DECISION MATHEMATICS COMPUTATION, DC (4773) A2

Objectives

To give students experience of modelling with the aid of suitable software and of the use of algorithms in a variety of situations.

To develop modelling skills with the aid of suitable software.

The problems presented are diverse and require flexibility of approach. Students are expected to consider the success of their modelling, and to appreciate the limitations of their solutions.

Assessment

Examination (72 marks)
2½ hours
Candidates answer four questions.
Each question is worth about 18 marks.

Candidates require access to a computer with a spreadsheet program and a linear programming package, and suitable printing facilities, throughout the examination.

Assumed Knowledge

Candidates are expected to know the content of *C1* and *C2* and *D1*.

Calculators

In the MEI Structured Mathematics specification, no calculator is allowed in the examination for *C1*. For all other units, including this one, a graphical calculator is allowed.

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DECISION MATHEMATICS COMPUTATION, DC		
Specification	**Ref.**	**Competence Statements**

NETWORK FLOWS		
Using networks to model transmission systems.	DCN1	Be able to model a transmission system using a network.
Maximum flow/ minimum cut theorem.	2	Be able to specify a cut and to calculate its capacity.
	3	Understand that if an established flow is equal to the capacity of an identified cut, then the flow is maximal and the cut is a minimum cut.
Flow augmentation.	4	Be able to use flow augmentation and the labelling algorithm to establish a maximum flow in simple transmission networks (directed and undirected).
Linear programming formulation.	5	Be able to formulate and solve network flow problems as linear programming problems.

MATCHINGS		
Bipartite graphs.	DCM1	Be able to identify when a bipartite graph is an appropriate model.
	2	Be able to construct a bipartite graph.
The matching algorithm.	3	Be able to construct an alternating path and use it to improve a matching.
	4	Be able to model a matching problem as a network flow problem.
Allocation and transportation.	5	Be able to recognise and formulate allocation and transportation problems.
LP formulation.	6	Be able to formulate and solve matching, allocation and transportation problems as linear programming problems.

LINEAR PROGRAMMING		
Problem solving.	DCL1	Be able to formulate and solve (using a computer package) a wide variety of problems as linear programming problems.
	2	Be able to interpret the solutions of linear programming problems.

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RECURRENCE RELATIONS		
Use in problem solving.	DCs1	Be able to model appropriate problems by using recurrence relations.
Solving recurrence relations.	2	Be able to solve first and second order homogeneous and non-homogeneous relations.
	3	Be able to produce, manipulate and interpret spreadsheet models of recurrence relations (including second order oscillatory relations).

SIMULATION		
Simulation modelling.	DCZ1	Be able to build and use discrete event/ discrete time simulation models.
	2	Be able to use a spreadsheet function to generate uniformly distributed random numbers (discrete and continuous).
	3	Be able to use spreadsheet functions to transform uniform discrete random variables to non-uniform discrete random variables.
	4	Be able to determine approximately the number of repetitions needed to obtain a required level of accuracy.
	5	Be able to verify and validate a model.
	6	Be able to interpret results.
Computer modelling.	7	Be able to use a spreadsheet package to build, run and interpret simulation models.