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DPP-5708

M.C.A. (Sem. II) Examination

April/May - 2016

Paper-204 : Computer Based Optimization Techniques

(Old & New Course)

Time : **3** Hours] [Total Marks : **70**

Instruction :

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **M.C.A. (SEM. II)**

Name of the Subject :

☛ **PAPER-204 : COMPUTER BASED OPTIMIZATION TECHNIQUES (OLD & NEW)**

☛ Subject Code No. : **5 7 0 8** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

1 (a) Define a general linear programming problem. Write the simplex algorithm to solve the given linear programming problem. 6

(b) Solve the following linear programming problem : 8

Maximize $z = 30\ x_1 + 40\ x_2 + 20\ x_3$

Subject to $10x_1 + 12\ x_2 + 7x_3 \leq 10000$

$7x_1 + 10x_2 + 8x_3 \leq 8000$

$x_1 + x_2 + x_3 \leq 1000$

$x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0$

OR

(b) Solve the following linear programming problem : 8

Maximize $z = 5\ x_1 - 4\ x_2 + 3\ x_3$

Subject to $2x_1 + x_2 - 6x_3 = 20$

$6x_1 + 5x_2 + 10x_3 \leq 76$

$8x_1 - 3x_2 + 6x_3 \leq 50$

$x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0$

2 (a) The owner of Metro sports wishes to determine how many advertisements to place in selected three monthly magazines A, B and C. His objective is to advertise in such a way that total exposure to principal buyers of expensive sports goods is maximized. Percentages of readers of each magazine are known. Exposure in any particular magazine is the number of advertisement placed multiplied by the number of principal buyers. the following data may be used. 6

Exposure Category	Magazine		
	A	B	C
Readers	1 lakh	0.8 lakh	0.5 lakh
Principal Buyers	12%	20%	10%
Cost per advertisement (Rs.)	6000	5000	4000

The budgeted amount is at most Rs. 1.5 lakh for advertisements. The owner has already decided that magazine A should not have more than 5 advertisements, and that B and C each have at least four advertisements. Formulate it as linear programming problem.

(b) Obtain the optimum solution for the following transportation problem. 8

		Warehouses					
		W1	W2	W3	W4	W5	Available
Factory	F1	275	350	425	225	150	300
	F2	300	325	450	175	100	250
	F3	250	350	475	200	125	150
	F4	325	275	400	250	175	200
Required		150	100	75	250	200	

OR

(b) Obtain the optimum solution for the following transportation problem : 8

		Warehouses					
		W1	W2	W3	W4	W5	Available
	F1	55	30	40	50	40	40
Factory	F2	35	30	100	45	60	20
	F3	40	60	95	35	30	40
Required		25	10	20	30	15	

3 (a) The captain of a cricket team has to allot five middle batting positions to five batsmen. The average runs scored by each batsman at these positions are as follows : 7

		Batting Position				
		B1	B2	B3	B4	B5
	P	40	40	35	25	50
Batsman	Q	42	30	16	25	27
	R	50	48	40	60	50
	S	20	19	20	18	25
	T	58	60	59	55	53

(i) Find the assignment of batsman to batting position which would give the maximum number of runs.

(ii) If another batsman 'U' with the following average runs in the batting positions is as given below :

Batting Positions :	B1	B2	B3	B4	B5
Average runs :	45	52	38	50	49

is also considered, find the optimum assignment. If U is to be retained in the team, then which of the current five batsman will be out ? What is the maximum number of runs now ?

(b) (i) What is sequencing problem. Write the algorithm to solve n jobs two machines sequencing problem. 7

(ii) Find the sequence that minimizes the total elapsed time required (when passing is not allowed) to complete the following tasks on three machines :

Task	1	2	3	4	5	6	7	8	9
Machine A	11	14	13	18	17	17	16	14	12
Machine B	14	16	15	12	11	17	11	16	19
Machine C	23	25	24	21	20	26	20	25	30

Also find the total elapsed time.

OR

3 (a) Solve the following travelling salesman problem. 7

		To				
	1	∞	10	13	11	12
	2	10	∞	12	10	12
From	3	14	13	∞	13	11
	4	11	10	14	∞	10
	5	12	11	12	10	∞

(b) Find the optimal sequence for the following sequencing problem of 4 jobs and 5 machines when passing is not allowed of which processing time in (hours) is given below : 7

Machine M1	29	20	18	24
Machine M2	35	14	19	26
Machine M3	35	10	17	36
Machine M4	25	10	15	30
Machine M5	28	16	20	26

Also find the total elapsed time.

