2107 **A**

M.Com./Sem. II

Paper–6203 : QUANTITATIVE TECHNIQUES FOR BUSINESS DECISIONS

(Admissions of 2009 and onwards)

Time : *3 Hours* *Maximum Marks* : 70

(Write your Roll No. on the top immediately

on receipt of this question paper.)

Note : Answers may be written *either* in English *or* in Hindi; but the same medium should be used throughout the paper.

Attempt all questions.

Attempt all parts of the question together.

Use of simple calculator is allowed.

1. Attempt any *two* of the following :

   (a) A mobile phone manufacturer is planning for advertising campaign through various media types namely TV, magazine and radio. Advertising campaigns are targeted at four regions I, II, III and IV with the desired respective requirement of 50, 40, 20

[P.T.O.

and 60 exposures during the four week period. The level of maximum exposures possible through each of the media type is : 50, 35 and 65 during four week period. The estimated cost of per exposure to each of the segment is given in the table below.

Media	Regions			
	I	II	III	IV
TV	10	7	12	9
Magazine	12	9	8	8
Radio	3	4	11	5

Formulate the problem as transportation problem and solve it to find the optimum solution with MODI method. Show the formulation of the problem as linear programming problem.   7

(b) The demand for an item is deterministic and constant over time at 500 units per year. The item costs Rs. 60 per unit and the cost of placing an order are estimated to be Rs. 10. The inventory carrying cost is 25% and the shortage cost is Rs. 2 per unit per month. Find the optimal ordering quantity if stockouts are permitted and the units can be back-ordered at the shortage cost indicated. What quantity should be allowed for back ordering ? What is the maximum inventory at any time of the year ?   7

(c) A company has two grades of inspectors 1 and 2, who are to be assigned for a quality control inspection. It is required at least 2,000 pieces to be inspected per 8-hour day. Grade 1 inspector can check pieces at the rate of 40 per hour, with an accuracy of 97%. Grade 2 inspector checks at the rate of 30 pieces per hour with an accuracy of 95%.

The wage rate of a grade 1 inspector is Rs. 5 per hour, while that of Grade 2 inspector is Rs. 4 per hour. An error made by an inspector costs Rs. 3 to the company. There are only nine Grade 1 inspectors and eleven Grade 2 inspectors available in the company. The company wishes to assign work to the available inspectors so as to minimize the total cost of the inspection. Formulate this problem as a linear programming model and solve it by graphical method.   7

2. (a) An electronic firm manufactures three electronic products with a profit (per 100 units) of Rs. 100, Rs. 60, and Rs. 40 respectively. Resource requirement (in hours) for each of the product (per 100 units) are as follows :

Resources	A	B	C
Engineering Services	1	1	1
Labour	10	4	5
Other services	2	2	61

There are 100 hours of engineering services available, 600 hours of direct labour and 300 hours of administration. Using simplex method find the most profitable product mix ? Write the dual of the given problem and give its economic interpretation.   14

Or

(b) Maximize $Z = 2x + 4y + 3z$

sub to

$3x + 4y + 2z \le 60$

$2x + y + 2z \le 40$

$x + 3y + 2z \le 80$

$x, y, z \ge 0$ *and integers*

Solve the given problem and provide integer solution using cut plane method. Find the equation for cut plane.   14

3. (a) What are the major characteristics of PERT model and CPM model ? Which one is better model for decision making ?   5

(b) Certain information related to completion of a small project is given below :

Activity :	A	B	C	D	E	F	G	H	I	J	K	L
Duration :	5	4	5	3	7	2	6	3	4	6	2	3
Immediate Predecessor :	–	A	A	A	B	E	C	D	G	D	J	F, H, I

Draw the network. Compute various floats for each of the activity.

