UTILIZATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN ADULT DISTANCE LEARNING

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Working adults in evening business program often have difficulty with courses involving quantitative reasoning. The most common complaint among these students is the pace of the course and, due to the fact that they may be only on campus one night a week, it is often difficult for them to utilize the learning resources available to full-time students. Recent developments in AI technology have brought about the capability to significantly improve the self-learning process. This paper proposes and outlines the steps required to develop an expert system-based learning program for working adults who have returned to the classroom.

INTRODUCTION

Students in both undergraduate and graduate business programs often have difficulty with courses involving quantitative reasoning. This problem is compounded in evening degree programs that are tailored toward working adults. A majority of working adults have been away from school for a number of years. Often, their skills in mathematics have deteriorated over time. Furthermore, many of these students report a less than satisfactory experience with these types of courses. As a result, a large of number of students in evening programs find themselves struggling in their courses involving quantitative reasoning, e.g., statistics, and a few even quit these programs. The most common complaint among these students is the pace of the course. They often claim, that if given more time to absorb the material, their overall understanding and performance would substantially improve. However, due to the fact that they are often on campus only one night a week, and are often involved in job related travel, it is difficult for them to utilize the learning support resources available to full time residential students (Kerka 1992).

As a result of these conditions, adult learners often seek other approaches for mastering the subject material. These alternatives include tutors, group processing and videos. Unfortunately, each of these approaches has a number of serious limitations. Computer-based information technology is a relatively new approach to providing

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students with access to self-paced study programs Although useful, a majority of the currently available tutorial software packages lack the sophistication and flexibility to accommodate the growing demands for adult education. System requirements for adult education and training are fundamentally different than those associated with most traditional business programs, (Newstrom 1991, pp.43-48). For example, "Adult learners have a deep and powerful drive to be self-directing to be in charge of their developmental destinies and to take control of their learning processes." This observation is one of the basic assumptions of Malcolm Knowles' andragogical paradigm which addresses the educational and training needs of the working adult (Lawson,1997, p.10).

In recent years, advances in technology have significantly enhanced the capabilities and affordability of PC's for business education applications. For example, the availability of inexpensive CD-ROM (Compact Disks - Read Only Memory) drives has added the dimension of sound and motion to what used to be mundane programs. Presently, CD-ROM-based, interactive media, commercial software packages are available for teaching basic business subjects such as statistics and accounting. These packages incorporate sound, music, and animation and produce a comprehensive and entertaining teaching software package.

Over the past few years, technology has been used increasingly and successfully in teaching second languages. Under the umbrella of Computer Assisted Instruction (CAI), individual students, whether in a classroom or media center or over long-distance computer networks, are studying second languages. Learning components such as speaking, listening, reading, writing, and culture are identified first. Then, the appropriate technology for delivering each component is determined. For example, interactive audio programs allow students to practice with other students. Interactive video disk programs are used for listening comprehension activities. Techniques ranging from fill-in-the-blank, multiple-choice, word recognition, and word processing in the target language can be used to enhance a student's writing skills. Cultural differences and similarities in their proper context can be demonstrated using video-based activities. And finally, computer-assisted testing can be used to measure the level of learning that has taken place (Willetts, 1992, p.4-7) These capabilities can be enhanced as technology becomes more sophisticated.

A common flaw with most CAI commercial applications is the "One-size-fits-all" nature of these packages. Most tutorial programs offer a "canned" package of learning experiences that disregard whether the learner is a novice or advanced, or even how a particular user learns best. This problem is even more critical when dealing with technical subjects such as statistics and operations management. Ideally, the software would include an "expert system" driven diagnostic module which would prescribe learning experiences for the user. That is, based on a series of questions and the responses, the software would diagnose the needs of the learner and determine the appropriate approach to a certain topic. These capabilities do not generally exist in CAI software. However, Expert System (ES) technology will allow for direct incorporation of these features.

This paper proposes the development of an Adaptive Learning System (ALS) software package that considers the specific needs of a user and provides the appropriate learning experience. The software features:

- A series of topics divided into learning components that become the building blocks of this system. Each learning component is presented in a multi-step sequence of learning. The learning system consists of text material, video presentations and simulation analysis.
- An adaptive routine that changes the sequence of learning and difficulty level within each learning component based on the user's responses to questions posed.
- A diagnostic feature using expert knowledge to determine the appropriate learning experience and mode of delivery.
- An ability to reference additional support material for subsequent study.
- A capability to save a partially completed learning session.
- The capacity to provide this service via the Internet.

