

2015

M. Com.

1st Semester Examination

OPERATIONS RESEARCH

PAPER — COM-103

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full 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 : 2×5
- (a) What is an 'Artificial Variable' as it is used in linear programming? State the situations when and why it is used.
- (b) Perform optimally test under 'uv' method on the following solution of a transportation problem (Notations and figures have their usual meaning) :

(Turn Over)

	P	Q	R	S	T	
A	6/5	7	6	7/8	4	13
B	9	7	5/5	6	6/7	11
C	5	8/7	6	6/4	8	14
D	6	5/6	4	7	6/5	11
	6	13	5	13	12	

- (c) What is 'Degeneracy' in a transportation problem? How can you solve it?
- (d) Describe, with a suitable example, the steps to be followed for solving an assignment problem when a particular assignment is prohibited.
2. Answer any *one* of the following questions : 1×10
- (a) A salesman has to visit five cities. The costs involved in visiting different cities from other cities are represented in the following matrix :

		To City (Cost in \square)				
		P	Q	R	S	T
From City	A	—	25	32	34	39
	B	26	—	31	36	29
	C	32	33	—	41	31
	D	30	21	30	—	25
	E	28	45	28	36	—

Determine the optimum sequence the salesman should follow to minimise the total costs for visiting all the cities in a single trip. Find out the total costs involved.

- (b) Three products are produced using three resources. The quantity of resources available, the unit consumption of these resources for production of different products, and the profit per unit sale of the products are indicated by the table below :

		Products			
		X	Y	Z	
Resources	A	1	2	1	≤ 11
	B	1	1	1	≤ 9
	C	2	1	1	≤ 12
Profit		3	2	4	

Find an optimum production programme using simplex method.

Unit--II

[Marks : 20]

3. Answer any *two* of the following questions : 2×5
- (a) (i) Define 'forward pass' and 'backward pass' in network analysis (CPM/PERT).
- (ii) How will you deal with the situation if negative value of independent float or interfering float is obtained ?
- (iii) What is 'activity cost slope'? What does it signify ?

2+1+2

- (b) Explain economic lot size inventory model with different rates of demand in different cycle using suitable diagram. 5
- (c) A small project consists of six activities with the following information :

Activity	Normal Duration	Minimum Time to complete activity	Reduction Cost per day (Rs.)
1 - 2	9	9	—
1 - 3	8	6	25
1 - 4	15	10	30
2 - 4	5	5	—
3 - 4	7	6	15
4 - 5	2	1	40

- (i) Draw the network and find Critical Path and normal project duration.
- (ii) Find out various alternatives to reduce the normal duration to 16 days (with the help of minimum time given to complete each activity) and associated cost and suggest the best alternative.
- (1+1+1)+2
- (d) Find the optimal order quantity for a product when the annual demand for the product is 500 units, the cost of storage per unit per year is 10% of the unit cost and ordering cost per order is Rs. 180. The unit cost are given below :

Quantity	Unit Cost
$0 \leq q_1 < 500$	Rs. 25.00
$500 \leq q_2 < 1500$	Rs. 24.80
$1500 \leq q_3 < 3500$	Rs. 24.60
$3000 \leq q_4$	Rs. 24.40

5

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

(a) The following information is given below :

Activity	:	(1-2)	(2-3)	(2-4)	(3-5)	(4-6)	(5-6)	(5-7)	(6-7)
Pessimistic time (in weeks)	:	3	9	6	8	8	0	5	8
Most likely time (in weeks)	:	3	6	4	6	6	0	4	5
Optimistic time (in weeks)	:	3	3	2	4	4	0	3	2

Required :

- (i) Draw PERT network.
- (ii) Find the expected time and variance for each activity.
- (iii) Determine the critical path and expected project length.
- (iv) What is the probability that the project will be completed in 23 weeks ?

Given that :

Z value	:	1.90	1.91	1.92	1.93	1.94
Probability	:	0.9713	0.9719	0.9726	0.9732	0.9738

- (v) Why is critical activity with the lowest cost slope selected for crashing.

5×2

- (b) (i) State the assumptions made in single-channel queuing model.

- (ii) Discuss the terms : balking, renegeing and jockeying.

- (iii) A self-service store employs one cashier at its counter. Nine customers arrive on an average every 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find :

(I) Average number of customers in the systems.

(II) Average queue length.

- (iii) Average time a customer spends in the system.

- (iv) Average time a customer waits before being served.

3+3+(1×4)

[Internal Assessment : 10]