

Activity	Imm preceding activity	NORMAL TIME (DAYS)	NORMAL COST (RS)	CRASH TIME	CRASH COST (RS)
A	—	3	140	2	210
B	—	6	215	5	275
C	—	2	160	1	240
D	A	4	130	3	180
E	A	2	170	1	250
F	A	7	165	4	205
G	B,D	4	210	3	290
H	C,E	3	110	2	160

- (i) Draw a PERT network.
- (ii) Find out the critical path and the expected project completion date.
- (iii) What is the minimum possible project completion time after crashing the activities and the associated cost of completing the project? (20)

(400)

[This question paper contains 10 printed pages.]

7739

Your Roll No.

M.Com. SEMESTER - II (OC)

E

Paper No. 6203 : Quantitative Techniques
for Business Decisions

Time : 3 Hours

Maximum Marks : 100

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt all questions.

All questions carry equal marks.

1. Attempt **any two** parts :

- (a) A Shopkeeper has a uniform demand of an item at the rate of 50 units per month. He buys the item from the supplier at the cost of Rs. 6 per unit and the cost of placing an order is Rs. 10 every time. If the stock holding cost is 20% p.a. of the stock value, how frequently should he replenish his stock? Further, suppose the supplier offers a 5% discount on orders between 200 units and 999 units of the items and a discount of 10% on orders exceeding or equal to 1,000 units. Is it advisable for the shopkeeper to avail either of these discount offers?

P.T.O.

Simulate demand for 20 weeks using the following random numbers :

10, 24, 03, 32, 23, 59, 95, 34, 34, 51,

08, 48, 66, 97, 03, 96, 46, 74, 77, 44

- (i) If he maintains a constant supply of 8 hot water heaters in any given week, how many times will he be out of stock during 20-week period ?
- (ii) What is the average number of heaters demanded per week over 20-week interval ?

(5+15)

5. (a) What do you understand by transition probabilities ? Is the assumption of stationary transition probabilities realistic, in your opinion ? Why or why not ?

(6)

- (b) The data on the operating costs per year and resale prices of equipment A whose purchase price is Rs. 10,000 are given here :

- (a) Determine the optimal product mix and the maximum profit.
- (b) What are the Shadow prices of each resource ? Which resource has highest marginal value ?
- (c) Over what range in each of RHS values, are these shadow prices valid ?
- (d) Ranges over which the objective function coefficients can vary for each of the decision variables ?
- (e) State the dual to this problem and write its solution.

(20)

OR

Activity	Immediate predecessor	Time		
		Most optimistic	Most likely	Most pessimistic
A	-	4	6	8
B	A	5	7	15
C	A	4	8	12
D	B	15	20	25
E	B	10	18	26
F	C	8	9	16
G	E	4	8	12
H	D,F	1	2	3
I	G,H	6	7	8

P.T.O.

- (iv) Managerial significance of multiple optimal solution
- (v) If it is considered necessary to transport 20 units from factory A to Z what will be the least cost distribution schedule and its effect on cost?
- (vi) If transport cost from factory A to stockist Z is increased by Rs. 5 per unit, will the solution change? If so, find new solution. (20)

OR

- (b) Explain the concept of float. Distinguish clearly between the free, interfering and independent floats. (6)

- (c) A company has four salesmen who are to be assigned to four different sales territories. The monthly increases, estimated for each salesman in different territories (in lakh rupees) are shown in the table below :

Salesman	Sales territories				
	I	II	III	IV	V
A	75	80	85	70	90
B	91	71	82	75	85
C	78	90	85	80	80
D	65	75	88	85	90

P.T.O.

Suggest optimal assignment for the salesmen. Which sales territory will remain unassigned? What will be the maximum sales increase every month?

If for certain reasons, salesman D cannot be assigned to territory III, will the optimal assignment schedule be different? If so, show the new assignment schedule. (14)

4. (a) A truck company has a budget Rs. 40,00,000 and it is deciding to buy 3 types of vehicles

Vehicle type	Capacity	Mileage	Cost	Crew requirement per shift	Avg run per day
A	10 tonnes	35 kmph	80,000	1	18 hrs in 3 shifts
B	20 tonnes	30 kmph	1,30,000	2	18 hrs in 3 shifts
C	18 tonnes	30 kmph	1,50,000	2	18 hrs in 3 shifts

Company has 150 drivers available and the total number of vehicles must not exceed 30

Company wants to maximise its capacity in tonne-kms per day

Formulate it as LPP

- (a) Construct an arrow diagram, determine the critical path and state the expected project completion time.
- (b) Determine the probability that the project will be completed in 55 days.
- (c) If the co. wants to be 90% sure that the project is completed by a certain due date, how many days prior to that should it start the work?
- (d) Suppose the co. agrees to complete the project in 50 days, failing which it would pay a penalty of Rs. 500 per day. What is the probability that a penalty but not exceeding Rs. 2000 will be paid?

(20)

3. (a)

Factories	X	Y	Z	CAPACITY
A	4	8	8	56
B	16	24	16	82
C	8	16	24	77
Demand	72	102	41	

The goods are transported as follows: A to X 31 units, A to Y 25 units, B to X 41 units, B to Z 41 units, C to Y 77 units.

- (i) Show that the solution is not optimal
- (ii) Find an optimal solution
- (iii) Is there an alternate optimal solution

- (b) In an emergency clinic, on an average 4 patients per hour arrive and it takes 10 minutes to serve a patient. It cost the clinic Rs. 300 per patient treated. Each minute decrease in the average service time will cost Rs. 50 per patient. How much should be the budgeted cost of the company if it wants to reduce the average size of the queue from $\frac{4}{3}$ patients to $\frac{1}{2}$ patients? (10+10)

OR

- (c) What is a sequencing problem? What assumptions are generally made in solving sequencing problems?
- (d) A water heater supplier sells its hot water heaters to home owners and installs for them. He examines hot water heater sales over the past 50 weeks and notes the following:

Hot Water Heater Sales	No. of weeks
4	6
5	5
6	9
7	12
8	8
9	7
10	3

- (b) The pay-off table for a zero-sum game between A and B is shown below, where A is playing to maximize his pay-off. Solve the game for the optimal strategies of the two players and the value of the game.

	B1	B2	B3	B4
A1	150	-18	78	90
A2	6	102	54	70
A3	130	-30	78	80

- (c) Find the sequence that minimizes the total elapsed time required (T) in completing the following jobs. Each job is processed in the order ABC. Also, Calculate T.

Job	1	2	3	4	5	6	7
Machine A	10	8	12	6	9	11	9
Machine B	6	4	6	5	3	4	2
Machine C	8	7	5	9	10	6	5

(10+10)

2.

Product	Manufacturing requirement (hrs/unit)				
	Centre 1	Centre 2	Centre 3	Cost (Rs.)	Selling price (Rs.)
A	1	3	2	11	15
B	3	4	1	12	20
C	2	2	2	10	16
Hours	160	120	80		

Year	Operating cost (Rs.)	Resale Value (Rs.)
1	1500	5,000
2	1900	2,500
3	2300	1,250
4	2900	600
5	3600	400
6	4500	400
7	5500	400

- (i) What is the optimum period for replacement ?
- (ii) When equipment A is 2 years old, equipment B, which is a new model for the same usage, is available. The optimum period for replacement is 4 years with an average cost of Rs. 3,600. Should we change equipment A with that of B? If so, when? (14)

OR

- (c) Following are the various activities involved in a project. The cost and time information for these activities is given below :