EXPERT SYSTEMS OVERVIEW

An Expert System (ES) is a decision support tool designed to computerize the sum of available knowledge and rules that emulate the human decision-making process. Perhaps one of the most comprehensive definitions of an ES is given by Parsaye and Chingnell (1988, p.1) as "A program that relies on a body of knowledge to perform a somewhat difficult task usually performed by a human expert. The principal power of an expert system is derived from the knowledge the system embodies rather than from search algorithms and specific reasoning methods. An expert system successfully deals with problems for which a clear algorithm solution exists." The purpose of an ES is to assist or replace a manager or an operator. Expert systems augment conventional educational support programs such as databases, word processors, and spreadsheet analysis.

Some recent applications of ES have been in psychological testing, investment management research and development tourism management, total quality management, crime investigation, and qualitative and quantitative analyses, as well as numerous applications in marketing, strategic planning, chemical analysis, project/production management, and engineering. Most recent applications of expert systems are no longer stand-alone, but rather software applications "embedded" in a larger software system. Many commercial statistical analysis programs, data management systems, information management systems, and other data analysis systems now contain embedded heuristics that constitute expert system components of the package.

Expert systems contain an ES shell or an interpreter, a "knowledge base" or system of related logic or rules that enable the computer to approximate human knowledge, and a more sophisticated user interface. The ES shell simplifies the process of creating a knowledge base. It is the shell that actually processes the information entered by a user, relates it to the concepts and rules in the knowledge base, and provides an assessment or a solution to a problem. The knowledge base provides the connection between the concepts, ideas, and statistical probabilities that allow the reasoning part of the system to perform an accurate evaluation of a problem. They also rely on associative relationships among different concepts, statistical probabilities of certain solutions, or simply large databases of facts that can be compared to one another based on simple conventions intrinsic to the expert system. In arriving at decisions, expert systems use probabilities, fuzzy logic, or certainty theory. The newer Graphical User Interface (GUI) designs and pop-up menus are quite common in ES applications. Typically, expert systems can be classified into one of three basic types: production, frame-based and logic. This paper focuses on the use of a production expert system whose primary characteristics are as follows:

- Knowledge Base - Contains the facts and data relevant to a particular problem.
- Inference Engine - Provides the control and logic for applying the knowledge.
- Explanation System - Furnishes a description of the proposed problem solution.
- User Interface - Provides the linkage between the user and inference engine.
- Knowledge Acquisition System - Updates the knowledge base with new facts.

A summary of selected commercially available production ES shells is given in Appendix A.

ADAPTIVE LEARNING SYSTEM STRUCTURE

Topics in quantitative reasoning are broken down into learning components. Each learning component is then segmented into a three-step sequence of learning: calculation, interpretation, and application. The steps in the sequence of learning are designed to be progressively more difficult. Every step builds on the previous step, thus providing continuity and repetition. The first step focuses on generation of a quantitative statistic or parameter. The focus of the second step is on analysis; that is, interpreting the measure within the specific context of the given problem. The third step requires synthesis or application of the measure. At this step, the user is given a small case study. The user must identify whether or not the quantitative principle being studied is appropriate given the facts of the case, has the measure been correctly interpreted, and are the conclusions drawn in the case accurate. Within each step in the sequence, a database of problems at varying levels of difficulty exists. The user begins at the least difficult level and progresses toward the most difficult level. Using an adaptive routine, the ALS will adjust the level of difficulty based on user responses. In this case, the ALS consists of three levels of difficulty. In practice, the system can consist of any number of difficulty levels, however, system complexity increases dramatically as additional levels are included. Figure 1 presents the logic structure for the prototype ALS. The learning process begins with the user selecting a particular study category from the topical selection menu, e.g., descriptive statistics. The user is then exposed to a brief review of the basic principles associated with the selected topic (mode 1 instruction).

