

UNIVERSITY OF LONDON
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 2000

BEng Honours Degree in Computing Part III
MSc in Computing Science
BEng Honours Degree in Mathematics and Computer Science Part III
MEng Honours Degree in Mathematics and Computer Science Part III
for Internal Students of the Imperial College of Science, Technology and Medicine

*This paper is also taken for the relevant examinations for the
Associateship of the City and Guilds of London Institute
This paper is also taken for the relevant examinations for the
Associateship of the Royal College of Science*

PAPER C344

INFORMATION AND DECISION SUPPORT SYSTEMS

Monday 8 May 2000, 10:00
Duration: 120 minutes

Answer THREE questions

Paper contains 4 questions

- 1 A large multinational has decided to set up an annual contract with a parcel courier service. Four firms have been short-listed: Ultraspeed, Suricor, Fastcare and Carrymore. The mailroom manager, who has been trained in the Edwards' SMART method, has identified three benefit attributes relevant to the decision: Speed, Security and Care, and has allocated respective weights of 20, 65 and 15 to them.

The manager then rated each courier on the different attributes and estimated annual costs as follows:

Courier	Speed	Security	Care	Costs (£)
Ultraspeed	90	40	75	100,000
Suricor	20	100	40	90,000
Fastcare	70	40	80	40,000
Carrymore	60	0	10	50,000

- a Explain, briefly, how the manager might have arrived at the benefit values and weights for the benefit attributes.
- b What assumptions underlie the use of SMART to compare the firms?
- c Assuming that these assumptions are met, which courier offers the highest overall benefits?
- d Plot the value of overall benefits against costs for each courier, and identify which couriers lie on the efficient frontier.
- e If the manager is prepared to pay an extra £50,000 to switch from the lowest level of security to the highest, which alternative should be selected?

The five parts carry, respectively, 20%, 10%, 30%, 10%, 30% of the marks.

- 2a What role does a data warehouse play in a modern, large-scale decision support system? What kind of data does it contain?
- b How does a data mart differ from an enterprise data warehouse? What strategies are open to a large organisation when embarking on the development of a data warehouse/data mart system?
 - c A national supermarket chain is implementing a data warehouse based on relational technology. Sales data will include details of date, product and location. Explain how the data in the warehouse should be organised in order that OLAP-type queries can be answered efficiently.

The three parts carry, respectively, 30%, 30%, 40% of the marks.

- 3 Lemon is hoping to develop a new series of mobile phones that connect to the Internet. Two alternative systems have been proposed - one using mainly plastic components, the other mainly metal ones. Ideally, the new phones should be as light and as durable as possible, but some compromise may have to be reached.

The company estimates that the plastic design has a 60% chance of weighing 130 grams and having a guaranteed lifetime of one year and a 40% chance of weighing 180 grams with a two-year lifetime. On the other hand, if mainly metal phones were developed, there is a 70% chance that they would have a two-year lifetime and weigh 250 grams and a 30% chance that they would have a guaranteed lifetime of three years and weigh 290 grams.

The head of Lemon R&D is convinced that weight and guaranteed lifetime are mutually utility independent. The following utility values for weight and lifetime were elicited from her:

Weight (grams)	Utility
130	1.0
180	0.9
250	0.6
290	0.0

Guaranteed Lifetime (years)	Utility
3	1.0
2	0.6
1	0.0

After further questioning by the decision analyst, she indicates indifference between A and B:

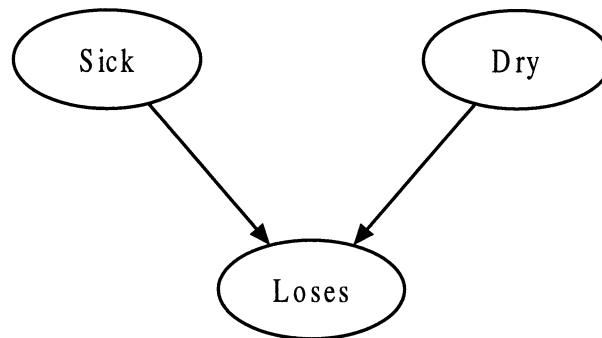
- A: A product certain to weigh 130 grams and have a guaranteed lifetime of one year.
- B: A lottery which offers a 70% chance of a product with a weight of 130 grams and a guaranteed lifetime of three years, and a 30% chance of a product with a weight of 290 grams and a guaranteed lifetime of one year.

and indifference between C and D:

- C: A product certain to weigh 290 grams and have a guaranteed lifetime of three years.
- D: A lottery which offers a 90% chance of a product with a weight of 130 grams and a guaranteed lifetime of three years, and a 10% chance of a product with a weight of 290 grams and a guaranteed lifetime of one year.
- a What do the head of R&D's responses indicate about her attitude to risk and the relative weights which she attaches to the two attributes of the proposed designs?
- b Which design should she choose, given the above responses?
- c What further analysis should be carried out before going ahead?

The three parts carry, respectively, 40%, 40%, 20% of the marks.

- 4 A large business has interests in agriculture, manufacturing and financial services. The board has asked you to report on the potential of data mining technology for providing valuable new information to the company.
- Describe the different tasks (*NOT techniques*) that data mining technology can conduct, with examples relevant to the company.
 - Your report includes an example of a Bayesian Network, dealing with the health of apple trees, seen to be losing their leaves. Such trees may simply be dry, in which case there is no reason to be too concerned, but if they are sick then treatment needs to be carried out promptly.



Each of the three nodes has two states "yes" and "no". The probabilities of the various states are given in the following tables:

	P(Sick)		P(Dry)
Sick = yes	0.1	Dry = yes	0.1
Sick = no	0.9	Dry = no	0.9

Sick	Dry	P(Loses Sick, Dry)
yes	yes	0.95
yes	no	0.90
no	yes	0.85
no	no	0.02

- Calculate the joint probability of a tree losing its leaves, being dry but not sick.
- Find the most likely combination of states for a tree losing its leaves.
- Calculate the probability that a tree that is losing its leaves is sick.

The four parts and subparts carry, respectively, 40%, 20%, 20%, 20% of the marks.