to visit Texas again.

Best wishes on a successful event and continued success for the future!

Sincerely,

ANN W. RICHARDS
Governor

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