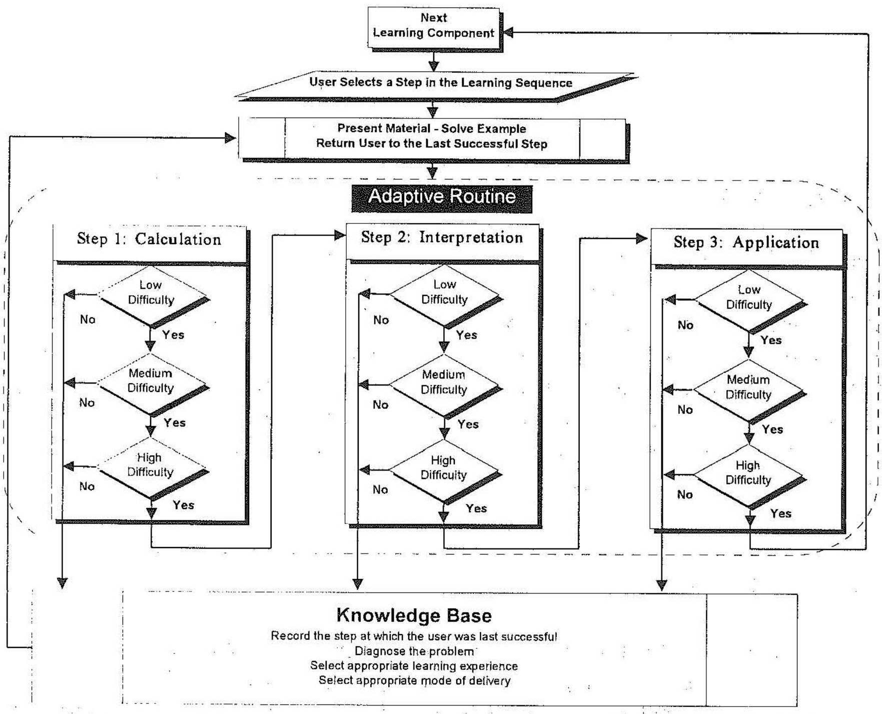
The Adaptive Routine

The adaptive routine's main function is to advance the user through the different layers of the ALS and to keep track of the learner's progress. At each step, once the user completes a level of difficulty, the adaptive routine records that completion and moves to the next, more difficult step. Typically, each level would contain three or four questions. Once the user completes all levels in a section, the adaptive routine moves the user to the next section until the user completes the entire learning module. The adaptive routine notes areas where the user experiences difficulty, and alerts the knowledge base for a diagnosis and a suggested remedy.

The Diagnostic Feature

The diagnostic feature of the system uses expert knowledge to assess the user's problems and to select the appropriate learning experience. Since the system is organized in three distinct sequential learning steps, namely calculation, interpretation and application, the diagnosis process also revolves around the same three steps. That is, the inference engine will first decide whether the user's problem is with one of the three steps and then determine at what level of difficulty this problem exists. For example, a user may prove unable to calculate a statistic at the lowest level of difficulty. Obviously, the problem involves a calculation deficiency, therefore, no diagnosis will be required. So, the inference engine will select an appropriate learning experience as follows: Suppose the selected learning experience showed a video of the computational process. Further suppose that the user completes the learning experience and successfully completes another low difficulty calculation. The inference engine will keep track of the user's success and the medium of delivery that was successfully used (a video of an example) to present the material. Now, suppose the user advances to the application level but cannot solve the problem presented.

