

UNIVERSITY OF LONDON

GOLDSMITHS COLLEGE

B. Sc. Examination 2006

**IS53006A(CIS319) DECISION SUPPORT AND
EXECUTIVE INFORMATION SYSTEMS**

Duration: 2 1/4 hours

Date and time:

There are five questions on this paper.

Do not attempt more than three questions. All questions carry equal marks and full marks can be obtained for complete answers to three questions.

Electronic calculators may be used. The make and model should be specified on the script. The calculator must not be programmed prior to the examination. Calculators that display graphics, text or algebraic equations are not allowed.

**THIS EXAMINATION PAPER MUST NOT BE
REMOVED FROM THE EXAMINATION ROOM.**

1. Consider the following situation:

- There is a 50% chance that the price of the pound will go up.
- There is a 30% chance that it will go down.
- There is a 20% chance that it will stay as it is.
- When the price of the pound goes up, the price of shares of “O-mobile” go up with 50% probability.
- When the price of the pound goes down, shares of “O-mobile” go up with 20 % probability.
- When the price of the pound stays as it is, shares of “O-mobile” go up with 45% probability.

a) Draw an influence diagram for the decision of whether to buy “O-mobile” shares.

[6]

b) Use probability notation to define the six statements above, and calculate the probability that the price of the pound goes down at the same time that the price of “O-mobile” shares goes up.

[6]

c) Calculate the probability that the price of “O-mobile” shares will go up.

[6]

d) Describe the representation of this situation using Dempster-Shafer Theory of Evidence, and discuss its advantages and disadvantages. (You need not indicate the degrees of belief; only the belief sets.)

[7]

RELEVANT EQUATIONS:

$$p(A \wedge B) = p(A|B) p(B)$$

$$p(A) = 1 - p(\sim A)$$

$$p(A) = p(A \wedge B) + p(A \wedge \sim B)$$

$$p(A) = p(A|B) p(B) + p(A|\sim B) p(\sim B)$$

2. A manufacturer produces high-precision lenses for digital readers. Each lens has to pass two tests before it is approved for sale. If either test fails, the lens is useless, and you have to start again with a new lens. The tests cannot be done simultaneously.

- Test A takes 5 minutes, and 50% of the lenses fail it
- Test B takes 10 minutes, and 20% of the lenses fail it

a) Draw a decision tree for this situation.

[5]

b) You need to find a flawless lens as soon as possible. You will need to decide which test to run first, in order to minimise the time it takes to find a flawless lens. For this you will use a Markov decision chain.

Consider the following four states only:

S0: the current lens has not undergone any tests.

S1: the current lens has passed test A.

S2: the current lens has passed test B.

S3: The current lens passed both tests.

i) Show graphically the decisions and transitions that are possible from each state.

[5]

ii) Explain why decision trees would not represent this situation properly. Give a brief answer—no more than two lines.

[3]

iii) Calculate the expected time from the initial state to the final one, if test A is always performed first. (Approximate it to the nearest unit)

[5]

iv) Calculate the expected time from the initial state, if test B is always performed first. (Approximate it to the nearest unit)

[5]

v) Which one of the policies given in iii and iv is the best policy for this problem? Briefly explain why.

[2]

3. A financial company uses a system that keeps track of the main currency exchange rates. The system is constantly displaying and updating its information. The user can call a general statistical tool to dynamically filter and analyse the data. Also, the system permits exploring the source of aggregated information and regrouping it in different ways. An important feature is that when potentially interesting investment opportunities appear, the system raises an alarm on-screen so that the user knows and takes action. The system achieves this by checking whether currency exchange rates meet certain criteria expressed as mathematical relations.

a) Is this an executive information system? Justify your answer.

[5]

b) Briefly indicate what you expect this specific system to have in its database, its model base, its knowledge base and its user interface.

[7]

c) An advanced version of this system relies on a set of rules and heuristics that predict changes in several important currencies. For this, the system uses a combination of keywords from newspaper headlines and measures of belief/disbelief from the user.

i) Where would these components be kept?

[2]

ii) Which type of knowledge-based system would this be? Justify your answer.

[3]

iii) Data mining was used in the development of this system. Describe what data mining does, using this system as example.

[8]

4. A Civil Engineering firm uses a Decision Support System to generate ideas to solve structural problems in architectural projects. The difficulty with these problems is that their description can be complex, there is usually more than one solution and there are no specific rules to find them. The system asks the user details about the structural constraints they are facing, architectural style and budget. The system then looks in an extensive database of structural models for similar cases, and modifies the closest one to adapt it to the needs of the specific situation. The adaptation is imperfect, but is treated as a proposed idea that the architects can develop into a feasible solution to their problems.

a) We can conclude from the description above that this system uses case-based reasoning. Justify that conclusion by describing briefly the following components and giving examples of their presence in the system:

i) Case memory [2]

ii) Indexing rules [2]

iii) Similarity metrics [2]

iv) Modification rules [2]

b) Is this an expert system? Justify your answer by discussing briefly the presence or absence of a knowledge base and reasoning engine in this system. [7]

c) A competitor uses a system that also generates and selects structural configurations to solve similar architectural problems. This system is based on the Delphi technique. Describe the stages that this system (or the Delphi technique) would follow to develop the ideas. [5]

d) Give an example of a program that aids decision-making in business or industry by stimulating human creativity. Briefly describe the way it works. [5]

5.

a) Describe forward chaining and backward chaining. Mention at least one advantage of each.

[8]

b) Describe and give an example of the stages in Simon's model of problem solving.

[9]

c) Think about two examples of how expert systems could assist or complement the functioning of a data warehouse, and discuss them. Make reference in your examples to the components of data warehouses.

[8]

END OF EXAMINATION