

UNIVERSITY OF LONDON
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1998

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

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

PAPER 3.44

INFORMATION AND DECISION SUPPORT SYSTEMS

Friday, May 1st 1998, 10.00 - 12.00

Answer THREE questions

For admin. only: paper contains 4
questions

- 1 An oil company, that employs the expected monetary criterion for its decision making, has the option of exploring for oil at only one of three sites. The expected drilling costs for each site are £1,000,000, £200,000 and £2,000,000, respectively. Their probable well outputs are given in the following table:

	Output in barrels per day			
	0	20,000	100,000	1,000,000
Site	P(output)			
1	0.05	0.4	0.5	0.05
2	0.1	0.75	0.1	0.05
3	0.7	0.05	0.05	0.2

From past experience it is known that a well in this area will net the company £100 for each barrel a day of production.

- a At which site should the company drill?
- b Suppose that the company commissioned detailed and reliable seismic tests for £500,000, and now has a revised estimate of the output at each site:

	Output in barrels per day			
	0	20,000	100,000	1,000,000
Site	P(output)			
1	0	0.1	0.8	0.1
2	0	0.8	0.15	0.05
3	0.5	0.2	0.15	0.15

In retrospect, was it worthwhile to have the tests done?

- c The company's geologist now estimates that the drilling costs for each site have the probabilities given in the following table:

	Costs in £millions			
	0.2	1	2	4
Site	P(costs)			
1	0.1	0.1	0.3	0.5
2	0.8	0.2	0	0
3	0.4	0.2	0.3	0.1

and that these probabilities are independent of the probabilities of well outputs. Where should the company now drill? Was it still worthwhile to commission the seismic tests?

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

- 2 Five cars have reached the finals of the Car of the Year award: the Croesus, Emperor, Illustra, Mona Lisa and Series 34B, priced at £35K, £25K, £17K, £12K and £20K, respectively.

In order to help them to choose the winner, the judges have arranged for a decision analyst to attend one of their meetings.

He first had the judges consider the factors which they thought were relevant to the decision and four factors were identified: engineering quality, visual impact, safety features and price.

He then asked the managers to assign scores on scales from 0 (worst) to 100 (best) to show how well the cars performed on each of the first three attributes. Eventually, they agreed on the following:

Car	Engineering Quality	Visual Impact	Safety Features
Croesus	100	30	60
Emperor	20	70	100
Illustra	70	0	10
Mona Lisa	0	100	0
Series 34B	50	70	60

The decision analyst then asked the judges to consider a car with the worst possible engineering quality, visual impact and level of safety features. If they had the chance of switching from this car to a model which had just one of the benefits at its best value, which one would they choose? The judges agreed that they would switch to a car offering the highest level of safety features. A switch to a car with the best possible engineering quality was considered to be 80% as preferable as this, while a switch to one with the best visual impact was 70% as preferable.

- a Is it true to say that the engineering quality of the Croesus is twice as good as that of the Series 34B?
- b An alternative way of assigning weights to the three benefit attributes would be to ask the judges to allocate figures that reflect the importance of each attribute. Is this approach just as good?
- c Assuming that mutual preference independence exists between the three benefit attributes, find the value of the aggregate benefits of each car.
- d Plot the price against aggregate benefits of each car, find the models on the efficient frontier, and briefly interpret the chart.
- e Carry out a sensitivity analysis on the weight assigned to engineering quality, to examine its effect on the aggregate benefits of the cars.

The five parts carry, respectively, 15%, 15%, 25%, 20%, 25% of the marks.

Turn over ...

- 3 Describe, in some detail, your design for a decision support system intended to assist Computing students at Imperial College make informed choices of their lecture course options. You may either address the system at 2nd year Computing or JMC undergraduates about to embark on their third year, or at MSc Computing Science students coming to the end of their first term. You should include:
- a an introductory section explaining the various issues involved in taking such decisions;
 - b a description of the database subsystem, explaining its components, structure and purpose;
 - c a similar type of description of the model subsystem; and
 - d a similar type of description of the dialogue subsystem that gives a feel for what it would be like for a user to interact with your system.

The four parts each carry 25% of the marks.

- 4 You work for the IT department of Safeway's, one of the largest supermarket chains in the UK. Like many such businesses, Safeway's sells petrol, household and car accessories, as well as groceries.

For some years, Safeway's have been operating a loyalty card scheme. Customers may apply to join the scheme, for free, by simply filling in their personal details on an application form. At the checkout, a member's card is swiped through a reader and a record is kept of his or her purchases. Members accumulate points, which earn money-off coupons, sent out quarterly.

You realise that the data being acquired for the purpose of computing membership points is a resource that could be of great value to Safeway's business.

- a Write a management report that looks at the issues of Data Mining from the perspective of Safeway's business needs. The report should include:
- i) an explanation of how applying Data Mining technology to the database of members' purchases could benefit the company;
 - ii) descriptions of the type of tasks that Data Mining can accomplish and
 - iii) simple descriptions of the types of methods that are employed.
- b As an illustration of one of Data Mining's techniques, decision trees, you take the following fragment of the database, dealing with car ownership among the members of the loyalty card scheme:

Sex	Usage	Driving Style	Children	Capacity	Car Type
Male	Family	Sport	3	Big	4 x 4
Male	Business	Easy	2	Medium	luxury
Male	Pleasure	Sport	0	Small	Sports car
Female	Family	Easy	1	Big	van
Female	Family	Sport	2	Big	4 x 4
Female	Business	Sport	2	Small	Sports car
Male	Pleasure	Safety	3	Big	4 x 4

Explain in simple layman's terms the way in which a decision tree, focussed on 4 x 4 (four-wheel-drive) ownership, might be derived from this data and how it could then be employed.

The three subparts of part a and part b itself each carry 25% of the marks.

End of paper