FIGURE 1 - LOGIC STRUCTURE OF THE PROTOTYPE ALS



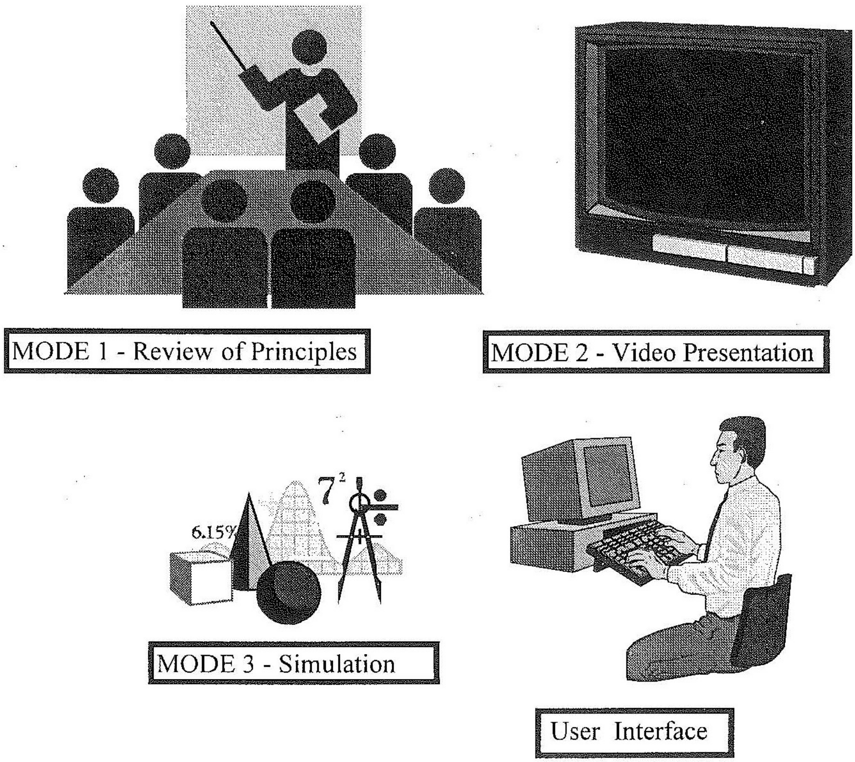
The inference engine will determine if the inability to solve the problem is due to misunderstanding the application, interpreting it, or simply miscalculating it. If the problem is with the calculation, the inference engine will consider the user's previous difficulty with calculating and recommend a calculation learning experience at the appropriate difficulty level. Furthermore, the inference engine may use another video for presentation. Once the presentation is completed, the user is returned to the last successful step and the process continues.

Selection of Instructional Delivery Mode

The following general methodology is used to determine the most appropriate mode of delivery:

- Suppose a user answers a low level of difficulty question incorrectly. The rule requires that the knowledge base identify the source of the problem using one of the prescribed categories that users may have trouble with. Also, the rule requires the inference engine to outline the material using a video presentation (mode 2).
- If the user answers a mid-level of difficulty question correctly, then the inference engine will record that the user responded well to a video presentation having this category of questions. A video presentation will then become the first choice of the knowledge base when another question of this type is answered incorrectly by the user.

FIGURE 2 - OVERVIEW SCHEMATIC OF THE ADAPTIVE LEARNING SYSTEM



- Should the user answer the mid level question incorrectly, then the inference engine will determine that the video presentation was ineffective and present the user with a simulation (step-by-step solution - mode 3). If the user answers a high level of difficulty question correctly, then the knowledge base will record that the user responded well to a simulation when having difficulty with this category of questions.

Current technology allows the incorporation of a large database of questions with varying levels of difficulty, a number of presentations in each delivery mode, and the expert systems together on one CD-ROM. Another feature of the ALS is the ability to save a partially completed learning session. Figure 2 presents a schematic overview of the proposed adaptive learning system.

HOW THE ADAPTIVE LEARNING SYSTEM WORKS

The proposed ALS will be illustrated using statistical confidence intervals, a common but often misunderstood basic tenet of modern business management. The user may choose to begin at any of the three modes available. The ALS begins with a classical presentation of confidence intervals for the proportion. This presentation will be available in three forms: A textual description of confidence intervals similar to those found in textbooks; a specially prepared video presentation of a classroom lecture on confidence intervals; and a computer simulation that moves the student through all the pertinent steps. The user first completes the textual presentation. Upon completion of the textual presentation, the user is given a confidence interval calculation at the low difficulty level. If the user solves the easy problem, the adaptive routine will advance the user to the next difficulty level. If the user is successful in calculating the medium and high difficulty level problems, they will advance to the interpretation step.

At the interpretation step, as in the calculation step, the topic is first presented using the classical approach of textual presentation. Unless the user fails to solve a problem at one of the degrees of difficulty, they will go through the same process as in the calculation step and proceed to the application step where the same routine is repeated. Should the user fail to solve a problem correctly at any step, the adaptive routine alerts the knowledge base for a diagnosis. The knowledge base will first determine if the problem a user is having is mathematical, analytical or in application of the statistical measure. Once this determination is made, the inference engine, based on the level of difficulty the user was facing last, and the levels of difficulty the user had completed previously, will determine the level of difficulty appropriate for the user now. Finally, based on expert knowledge and the user's previous response, the knowledge base will select the appropriate delivery mode of instruction for the user. Therefore, suppose a user has previously answered calculation problems at the low and medium levels of difficulty, but has had problems with calculations at the high level of difficulty. This user has been able to solve problems with which he or she has had trouble after viewing a computer simulation. The appropriate learning experience for this user would be a simulation of the calculation process.

