M.Com. 1st Semester Examination, 2012

OPERATIONS RESEARCH

PAPER – COM-103

Full Marks : 50

Time : 2 hours

The figures in the right-hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Illustrate the answers wherever necessary

UNIT – I

[Marks : 20]

1. Answer any *two* of the following questions : 5 × 2

(*a*) Why is square evaluation of empty cells made in solving a transportation problem ? If you commit a mistake in evaluating the empty cells in any of the iterations, can you ever reach the optimal solution without detecting the mistake ? 2 + 3

(*b*) How would you solve an assignment problem where two jobs are to be assigned to a particular individual ? Explain with an example. 5

(*c*) What is the prime objective of a travelling salesman problem ? What assumptions are commonly made in solving such a problem ? 1 + 4

(*d*) What do you mean by 'Dual' in linear programming ? Write the Dual for the following linear programming problem : 2 + 3

Minimise $Z = 4x_1 + x_2$

subject to : $3x_1 + x_2 \leq 2;$

$4x_1 + 3x_2 \geq 6;$

$x_1 + 2x_2 \leq 3$

where $(x_1, x_2) \geq 0.$

2. Answer any *one* of the following questions : 10 × 1

(*a*) The following table gives the cost of transporting material from supply points *A*, *B*, *C*, and *D* to demand points *E*, *F*, *G*, *H*, and *I* :

To → From ↓	*E*	*F*	*G*	*H*	*I*
A	10	8	17	15	12
B	13	15	18	9	11
C	20	14	10	13	13
D	19	13	12	9	8

The present allocations are as follows : A to E – 90 units, A to F – 10 units, B to F – 150 units, C to F – 10 units, C to G – 50 units, C to I – 120 units, D to H – 210 units, D to I – 70 units. Check if the allocation is optimum. If not, find an optimum schedule. 10

(*b*) Three products A, B, and C have to be processed by three machines M_1, M_2 and M_3. Available machine hours for the three machines, machine hour requirements per unit of each product, and profit per unit of each product are given in the following table :

Machines	Machine Hour Requirements per unit			Available Hours
	Product A	Product B	Product C	
M_1	1	1	1	100
M_2	10	4	5	600
M_3	2	2	6	300
Profit per unit (Rs.)	100	60	40	

Write down the complete linear programming formulation of the problem and determine the optimum feasible solution. 10

UNIT – II

[Marks : 20]

3. Answer any *two* of the following questions : 5 × 2

(*a*) Raj service station has a central store where service mechanics arrive to take spare parts for the jobs they work upon. The mechanics wait in queue if necessary and are served on a first-come-first -served basis. The store is manned by one attendant who can attend 8 mechanics in an hour on an average. The arrival rate of the mechanics averages 6 per hour. Assuming that the pattern of mechanics' arrivals is poisson distributed and the servicing time is exponentially distributed, determine Ws, Wq and Lq where the symbols carry their usual meaning. 5

(*b*) A contractor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that when he starts a production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for one year is 20 paise and set-up cost of a production run is Rs. 180. How frequently should production run be made ? 5

(*c*) Define inventory. What are the costs associated with inventory ? 2 + 3

(*d*) Briefly explain the following with examples in relation to network analysis : $2\frac{1}{2} + 2\frac{1}{2}$

(*i*) Float.

(*ii*) Event.

4. Answer any *one* of the following questions : 10 × 1

(*a*) A hardware store procures and sells hardware items. Information on an item is given here :

Expected annual sales = 8,000 units
Ordering Cost = Rs. 180 per order
Holding Cost = 10% of the average inventory value

The item can be purchased according to the following schedule :

Lot size	Unit price (Rs.)
1-999	Rs. 22.00
1000-1499	Rs. 20.00
1500-1999	Rs. 19.00
2000 and above	Rs. 18.50

You are required to determine the best order size. 10

(*b*) The following table shows, for each activity of a project, the normal and crash times as also the normal and crash costs. The contract includes a penalty clause of Rs. 200 per day in excess of 19 days. The overhead cost is Rs. 400 per day.

	Time (Days)		Cost (Rs.)	
Activity	Normal	Crash	Normal	Crash
1-2	6	4	600	1,000
1-3	4	2	600	1,400
2-4	5	3	500	1,500
2-5	3	1	450	650
3-4	6	4	900	2,000
4-6	8	4	800	3,000
5-6	4	2	400	1,000
6-7	3	2	450	800

(*i*) Draw the project network and determine the critical path.

(*ii*) Find the cost of completing the project in normal time.

(*iii*) Crash the project activities and determine the cost of completing the project in minimum time.

(*iv*) Determine the optimal duration of the project and the cost involved. 2 + 3 + 3 + 2

[*Internal Assessment* = 10 Marks]
