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- (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? (6)
- (ii) What is average number of heaters demanded per week over 20-week interval? (14)

(100)

17/5/16 (M)

[This question paper contains 10 printed pages.]

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Your Roll No. ....

M.COM. : SEMESTER - II (OC) F

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. (a) What is a 'game' in games theory? What are the properties of the game? Explain the 'Best strategy' on the basis of minimax criterion of optimality (8)

- (b) You are given the following information regarding the production lot size of a particular product:

Annual Demand: 5000 units

Set-up Costs: Rs. 100 per set-up

P.T.O.

Daily Demand: 17 units

Production Rate: 50 units per day

Optimal production-lot size: 275 units

Rising interest rates and other costs have caused 10% increase in the annual holding costs. Determine the new optimum production lot size for the product.

(12)

OR

(a) What is the significance of the duality theory of linear programming? Describe the general rules for writing the dual of a linear programming problem.

(8)

(b) At a tool counter, the supply clerk is paid daily wage at Rs. 100 per day for an 8-hour working day. The employees who come to him to take and return the tools, their daily charges are Rs. 120 per day. On an average, 25 workers come to the counter every hour for replacing the tools. The supply clerk takes on an average, 2 minutes either for issuing or for replacing the tools. The company is considering a semi-automatic device at the tool counter so that the service rate becomes faster. It will involve an additional expenditure of Rs. 100 per day besides the clerk. But, at the same

time, it will increase the service rate by 33.33 percent (one-third). Should the company install the semi-automatic device?

(12)

2. Given below is a table after few iterations using simplex method to solve a LPP to maximize total contribution margin from products A and B:

	C <sub>j</sub>	8.5	10.5	0	0	0
Mix	Total	X <sub>1</sub>	X <sub>2</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>
X <sub>2</sub>	300	0	1	3/5	-2/5	0
X <sub>1</sub>	300	1	0	-2/5	3/5	0
S <sub>3</sub>	400	0	0	-1/5	-1/5	1

Give answers to the following questions giving reasons as well:

- Is the above solution optimal?
- Is the above solution feasible?
- Does the problem have alternative optimal solution? If so, find another optimal solution.
- Write the objective function of the problem.
- What are the shadow prices for the three resources?
- If S<sub>1</sub> represents the slack for the production capacity constraint, how much should the company be willing to pay for each additional unit of production capacity?

P.T.O.



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- (g)  $S_3$  represents the slack for demand constraint. If the company is able to increase its total demand by 20 units, what will be the optimal mix and total contribution margin (20)

OR

A firm marketing a product has four salesmen  $S_1$ ,  $S_2$ ,  $S_3$  and  $S_4$ . There are three customers to which a sale of a unit each is to be made. The chances of making a sale to a customer depend on the salesman-customer rapport. The following table depicts the probability with which each of the salesman can make a sale to each of the customers.

	Salesman			
Customer	$S_1$	$S_2$	$S_3$	$S_4$
$C_1$	0.7	0.4	0.5	0.8
$C_2$	0.5	0.8	0.6	0.7
$C_3$	0.3	0.9	0.6	0.2

If only one salesman is assigned to each of the customers, what combination of salesmen and customers shall be optimal, given further that the profit obtainable by selling one unit to  $C_1$ ,  $C_2$  and  $C_3$  is Rs. 500, Rs.450 and Rs. 540? What is the expected profit? (20)

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

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Activity	NORMAL TIME (DAYS)	NORMAL COST(RS)	CRASH TIME (days)	CRASH COST (RS)
1-2	3	300	2	450
2-3	3	75	3	75
2-4	5	200	3	300
2-5	4	120	4	120
3-4	4	100	1	190
4-6	3	90	2	130
5-6	3	60	1	110

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

OR

Inter arrival and service durations studied over past few years for a single channel queuing system revealed the following patterns:

P.T.O.



Inter-arrival time		Service time	
minutes	Probability	minutes	Probability
2	0.19	1	0.15
4	0.22	3	0.28
6	0.32	5	0.30
8	0.17	7	0.17
10	0.10	9	0.10

Using the following random numbers simulate the queue behavior for a period of 60 minutes

1908 3227 5974 8196 2748 4507 2665 5278 7792  
4649 8512 8363 3410 4206 4397 0753 1748 2375

(in the given four-digit random numbers, the first two digits are used for inter arrival times and the other two digits are for service time) Use the above simulation to estimate:

- The probability of the server being idle
  - The mean time spent by the customer waiting for the service.
- (20)

4. ABC Ltd. has three production shops supplying a product to five warehouses. The cost of transportation are given as follows:.

	Warehouses					
	I	II	III	IV	V	Supply
Shop A	6	4	4	7	5	100
Shop B	5	6	7	4	8	125
Shop C	3	4	6	3	4	175
Demand	60	80	85	105	70	

The cost of manufacturing the product at different production shops is :

Shop:	A	B	C
Variable cost (Rs.):	14	16	15

- Find the optimum distribution pattern so as to minimize cost
  - Identify alternate solution (if any)
- (20)

OR

A company manufactures three models of cars. There is backlog of orders with the company. Model A requires 60, 100 and 80 worker days in three production processes I, II and III respectively. Model B requires 100, 240 and 100 worker days, while model C requires 200, 360 and 160 worker days respectively in the three production processes. The number of workers employed in the three production processes are 15, 30 and 15 respectively, and average worker is on the job for 200 working days in a year. The expected profit per car of the three models is Rs. 7500, Rs. 15,000 and Rs. 30,000 respectively.

- Determine the optimal product mix and total maximum profit obtainable.

P.T.O.

- (ii) What are the shadow prices of the resources? Determine the range over which each of these is valid.
- iii) Write the dual to the above LPP and obtain the optimal values of the dual variables from the solution in i) above. (20)
5. (a) Discuss integer linear programming. Give an example each of a pure and mixed integer programming problem. (6)
- (b) Reduce the following two-person zero-sum game to  $2 \times 2$  order and obtain the optimal strategies for each player and the value of the game:

		Player B			
		B1	B2	B3	B4
Player A	A1	3	2	4	0
	A2	3	4	2	4
	A3	4	2	4	0
	A4	0	4	0	8

(14)

OR

A plumbing and heating company maintains a stock of 30-gallon water heaters that it sells to home-owners and installs for them. The owner likes the idea of

having large supply on one hand So as to meet all customer demand, but he also recognizes that it is expensive to do so. He examines hot water heater sales over the past 50 weeks as follows:

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

Using the random numbers below, Simulate demand for 20 weeks using the following random numbers:

10, 24, 03, 32, 23, 59, 95, 34, 84, 51,

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

P.T.O.