

**OLLSCOIL NA hÉIREANN, GAILLIMH**  
**NATIONAL UNIVERSITY OF IRELAND, GALWAY.**

**SUMMER EXAMINATIONS**

**2000**

**HIGHER DIPLOMA IN MANAGEMENT**

***OPERATIONS RESEARCH***

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**Instructions:** Time allowed: 2 Hours  
Answer any three questions  
Show all your work clearly.

- Q 1 (i) A car manufacturer has two Suppliers, A and B, of wing mirrors. Given the following data on the quality from each supplier:

<i>Percent Defective</i>	<i>Probability for Supplier A</i>	<i>Probability for Supplier B</i>
1	0.80	0.50
2	0.15	0.40
3	0.05	0.10

A defective mirror can be replaced at a cost of £1.00 per mirror. Clearly the quality of supplies from B is lower than that of supplies from A.

How much less would supplier B have to sell an order of 20,000 mirrors than supplier A for you to be indifferent between these two suppliers?

(80%)

- (ii) Add a note to your answer on the use of utility theory in Managerial Decision Making.

(20%)

- Q 2 Passenger miles for a Galway based taxi service for the past 10 weeks are as follows:

<i>Week</i>	<i>Actual Passenger Miles in (100's)</i>
1	18
2	20
3	17
4	24
5	19
6	17
7	21
8	19
9	20
10	21

→  
(Most recent)

- (i) Assuming an initial forecast for week 1 of 1800 Passenger Miles, use exponential smooting to complete the forecast miles for weeks 2 to 10 (9 weeks in total).

Use  $\alpha = 0.3$

(50%)

- (ii) What is the MAD for the model as presented? (30%)
- (iii) Add a note to your answer on forecasting accuracy in practice. (20%)

**Q 3 (i)** Derive the classical economic order quantity (vendor model)

$$Q^* = \sqrt{\frac{2DCo}{Ch}}$$

where

$Q^*$  : Optimal Order Quantity

$D$  : Annual Demand

$Co$  : Ordering Cost (Set Up Cost) per order

$Ch$  : Holding Cost per unit per year

(40%)

- (ii) Galway Electronics orders a particular component from Kilcolgan Supplier Company. This component is ordered in batches of 150 units and annual demand is known to be 250 units. If carrying cost is assumed to be £1 per unit per annum, determine the ordering cost if Galway Electronics follow an optimal ordering policy. (40%)

- (iii) Briefly explain how quantity discounts are handled in the context of classical optimal inventory modelling. (20%)

**Q 4** Solve the following linear programming problem

Maximize  $30X_1 + 40X_2$

Subject to  $2X_1 + X_2 \leq 8$

$2X_1 - X_2 \geq 2$

$X_2 \leq 3$

$X_1, X_2 \geq 0$

- (i) Using the Graphical Method (30%)
- (ii) Using the Simplex Algorithm (50%)
- (iii) Add a note to your answer on the use of post optimality analysis in linear programming. Clearly explain what you understand by duality in the context of linear programming. (20%)

Q 5 (i) Solve the following transportation problem

From \ To	A	B	C	Supply
D	£3	£3	£2	25
E	£4	£2	£3	40
F	£3	£2	£3	30
Demand	30	30	35	95

where the costs in the top right hand corner of each cell is the cost of transporting one unit from the corresponding producer to the corresponding market.

(40%)

(ii) Solve the following simple assignment problem (machine - job)

		<i>Job</i>			
		<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
<i>Machine</i>	<i>1</i>	8	4	5	9
	<i>2</i>	6	5	7	6
	<i>3</i>	7	8	10	7
	<i>4</i>	9	7	8	5

where the costs in the matrix indicate the cost of assigning machine  $i$  ( $i = 1, 2, 3, 4$ ) to job  $j$  ( $j = 1, 2, 3, 4$ ).

(30%)

(iii) Develop a network for the following problem

Activity	Immediate Predecessors
A	-
B	-
C	-
D	B
E	A, D
F	C
G	E, F

(20%)

(iv) What types of problems can be solved using the minimal spanning tree technique?

(10%)