Find critical path.   9

Or

(c) The following are the various activities related to a project. The cost and time information for these activities is given below :

Activity	Immediate Predecessor	Normal		Crash	
		Time (Days)	Cost (Rs.)	Time (Days)	Cost (Rs.)
A	—	6	300	5	400
B	—	8	400	6	600
C	A	7	400	5	600
D	B	12	1,000	4	1,400
E	C	8	800	8	800
F	B	7	400	6	500
G	D, E	5	1,000	3	1,400
H	F	8	500	5	700

(i) Draw the project network.

(ii) Find out the critical path with normal time and crash time.

(iii) Find out the activities that need to be crashed to complete the project within crash time with minimum cost.   14

4.   Attempt any *two* of the following :

(a)   Manufacturing company is deliberating on make or buy decision for its one of the product component. It needs 3,500 units of that component every year, which it can buy at the rate of Rs. 50 per unit from the market. The estimated cost of placing an order is Rs. 20 and the cost of carrying the stock is Rs. 5 per year.

Company can manufacture the component internally also and in that case it can save almost 20% of the price of the product. The set up cost of Rs. 250 per production run, however, to be incurred by the company with the annual production rate of 5,000 units.

(i)   Find the EOQ and the optimum number of orders placed in a year.

(ii) Should the company manufacture the part internally or continue to purchase it from the supplier ?   7

(b)   A firm is using a machine whose purchase price is Rs. 13,000. The installation charges amount to Rs. 3,600 and the machine has a scrap value of only Rs. 1,600.

The maintenance cost in various years is given below :

Year :	1	2	3	4	5	6	7
Maintenance Cost (Rs.) :	250	750	1,000	1,500	2,100	2,900	4,000

The firm wants to determine after how many years the machine should be replaced on economic considerations. Assume that the machine can be replaced only at the year end.   7

(c) The rate of arrival of customers at ATM follows poisson distribution, with an average of five minutes between one and the next customer. The duration of ATM usage is assumed to follow exponential distribution with the mean time of three minutes.   7

   (i)   What is the probability that a person arriving at the booth will have to wait ?

   (ii)   What is the average length of the queue ?

   (iii) What is the mean number of customers waiting in the queue ?

   (iv)   What is the probability of zero customers on the system ?

(d) The owner of the small machine shop has four machinists available to assign to jobs for the day. Five jobs are offered with an expected profit in rupees for each machinist on each job as follows :

Machinist	A	B	C	D	E
1	62	78	50	101	82
2	71	84	61	73	59
3	87	92	111	71	81
4	48	64	87	77	80

Determine the assignment of machinist to jobs that will result in a maximum profit.   7

5. (a) The two persons zero sum game is given below. Find the optimal strategies for the two players and the value of the game :

		Player B		
		B_1	B_2	B_3
Player A	A_1	5	9	3
	A_2	6	– 12	– 11
	A_3	8	16	10

If the saddle point exists, determine it using the principale of dominance. 7

(b) The probability distribution of monthly costs and revenues are given below :

Cost (Rs.)	Probability	Sales Revenue	Probability
10,000	.15	11,000	.10
11,000	.15	13,000	.10
12,000	.20	14,000	.25
13,000	.25	15,000	.35
14,000	.10	16,000	.15
15,000	.15	17,000	.05

Use the following random numbers in respective order for estimating costs and revenues. Obtain the probability distribution of monthly net revenue.

Sequence 1 : 82, 84, 28, 82, 36, 92, 73, 91, 63, 29

Sequence 2 : 39, 72, 38, 29, 71, 83, 19, 72, 92, 59   7

Or

(c) Three companies A, B and C introduced new potato chips in the market almost at the same time. Initially they had 40%, 30% and 30% respective market share. During the first year A retained 80%, B retained 75%, and C retained 85% of its customers. A could get 15% of B's and 5% of C's customers. For B the share in A's and C's customers was 10% each. C also shared 10% each in A's and B's customers. Assuming that customer buying habits do not change, find the market share of each of the company at the end of first two years. Also, what would be the market share of each of the company in the long run time ?   7

(d) In the case of linear programming problem explain with example the cases of unbounded solution, multiple solution, and no solution. How these cases are identified with simplex technique.

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