# EXPERT SYSTEM

Kovalenko Katya, *IT-71*

In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning about knowledge, like an expert, and not by following the procedure of a developer as is the case in conventional programming. The first expert systems were created in the 1970s and then proliferated in the 1980s. Expert systems were among the first truly successful forms of Al software. An expert system has a unique structure, different from traditional programs. It is divided into two parts, one fixed, independent of the expert system: the inference engine, and one variable: the knowledge base. To run an expert system, the engine reasons about the knowledge base like a human. In the 80's a third part appeared: a dialog interface to communicate with users. This ability to conduct a conversation with users was later called "conversational".

Automating a vast knowledge, the developer may meet a classic problem: "combinatorial explosion" that greatly complicates his work and results in a complex and time consuming program. The reasoning expert system does not encounter that problem since the engine automatically loads combinatorics between rules. This ability can address areas where combinatorics is enormous: highly interactive or conversational applications, fault diagnosis, decision support in complex systems, educational software, logic simulation of machines or systems, constantly changing software.

The inference engine is a computer program designed to produce a reasoning on rules. In order to produce reasoning, it is based on logic. There are several kinds of logic: prepositional logic, predicates of order, epistemic logic, modal logic, temporal logic, fuzzy logic, etc. Except propositional logic, all are complex and can only be understood by mathematicians, logicians or computer scientists. Propositional logic is the basic human logic expressed in the syllogism. The expert system that uses that logic is  also called zero-order expert system. With logic, the engine is able to generate new information from the knowledge contained in the rule base and data to be processed.

The engine has two ways to run: batch or conversational. In batch, expert system has all the necessary data to process from the beginning. For the user, the program works as a classical program: he provides data and receives results immediately. Reasoning is invisible. The conversational becomes necessary when the developer knows he can't ask the user all the necessary data at the start, the problem being too complex. The software must "invent" the way to solve the problem, request the user missing data, gradually, approaching the goal as quickly as possible.

Expert systems address areas are enormous, for example: 1) highly interactive or conversational applications, voice server; 2) fault diagnosis, medical diagnosis; 3) decision support in complex systems, process control, interactive user guide; 4) educational and tutorial software; 5) logic simulation of machines or systems; 6) knowledge management; 7) constantly changing software. They can also be used in software engineering for rapid prototyping applications (RAD).

Any program containing expert knowledge and classic programming always begins with an expert interview. A program written in the form of expert system receives all the specific benefits of expert system: it can be developed by anyone without computer training and without programming languages. But this solution has a defect: expert system runs slower than a traditional program because it consistently "thinks" when in fact classic software just follows paths traced by the programmer.

Expert systems are designed to solve tasks in the fields of accounting, medicine, process control, financial service, production, human resources. Typically, the problem area is complex enough that a more simple traditional algorithm cannot provide a proper solution. The foundation of a successful expert system depends on a series of technical procedures and development that may be designed by technicians and experts. Expert systems do not typically provide a definitive answer, but provide probabilistic recommendations.

The building, maintaining and development of expert systems is known as knowledge engineering. Knowledge engineering is a "discipline that involves integrating knowledge into computer systems in order to solve complex problems normally requiring a high level of human expertise". There are generally three individuals having an interaction in an expert system. Primary among these is the end-user, the individual who uses the system for its problem. In the construction and maintenance of the system there are two other roles: the problem domain expert who builds the system and supplies the knowledge base, and knowledge engineer who assists the experts in determining the representation of their knowledge, enters this knowledge into an explanation module and who defines the inference technique to solve the problem. Usually the knowledge engineer will represent the problem solving activity in the form of rules.

S.V.Podolkova – *EL Adviser*