4 (a) Define the following terms : 4

(i) Event

(ii) Most likely time

(iii) Estimated time

(iv) Successor Activity

(b) The following table gives the activity times (in days) of a network. 10

Activity	Optimistic Time	Most Likely Time	Pessimistic Time
1-2	3	3	3
2-3	3	6	9
2-4	2	4	6
3-5	4	6	8
4-6	4	6	8
5-6	0	0	0
5-7	3	4	5
6-7	2	5	8

(i) Construct the network

(ii) Compute earliest and latest times for each activity

(iii) Find the critical path and its duration

(iv) What is the probability that the project should be completed in 23 days ?

OR

4 (a) Write the PERT algorithm to solve a given network problem. 4

(b) A small project consists of the jobs in the table given below. With each job is listed its normal time and a minimum or crash time (in days). The cost (in Rs. per day) of crashing each job is also given. 10

Job	Normal Time (days)	Crash time (days)	Cost of Crashing (Rs. Per day)
1-2	9	6	20
1-3	8	5	25
1-4	15	10	30
2-4	5	3	10
3-4	10	6	15
4-5	2	1	40

Overhead cost is Rs. 60 per day.

(i) Draw the network

(ii) Find the critical path

(iii) Find the optimum project time and corresponding minimum total cost by crashing appropriate activities in proper order.

5 (a) Define different types of costs associated with inventory control. 4

(b) A machine shop produces three products 1,2 and 3 in lots. 4
The shop has a warehouse whose total floor area is 600 sq. meters. The relevant data for the three items are given below :

Product	1	2	3
Annual demand (Units/year)	4000	2500	8000
Cost/unit (Rs.)	8	12	3
Set-up cost per lot (Rs.)	80	180	60
Floor area required (sq. meters)	0.60	0.75	0.30

The carrying charge on each item is 20% of the average inventory valuation per annum. No stock outs are allowed.

Determine the optimal lot size for each item.

(c) The demand for an item in a company is 1500 units per month and the company can produce the item at the rate of 36000 per year. The cost of one set-up is Rs. 400 and the holding cost of one unit per month is 50 paise. Determine the optimum order quantity which minimizes the total production cost. 3

(d) A contractor of second hand motor trucks uses to maintain a stock of trucks every month. Demands of the trucks occur at a relatively constant rate but not in a constant size. The demand follows the following probability distribution : 3

Monthly demand	0	1	2	3	4	5	6
Probability	0.40	0.24	0.20	0.10	0.05	0.01	0.00

The holding cost of an old truck in stock for one month is Rs. 10 and penalty for a truck if not supplied on demand is Rs. 150 per month. Determine the optimal size of the stock for the contractor.

OR

5 (a) A company is producing three items and has limited storage space of averagely 625 items of all types. Determine the optimal production quantities for each item separately, for which the following information is given : 4

Product	1	2	3
Annual demand (Units/year)	130	150	120
Holding cost/unit (Rs.)	0.07	0.06	0.09
Set-up cost per lot (Rs.)	70	60	80

(b) Find the optimum order quantity for a product for which the breaks are as follows: 4

Quantity Range	Purchasing Cost
$0 \leq Q < 250$	Rs.8 per unit
$250 \leq Q < 450$	Rs.7.50 per unit
$450 \leq Q < 650$	Rs. 7.00 per unit
650 and above	Rs. 6.75 per unit

The monthly demand for the product is 1000 units. The monthly holding cost is 20% of the unit cost of the product and the cost of ordering is Rs. 50.00 per month.

(c) A dealer supplies you the following with regard to an item of inventory : 3

Annual demand	5000 units
Ordering costs	Rs. 250 per order
Inventory holding costs	30% of the value of inventory per year
Inventory stock-out costs	Rs. 10 per unit per year
Price	Rs. 100 per unit

Find out

(i) the economic order quantity

(ii) total minimum cost

(d) You have to supply your customer with 100 units of a certain product every Monday (and only then). You obtain the product from a local supplier at Rs. 60 per unit. The cost of set-up is Rs. 50 per order and the cost of carrying is 15% per year of the unit cost. Obtain the economic quantity and the minimum cost for the lot. 3