UNIVERSITY OF LONDON

B.Sc. Examination 2008

COMPUTING AND INFORMATION SYSTEMS
CIS331 INTRODUCTION TO MATHEMATICAL MODELING
IN MANAGEMENT SCIENCE

Duration: 2 hours 15 minutes

Date and time:

There are five questions in this paper. You should answer no more than THREE questions. Full marks will be awarded for complete answers to a total of THREE questions. Each question carries 25 marks. The marks for each part of a question are indicated at the end of the part in [.] brackets.

There are 75 marks available on this paper.

No calculators should be used.

THIS PAPER MUST NOT BE REMOVED FROM THE EXAMINATION ROOM

Question 1

a. Spreadsheet models involve inputs, decision variables and outputs. Explain these terms with one or more examples

[6]

b. List 4 characteristics that enable readability in spreadsheet models

[4]

c. Laura is a florist who purchases flowers and sells her flower arrangements at £4 per bunch. Laura purchases the flowers from a supplier at £1 for the flowers required per bunch. The fixed cost of £40.00 is paid to the supplier for the service per week. Any flowers that are not sold within the first 3 days will be sold at half price. Assume all flowers are sold and nothing is left once the price has been reduced to half price. Laura needs to calculate her weekly profit.

    i)   Assume the weekly demand to be 50 bunches of flowers. Propose a spreadsheet model grouping according to the terminology explained in question 1.

[8]

    ii)   Write the formulae used to calculate the profit.

[2]

    iii)   Propose a what-if question and write the new formulae to calculate the profit.

[5]

Question 2

a. Explain how the goal-seek tool in Excel is used to calculate Break-Even point.

[2]

b. Explain what a discount factor is and its relevance to the calculation of Net Present Value

[3]

c. A Chinese circus troop is visiting London for 2 weeks. You have been asked to develop a model to schedule their performances.

   i)   What data would you need to develop in the model?

[5]

   ii)   Suggest two constraints that can affect this model?

[5]

   iii) With the collected data and constraints describe how break-even could be calculated?

[5]

   iv)   Assume the troop is able to collect all their profit at the end of 3 years. Develop the formulae to calculate the Net Present Value using mathematical notations (eg. x, y, z) where necessary

[5]

Question 3

a. In linear modelling explain the terms *changing cells*, *target cells* and *constraints*

[6]

b.

Microsoft Excel 10.0 Sensitivity Report
Worksheet: [Dessert.xls]Model
Report Created: 8/14/2002 7:14:39 PM

Adjustable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
B16	Snackbar	1.25	0	3145	1486.25	57.5
C16	Ice cream	1.875	0.000	6175	115	1981.666667

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
B25	Grams_consumed	168.125	0	120	48.125	1E+30
B20	Calories Consumed	450	1.4375	450	150	50
B21	Fat (grams) Consumed	25	594.5	25	3.125	6.25

(Albright & Winston, Figure 3.11, page 73)

Explain from the above Sensitivity report the following terms:
   i)   Reduced cost
   ii)   Shadow price
   iii) Allowable decrease
   iv)   Objective coefficient
   v)   Constraint R.H.Side

[10]

c. "Two things can go wrong when we invoke Solver. Both of these might indicate that there is a mistake in the model" (Albright & Winston).

   i)   Name these two concerns. (characteristics)

[2]

   ii)   Explain graphically the relationship of the two characters to a spreadsheet model and show the optimal solution.

[7]

Question 4

a. List and define the three properties of a linear model.

[6]

b. You are responsible for a Printing Company that supplies printed t-shirts.

    i)   What is an Aggregate Planning Model?

[3]

    ii)   Explain the data you would need to produce such a model for this scenario and how you would obtain them.

[8]

    iii)   Assume backlogging is allowed and discuss how this scenario could be modelled using Excel.

[8]

Question 5

a. Define the 3 rules for drawing an AON network.

[6]

b. The following data is for the scheduling of a Five-Activity Project

Node	Immediate Predecessors	Immediate Successors	Duration
A	None	D,E	7
B	None	C	10
C	B	E	3
D	A	None	12
E	A,C	None	6

(Albright & Winston, Table 5.11, page 223)

    i)   Draw a network that represents the above situation.

[5]

    ii)   From the network, discuss the critical path and calculate the slack.

[9]

    iii)   Discuss how this problem could be modelled and solved using Excel.

[5]