Construction of the Knowledge Base

To construct the knowledge base, a series of rules representing expert knowledge is required. For example, in the case of constructing the confidence intervals for proportions, the ALS would required 12 presentations on the use of distributions (Four presentations in each of three modes of delivery), 12 presentations on how to physically calculate the statistic (Four presentations in each of three modes of delivery), 12 presentations on how to interpret the statistic (Four presentations in each of three modes of delivery), and, nine presentations on the application of the statistic (3 presentations in each of three modes of delivery), for a total of 45 presentations. To illustrate the knowledge base for this system and develop sample codes, a series of rules is developed for the learning component of confidence intervals for proportions. Presented below is a typical series of questions involving confidence intervals for the third step in the learning process (application) followed by the corresponding expert rules.

ALS Example: Confidence Intervals for Proportions (Step 3 - Application)

1. What information do you need to construct a confidence interval for the proportion of employees who are eligible for retirement?
   a. Average number of employees, sample size, and the percentage of those who wish to retire.
   b. Sample size, the number of those who are eligible for retirement, and the confidence.
   c. Confidence level, maximum allowable error, and the proportion of those who retired last year.
   d. Both a and b.

2. An estimate based on a 90% confidence interval is?
   a. More accurate than one based on a 95% confidence level.
   b. Only allows 10% error in the estimate.
   c. Only good for larger samples with at least 30 observation.
   d. As reliable and accurate as an estimate at any other confidence level.
   e. None of the above.

3. If you choose a sample of 29, the appropriate distribution to use is?
   a. Z distribution
   b. t distribution
   c. Insufficient information to determine
   d. Binominal distribution

4. Construct a 99% confidence interval for the proportion of those employees who are eligible for retirement, if a sample of 100 employees indicated that 29 were eligible. The correct answer is approximately?
   a. 20% to 40%
   b. 17.3% to 40.7%
   c. 7.3% to 67.3%
   d. 25.5% to 32.5%

Rule: The correct answers to parts 1 through 4 are "b," "e," "b" and "b." If the user selects answers all parts correctly, the adaptive routine advances the user to the *medium difficulty* level.

- If the user answers part 1 incorrectly, the knowledge base will determine that the user's difficulty is with applying confidence intervals. Accordingly, the knowledge base, using an appropriate mode of delivery, will select a presentation that discusses and gives examples of how and when to apply confidence intervals and what data is needed to calculate them.
- If the user answers part 1 correctly, but part 2 incorrectly, the knowledge base will determine that the user's difficulty is with understanding how to interpret a confidence interval. Accordingly, the knowledge base, using an appropriate mode of delivery, will select a presentation that includes illustrated examples that describe the correct interpretation of a confidence interval.
- If the user answers parts 1 and 2 correctly, but part 3 incorrectly, the knowledge base will diagnose the problem as difficulty using the appropriate distribution. The knowledge base will select an appropriate presentation on how and when to use which distribution and its accompanying table.
- If the user answers parts 1, 2, and 3 correctly, but part 4 incorrectly, then the knowledge base determines that the user has difficulty with the mathematics of the problem and presents the user with a step-by-step solution of the formula using the appropriate mediu

An example rule base for this application is given in Appendix B. This summary contains the sequence of learning and the levels of difficulty. At each level of difficulty, the appropriate rule is assigned a rule number and the rules, corresponding commands, and the description of the rule are stated. This particular application was executed using the VP Expert shell.

SUMMARY AND CONCLUSIONS

Increasing pressures on working adults to remain technically competitive call for new methods of delivering high quality business education. This is particularly true for courses and subjects involving quantitative reasoning. An adaptive learning methodology holds considerable promise for addressing many of the problems associated with adult education programs, particularly those involving distance learning. Adaptive learning systems have inherent advantages over more conventional approaches to developing learning and training programs. Curry and Moutinho identify four such advantages:

- More understandable and accessible expertise.
- Models encapsulate qualitative reasoning as compared to numeric processing.
- The models can conduct a consultation process with the user.
- The models can provide an explanation of their conclusions and give advice.

The proposed ALS outlined in this paper takes advantage of these benefits. The diagnostic feature proposed in this model utilizes qualitative reasoning to guide the user and to give the user clear explanations. The ability to diagnose and pinpoint the reason the user fails to answer a problem allows for a specific remedy as opposed to just another attempt at the same problem. The diagnostic feature embedded in the adaptive routine allows the user to master all facets of a learning component while, at their pace, navigating through increasing levels of difficulty. The user not only learns how to perform calculations, a common feature in all tutorial software, but also learns how to interpret and apply the analysis; a must for any course in quantitative reasoning.

