7.14 Expert systems

These systems have been developed to mimic the expertise and knowledge of an expert in a particular field. Examples include:

- diagnosing a person's illness
- diagnostics (finding faults in a car engine, finding faults on a circuit board, etc.)
- prospecting for oil and minerals
- tax and financial calculations
- chess games
- identification of plants, animals and chemical compounds
- road scheduling for delivery vehicles.

A basic expert system is made up of a number of elements, illustrated in Figure 7.16.
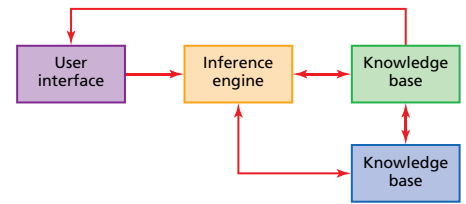
Figure 7.16 Elements of an expert system

How to set up an expert system

- Experts in the field are interviewed to find out what is needed in the expert system.
- Data is then collected from these experts.
- A **knowledge base** (defined below) is designed and then created.
- The **rules base** (defined below) is designed and created.
- An **inference engine** (defined below) is designed and created.
- The **input screen** and output format are also designed and created – this is known as the **user interface**.
- The **expert system** is tested against known conditions and scenarios.
- It is also checked to see if it meets the original specification.
- Experts are interviewed about how effective it is before the expert system goes out on general release.

Advantages

- Expert systems provide consistent answers.
- They never 'forget' to answer a question when determining the logic.
- Using expert systems reduces the time taken to solve a problem.
- A less skilled work force is needed, which gives the potential of saving money, but also allows areas of the world access to expertise which they could not normally afford.

Disadvantages

- They tend to lack common sense in some of the decision-making processes.
- Errors in the knowledge base can lead to incorrect decisions being made.
- It can be expensive to set up in the first place.
- Considerable training is necessary to ensure the system is used correctly by the operators.

Example of an expert system: oil prospecting

- An interactive user screen appears.
- Questions are asked about geological profiles.
- Answers to the questions and information about the geological profiles are typed in.
- The inference engine searches the knowledge base using the rules base.
- The system:
  - suggests the probability of finding oil as an output
  - indicates the probable depth of deposits
  - makes predictions about geological deposits above the soil
  - produces contour maps showing concentration of minerals, rocks, oil, etc.

Definitions of knowledge base, inference engine and rules base

Knowledge base

This is a database designed to allow the complex storage and retrieval requirements of a computerised knowledge-based management system (in support of an expert system).

Inference engine

This is software that attempts to derive answers from the knowledge base using a form of reasoning. It is how expert systems appear to use human-like reasoning when accessing information from the knowledge base in an effort to find a conclusion to a given problem. The inference engine is a type of reasoning engine.

Rules base

This is made up of a series of 'inference rules' (e.g. IF the country is in South America AND the language used is Portuguese THEN the country must be Brazil). These inference rules are used by the inference engine to draw conclusions. They closely follow human-like reasoning.