UNIVERSITY OF LONDON   279 0032 ZB

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.

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. One methodological issue that arises in Operational Research work relates to implementation. What do you understand by implementation within the context of Operational Research/Management Science. Illustrate your answer by reference to two problems of which you are aware. **(25 marks)**

2. What is 'Journey Making'? **(15 marks)**

   Illustrate your answer by applying the technique to two problems with which you are familiar. **(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) OPT   **(7 marks)**
   (b) root definition   **(9 marks)**
   (c) UE   **(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 customers switching between three internet travel sites that are used for booking airline flights. These three internet travel sites trade under the names "Easy Flight", "Quick Flight" and "Fly-Away". An analysis of historical data has produced the transition matrix shown below for the probability of a customer switching at each flight booking between these sites. On average customers book a flight once every two months.

		From Easy Flight	Quick Flight	Fly-Away
To	**Easy Flight**	0.70	0.05	0.20
	Quick Flight	0.20	0.80	0.05
	Fly-Away	0.10	0.15	0.75

In this transition matrix, for example, there is a probability of 0.05 of a customer switching from using Quick Flight to using Easy Flight when they come to make a new booking. The current market shares for the three internet travel sites are 25%, 40% and 35% for Easy Flight, Quick Flight and Fly-Away respectively.

What do you think the market share for Fly-Away will be in six months time?

(6 marks)

What is the long-run prediction for the market shares for each of these three internet travel sites? **(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? **(3 marks)**

2

UL06/48

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

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)**

3

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. The following table defines the various activities that have to be completed for a small project that is being planned:

Activity	Completion time (weeks)
A	3
B	5
C	9
D	4
E	3
F	2
G	10
H	3
I	7
J	4

The immediate precedence relationships are:

Activity		Activity	
A	must be finished before	B,C	can start
D		B,E	
J		H,I	
F		G,E	

In addition there must be a time lag of 5 weeks between the end of activity G and the start of H.

Draw the network diagram. **(2 marks)**

Calculate the critical path, the overall project completion time and the float times for each activity. **(14 marks)**

Suppose now that, at the planning stage, the project manager wishes to reduce the project completion time by one week and all activities in the project can be crashed if necessary. The project manager wishes to choose just one activity to crash. Which activities would you recommend the project manager considers for crashing and what criterion would you advise using to select one amongst them? **(2 marks)**

Just before the project starts it is realised that there has been a mistake in determining the completion time of activity G and it is actually just 2 weeks, not the 10 weeks shown above. What effect does this have on the completion time, the critical path and your recommendation to the manager for crashing? **(7 marks)**

END OF PAPER
5