

## IAI - Exercise Sheet 9

*This week we have a set of questions about Expert Systems. They should be read in conjunction with your lecture notes and handouts for Week 9. Question 1 is an exam style question which should be easily answerable using your lecture notes. Question 2 considers some potential implementational problems. Question 3 is a practical exercise designed to help you get some experience in the practical aspects of building an Expert System.*

### Question 1 (Exam style question)

- (a) Give a definition of “Expert System”.
- (b) Outline how Expert Systems can be distinguished from more conventional computer systems.
- (c) In the context of Expert Systems, describe what the term “knowledge acquisition” covers.
- (d) Outline some of the main technical problems one has to overcome when attempting to build a successful Expert System for a new domain.

### Question 2

Some common problems that can occur when building expert systems are:

1. The expert’s knowledge base and the inference engine algorithms get inextricably entwined, and it becomes impossible to update one without introducing problems into the other.
2. Having spent months extracting and representing rules from an expert, the knowledge base is still seriously incomplete and cannot solve even the simplest problems.
3. The expert has given us so many rules that the operation of the system has become unacceptably slow.
4. The knowledge acquisition process has taken much longer than we expected, and now our expert refuses to work with us any more.
5. Having got our expert system to perform well, it is now proving impossible to figure out how it is coming up with its outputs.

For each, suggest how we could minimize the chances of them happening, and how we should proceed if they do occur. [Hint: See Jackson, Sect. 17.4.1]

### Question 3 (Practical Exercise: *Expert System Building*)

The plan is to work in small groups (e.g. of about 4 or 5 people) containing ‘experts’ and ‘knowledge engineers’. The ‘knowledge engineers’ will use their knowledge elicitation skills to extract knowledge/expertise from the ‘experts’, and build up, via an appropriate intermediate representation, a small rule based Expert System.

First, choose a suitable problem domain to work with. Given the limited time available, you should try to pick something “simple”, for example:

1. Where to go on holiday
2. How to best supplement one’s income
3. Where to go for a night out in Birmingham
4. Which computer to buy
5. How to find a good husband/wife/boyfriend/girlfriend
6. How to pass your *Introduction to AI* exam

It will be assumed that the ‘knowledge engineers’ are already familiar with the technical terminology and jargon associated with the problem domain. You will soon find out how much, or little, expert knowledge your ‘experts’ actually have.

Think about the goals for your system, and the steps that will lead to them. Think about the different outputs your system should be able to produce. Clearly, how the Expert System should respond at each stage will depend on many different things (such as the age, sex, affluence, tastes, intelligence, skills, mood, etc. of the user), and appropriate rules will need to be built into the system so that it responds appropriately to each potential user in each potential situation.

The ‘knowledge engineers’ should build up an appropriate intermediate representation that their ‘expert’ can help them refine. Think about what kind of intermediate representation would be most appropriate for your chosen problem – a semantic network, or decision tree maybe?

You should also consider whether your system needs to be capable of reasoning with uncertain or fuzzy information, and if so, how in practice you could do this.

You clearly won’t have time to convert your intermediate representation into a fully functional expert system, but you should think about how you would go about doing it if you did have the time.

You should aim to consider as many different aspects of Expert System building as you can, rather than concentrating on one aspect in detail.