The construction of a knowledge base that contains enough rules for all learning components in a specific area of quantitative reasoning constitutes a major developmental effort. The challenge however is not one of complexity as illustrated in the sample knowledge base included earlier, but is one of volume. Developing a database of questions for each learning component will also be challenging. There are a number of test databases available; many of which accompany the more popular textbooks. These databases often come with three levels of difficulty. Many of them can be refined and incorporated in the proposed software design

The ALS described herein requires a marriage between decision support scientists and educators. In this marriage, neither role should be discounted. The quality of presentations and questions in each learning component is as critical as the development of rules. In prototyping, as much attention needs to be given to testing the learning and testing material as to the functionality of the software. During the prototyping process, particular attention needs to be given to the effectiveness of each presentation, as well as to the clarity of test questions. Unclear questions can lead to incorrect diagnosis which would defeat the purpose of the software entirely. If presentations are not clear and understandable, they would only add to the frustrations of the student and are counterproductive.

The proposed ALS is being implemented on several different delivery platforms including a stand alone PC version and an Internet version. The Internet in itself is another example of using information technology for improving education. This mode of delivery offers many benefits including ongoing database development and multi-user contributions. Additionally, it provides an effective medium for constructive feedback from both educators and student users.

The platform selected to provide the initial ALS Internet application is called Studynet. This system operates an Internet site at www.study.net. Studynet represents the state-of-the Art in virtual teaching, training and education. It supports audio, video and a wide range of supplemental material, e.g., Harvard Case Study articles and reports. Instructors can create lesson and study plans that drives collaborative, asynchronous or synchronous real time learning. This, of course, is an important key to providing effective distance learning education. Used in this way, an Internet based ALS offers considerable promise for meeting the business education and management training challenges of the 21st Century.

APPENDIX A - SELECTED COMMERCIALLY AVAILABLE EXPERT SYSTEM SHELLS

Vendor	Product	Price	Web Site/E-mail/Phone
Acquired Intelligence	ACQUIRE	$995	http//VVV.com/ai/
Arity Corp.	ARITY EXPERT		73677.2614@compuserve.com
	OS/2	$495	pgweiss@netcom.com
	DOS	$295	
EXSYS Corp.	EXSYS RuleBook	$1,495	WWW.Exsysinfo.com
	EXSYS Professional	$2,900	
	EXSYS Linkable Module	$5,000	
Information Builders	LEVEL 5 OBJECT Professional	N/A	WWW.L5R.com
Gold Hill Computers Inc.	GOLDWORKS III	N/A	WWW.goldhill-Inc.com
Logic Programming Assoc. Ltd.	FLEX	$1,000	WWW.lpa.co.uk
Template Software	KES		703-318-1000
	P.C.	$ 4000	
	Workstation	$10,000	
	Mini	$25,000	
	Mainframe	$60,000	
	SNAP (Mini)	$40,000	
KDS Corp.	KDS		708-251-2621
	VOX	$15,000	
	KDS 3+	$1,795	
ILOG Inc.	ILOG RULES	N/A	WWW.ilog.fr
Micro Data Base	GURU	N/A	info@mdbs.com
Wordtech	VP Expert	$129	WWW.copypro.com 510-689-1200
The Haley Enterprise	The Easy Resoner		WWW.hayley.com
	16 bit Windows Tool Kit	$249	
	32 bit Windows Tool Kit	$499	
	OS/2 Tool Kit	$499	
	Unix/Motif Tool Kit	$999	
Procedural Reasoning	C-PRS	N/A	ingrand@ingenia.fr cprs@ingenia.fr
Comdale Technologies	Comdale /C Comdale /X Process Vision	N/A	WWW.comdale.com

