

UNIVERSITY OF LONDON  
IMPERIAL COLLEGE OF SCIENCE, TECHNOLOGY AND MEDICINE

EXAMINATIONS 1997

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 Advanced Computing  
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

DECISION SUPPORT SYSTEMS  
Wednesday, April 23rd 1997, 10.00 - 12.00

*Answer **THREE** questions*

For admin. only: paper contains 4  
questions

- 1 A chemical engineering company, based in a South American country, has been developing a new industrial process, which at the moment creates significant environmental pollution. Before being able to operate this process on a commercial scale, they will have to receive a licence from the Ministry, and there is only a 50:50 chance of it being granted, with the existing pollution problem. However, if they were able to eliminate the problem, they would definitely be granted a licence. Whether creating pollution or not, if the company receives a licence it can expect to make £300 million operating profits in all.

The company has two possible courses of action. They could apply for a licence now or could undertake further development to cut out the pollution problem. For political reasons, once a licence is refused the decision cannot be reversed, and so the company cannot apply for a licence more than once.

Further development, currently estimated to have a 70% chance of successfully eliminating the pollution problem, would cost £100 million. Before embarking on this course the company would undertake a £10 million pilot project designed to indicate the likely success of further development. Even if further development would fail to eliminate the pollution problem, there is a 30% chance that the pilot project would erroneously indicate that such development would be successful. However, if further development would, in fact, succeed, the pilot project would forecast this result for certain.

If the pilot project indicated success, the company would proceed with further development. If the pilot project indicated failure, they would not undertake further development, but would apply for a licence directly.

- a Draw a decision tree representing the options open to the company and the possible outcomes. Include payoff figures and probabilities on the tree.
- b What should the company do?
- c Suppose that the regime in power in that country were open to bribery. What is the most that the company should pay in order to ensure that the current dirty process will be granted a license?
- d There has been a coup d'état and a new corruption-free government is in power. Suppose that, instead of the flawed pilot program, described above, it were possible to fly in experts from the USA who could guarantee to predict the outcome of further development with complete accuracy. Up to what price should the company pay for such perfect information?

*The four parts carry, respectively, 40%, 10%, 20%, 30% of the marks.*

- 2 A hotel is installing new air-conditioning equipment throughout its rooms. Four companies have submitted designs, and a choice has to be made between them. The hotel manager has identified three attributes which he considers important in the decision: cost, effectiveness and noise.

The manager has assessed how well each design performs on each attribute by allocating values on a scale from 0 (worst design) to 100 (the best). These values are shown below, together with the costs:

Design	Costs (£)	Benefits	
		Effectiveness	Noise
A	90,000	20	100
B	110,000	70	0
C	170,000	100	90
D	60,000	0	50

- The manager is having difficulty allocating weights to the two benefit attributes, and calls you in to advise him. Explain the concept of mutual preference independence as it applies to the two benefits.
- Assuming that the two weights sum to 100 and that the manager agrees that mutual preference independence exists between the two benefit attributes, perform a sensitivity analysis to show how the design offering the highest value for aggregate benefits will vary depending upon the weight which has been allocated to effectiveness.
- Eventually, the manager decides to allocate effectiveness a weight of 30 and noise a weight of 70. By plotting the benefits and costs of the designs on a graph, identify the designs which lie on the efficient frontier.
- The manager also decides that if he were offered a hypothetical design with the lowest effectiveness and worst noise level he would be prepared to pay £120,000 to convert that design to one which had the best effectiveness but still the worst noise level. Which design should the manager choose?

*The four parts carry, respectively, 15%, 35%, 15%, 35% of the marks.*

- 3a Briefly contrast the two key aspects of decision making: problem solving and problem finding.
- b Explain the difference in emphasis and philosophy between the problem-centred and the opportunity-centred approaches to the problem finding process.
- c Describe the main stages of the problem finding process.
- d Suggest some useful problem finding techniques.

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

- 4a Why is the user interface such a vital feature of a decision support system?
- b Describe the main components of a typical dialogue subsystem of a DSS, explaining how they work together and how they interface both to the user and to the other subsystems of the DSS.
- c What are the main types of interaction style?
- d Offer some guidelines for successful dialogue design.

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

*End of paper*