

This paper is not to be removed from the Examination Halls

UNIVERSITY OF LONDON

279 0032 ZA

BSc degrees and Diplomas for Graduates in Economics, Management, Finance and the Social Sciences, the Diploma in Economics and Access Route for Students in the External Programme

Management Science Methods

Tuesday, 30 May 2006 : 10.00am to 1.00pm

Candidates should answer **FOUR** of the following **EIGHT** questions: **ONE** from Section A, **TWO** from Section B and **ONE** further question from either section. All questions carry equal marks.

Graph paper is provided. If used, it must be fastened securely inside the answer book.

A hand held calculator may be used when answering questions on this paper but it must not be pre-programmed or able to display graphics, text or algebraic equations. The make and type of machine must be stated clearly on the front cover of the answer book.

PLEASE TURN OVER

SECTION A

Answer **one** question from this section and **not more than one** further question. (You are reminded that four questions in total are to be attempted with at least two from Section B.)

1. Two methodological issues that arise in Operational Research work are:

- Implementation
- Optimisation

Discuss what you understand by these issues within the context of Operational Research/Management Science. Illustrate your answer by reference to one or more problems of which you are aware. **(25 marks)**

2. (a) Describe the assumptions and stages used in Soft Systems Methodology (SSM). **(15 marks)**

- (b) Give two examples to illustrate SSM. **(10 marks)**

3. Write short notes on each of the following topics, (each part to be about 200 words in length, should address the topic, and should answer from the viewpoint of Operational Research/Management Science):

- | | |
|-------------------------|------------------|
| (a) integer programming | (7 marks) |
| (b) UR | (9 marks) |
| (c) JOURNEY | (9 marks) |

SECTION B

Answer **two** questions from this section and **not more than one** further question. (You are reminded that four questions in total are to be attempted with at least one from Section A.)

4. A company is considering using Markov theory to analyse people switching between four different internet search engines (engines 1, 2, 3 and 4). An analysis of data has produced the transition matrix shown below for the probability of switching every three months between search engines.

From search engine		To search engine			
		1	2	3	4
	1	1	0	0	0
	2	0	1	0	0
	3	0.3	0.2	0.3	0.2
	4	0.1	0.1	0.1	0.7

What will be the market shares in six months if the current market shares are 35%, 15%, 25% and 25% for search engines 1, 2, 3 and 4 respectively? **(4 marks)**

What is the long-run prediction for the market shares for each of the four search engines? **(16 marks)**

Give some indication as to why the actual market share may not be the same as predicted values in the short or the long term. **(5 marks)**

5. An organisation is reviewing the performance of its branches. The data they have collected for these branches is shown below.

Branch	Number of employees	Number of customers ('000)	Profit (£'m)
A	16	49.19	1.26
B	11	15.45	1.56
C	10	22.86	0.58
D	13	28.00	1.23
E	15	15.18	0.10
F	9	21.72	0.34
G	8	28.37	0.70

(question continues on next page)

For example branch G last year employed 8 people and had 28,370 customers. The profit that branch G made (after accounting for employee costs as well as the allocation of certain fixed overhead expenses) was £0.70m. The organisation treats profit as an output measure and number of employees as an input measure.

Assuming that the organisation treats the number of customers as an output measure what can you say about the relative performance (efficiency and reference sets) of these branches as a result of applying DEA? **(13 marks)**

If the organisation was to treat the number of customers as an input measure what effect would this have on the relative performance (efficiency and reference sets) of the branches when you apply DEA? **(12 marks)**

6. A company has the ability to manufacture 25000 units per month of a particular component X. Component X requires £117 of labour in the production of one unit. X is produced on a single machine which requires time to be setup for the production of X, and this setup time is estimated to cost £750. X is used for further assembly work at a rate of 3750 units per month.

Each unit of component X produced also requires as raw material two units of component Y. Component Y is purchased from an outside supplier at a cost of £55 per unit and the cost of placing an order with this supplier is estimated to be £45. The current interest rate is 12% per year.

By analysing this situation what advice can you offer the company on the order size for Y and the batch quantity for X? What will be the total cost per year given your recommendation? **(14 marks)**

Would your advice change if your supplier could supply Y at a cost of £50 per unit provided each order was for 1500 units or more? **(8 marks)**

Comment on any deficiencies in your analysis. **(3 marks)**

7. A company faces three choices with regard to a potential project they are considering with a partner company. They can choose to invest £150 million and this will entitle them to 85% of any profits made. Alternatively they could invest £75 million, but this would only entitle them to 40% of any profits made. In either case if a negative profit (loss) is made the company has to fund the appropriate percentage (85% and 40%) of the loss. Of course the company could choose not to invest at all.

There are three scenarios as to the performance of the project. It may be very successful (probability 0.3) giving a total profit of £500 million to be shared between the companies. Alternatively it may be only moderately successful (probability 0.5) giving a total profit of £160 million to be shared between the companies. The final alternative is that the project will be unsuccessful, giving a total loss of £100 million to be shared between the companies. In all three cases the total profit to be shared does not include the initial investment made by the company.

Analyse this situation using a payoff table. Using standard decision criteria what would you suggest the company should do? **(19 marks)**

Analyse this situation using a decision tree. What would you suggest the company should do? **(6 marks)**

8. You are working for a financial institution and have been approached by a rival institution who wish you to come and work for them. You have three objectives in choosing whether to stay with your current employer or move institution:
- Objective 1 – bonus – the larger the yearly bonus the better
 - Objective 2 – earnings potential – the more you can earn over time the better
 - Objective 3 – subordinates – the more subordinates the better

Your pairwise comparison matrix for these objectives is:

		Objective		
		1	2	3
Objective	1	1	-	-
	2	8	1	-
	3	4	7	1

Are the judgements made with respect to these objectives reasonably consistent or not (assume the value of RI for $n=3$ is 0.58)? **(16 marks)**

Currently your judgement (pairwise comparison matrices) of the relative worth of your current employer (institution A) as compared to your potential new employer (institution B) with respect to the above three objectives is:

Objective 1		A	B
	A	1	2
	B	-	1

Objective 2		A	B
	A	1	3
	B	-	1

Objective 3		A	B
	A	1	-
	B	9	1

Assuming that the judgements made with respect to the three objectives are reasonably consistent which institution should you work for? **(9 marks)**

END OF PAPER