APPENDIX B - EXAMPLE RULE BASED SPREAD SHEET

	Rule	Prob. 1	Prob. 2	Prob. 3	Prob. 4	Prob. 5	Command	Description
Low Difficulty	001	not b	*	N/A	N/A	N/A	Select Dist1	Presentation on use of distributions/tables
Low Difficulty	002	b	not c	N/A	N/A	N/A	Select Math1	Presentation on step-by-step calculations as related to the learning component
Medium Difficulty	003	not b	*	N/A	N/A	N/A	Select Dist2	Presentation on use of distributions/tables
Medium Difficulty	004	b	not b	N/A	N/A	N/A	Select Math2	Presentation on step-by-step calculations as related to the learning component
High Difficulty	005	not a	*	N/A	N/A	N/A	Select Dist3	Presentation on use of distributions/tables
High Difficulty	006	a	not d	N/A	N/A	N/A	Select Math3	Presentation on step-by-step calculations as related to the learning component

Step 2 - Interpretation

	Rule	Prob. 1	Prob. 2	Prob. 3	Prob. 4	Prob. 5	Command	Description
Low Difficulty	007	not a	*	*	N/A	N/A	Select Dist4	Presentation on use of distributions/tables
Low Difficulty	008	a	not b	*	N/A	N/A	Select Math4	Presentation on step-by-step calculations as related to the learning component
Low Difficulty	009	a	b	not c	N/A	N/A	Select Interpret1	Illustrations/examples on interpreting the statistic
Medium Difficulty	010	not b	*	*	N/A	N/A	Select Dist1	Presentation on use of distributions/tables
Medium Difficulty	011	b	not b	*	N/A	N/A	Select Math1	Presentation on step-by-step calculations as related to the learning component
Medium Difficulty	012	b	b	not b	N/A	N/A	Select Interpret2	Illustrations/examples on interpreting the statistic
High Difficulty	013	not a	*	*	N/A	N/A	Select Dist2	Presentation on use of distributions/tables
High Difficulty	014	*	not c	*	N/A	N/A	Select Math2	Presentation on step-by-step calculations as related to the learning component
High Difficulty	015	a	c	TRUE	TRUE	TRUE	Select Interpret3	Illustrations/examples on interpreting the statistic
		a	c	TRUE	TRUE	FALSE		
		a	c	TRUE	FALSE	TRUE		
		a	c	FALSE	TRUE	TRUE		

Step 3 - Application

	Rule	Prob. 1	Prob. 2	Prob. 3	Prob. 4	Prob. 5	Command	Description
Low Difficulty	016	not b	*	*	*	N/A	Select Apply1	Discussion and examples of how to apply the statistic
Low Difficulty	017	b	not e	*	*	N/A	Select Interpret4	Illustrations/examples on interpreting the statistic
Low Difficulty	018	b	e	not b	*	N/A	Select Dist3	Presentation on use of distributions/tables
Low Difficulty	019	b	e	b	not b	N/A	Select Math3	Presentation on step-by-step calculations as related to the learning component
Medium Difficulty	020	not d	*	*	*	N/A	Select Apply2	Discussion and examples of how to apply the statistic
Medium Difficulty	021	d	not a	*	*	N/A	Select Interpret1	Illustrations/examples on interpreting the statistic
Medium Difficulty	022	d	a	not a	*	N/A	Select Dist4	Presentation on use of distributions/tables
Medium Difficulty	023	d	a	a	not b	N/A	Select Math4	Presentation on step-by-step calculations as related to the learning component
High Difficulty	024	not b	*	*	*	N/A	Select Apply3	Discussion and examples of how to apply the statistic
High Difficulty	025	b	not d	*	*	N/A	Select Interpret2	Illustrations/examples on interpreting the statistic
High Difficulty	026	b	d	not c	*	N/A	Select Dist1	Presentation on use of distributions/tables
High Difficulty	027	b	d	c	not b	N/A	Select Math1	Presentation on step-by-step calculations as related to the learning component

Dist 1 - Dist 4 — Presentations on how and when to use which distribution, as well as how to use the accompanying table. The presentation will be available in three modes of delivery and for each mode of delivery 4 different presentations will be available for a total of 12 presentations

Math 1 - Math 4 — A step-by-step presentation of how to calculate the statistic. The presentation will be available in three modes of delivery and for each mode of delivery 4 different presentations will be available for a total of 12 presentations.

Interpret 1 - Interpret 4 — A presentation of how to interpret the findings obtained after calculating the statistic. The presentation will be available in three modes of delivery and for each mode of delivery 4 different presentations will be available for a total of 12 presentations

Apply 1 - Apply 3 — A presentation of how the statistic is applied, or could be applied, to a business situation including what information is needed for the application. The presentation will be available in three modes of delivery and for each mode of delivery 3 different presentations will be available for a total of 9 presentations.

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