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SC-4314

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

April / May - 2011

204 - Optimization Techniques

Time : 3 Hours] [Total Marks : 70

Instruction :

(1)

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. 2)

Name of the Subject :

☛ 204 - OPTIMIZATION TECHNIQUES

☛ Subject Code No. : 4 3 1 4 ☛ Section No. (1, 2,.....) : NIL

Seat No. :

Student's Signature

Q.1. Answer the following: **[14]**

(A) Write the simplex algorithm to solve linear programming problem. **[06]**

(B) Solve the following linear programming problem: **[08]**

Maximize $z = 12x1 + 15x2 + 9x3$,

subject to $8x1 + 16x2 + 12x3 \leq 250$,

$4x1 + 8x2 + 10x3 \geq 80$,

$7x1 + 9x2 + 8x3 = 105$,

$x1 \geq 0, x2 \geq 0, x3 \geq 0$.

-- OR --

(B) Obtain the optimum solution of the following linear programming problem: **[08]**

Maximize $z = 2x1 + 4x2 + 3x3$,

subject to $3x1 + 4x2 + 2x3 \leq 60$,

$2x1 + x2 + 2x3 \leq 40$,

$x1 + 3x2 + 2x3 \leq 80$,

$x1 \geq 0, x2 \geq 0, x3 \geq 0$.

Q.2. Answer the following: **[14]**

(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 multipled by the number of principal buyers. The following data may be used: **[06]**

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

The bugeted 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: **[08]**

		Warehouses W1	W2	W3	W4	Available
Factory	F1	42	48	38	37	160
	F2	40	49	52	51	150
	F3	39	38	40	43	190
Required		80	90	110	160	

-- OR --

(B) Obtain the optimum solution for the following transportation problem: **[08]**

		Ware houses				
		W1	W2	W3	W4	Available
	F1	25	17	25	14	300
Factory	F2	15	10	18	24	500
	F3	16	20	8	13	600
Required		300	300	500	500	

Q.3. Answer the following: **[14]**

(A) A company has six jobs to be processed by six machines. The following table gives the profit in rupees when the ith job is assigned to jth machine (i, j=1,2,..,6). **[07]**

		Job					
		1	2	3	4	5	6
	1	9	22	58	11	19	27
	2	43	78	72	50	63	48
Machine	3	41	28	91	37	45	33
	4	74	42	27	49	39	32
	5	36	11	57	22	25	18
	6	3	56	53	31	17	28

How should the jobs be assigned to the machines so as to maximize the overall profit.

(B) A manufacturer has to process 5 jobs on 4 machines. The time taken for each of these jobs on each machine are given below in appropriate units: **[07]**

Jobs :	1	2	3	4	5
Machine M1 :	20	22	18	25	26
Machine M2 :	13	12	14	11	15
Machine M3 :	15	16	14	17	13
Machine M4 :	24	17	22	18	20

Find the order in which these jobs are to be processed through these machines so as to minimize the total processing time. Also find the total elapsed time.

-- OR --

Q.3. Answer the following: **[14]**

(A) Solve the following travelling salesman problem. **[07]**

		To				
		1	2	3	4	5
	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: **[07]**

Jobs :	1	2	3	4
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.

Q.4. Answer the following: **[14]**

(A) Define the following terms: **[04]**

(i)Event, (ii) Optimistic time, (iii) Pessimistic time (iv) 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	7	9	17
1 - 3	10	20	60
1 - 4	5	10	15
2 - 5	50	65	110
2 - 6	30	40	50
3 - 6	50	55	90
3 - 7	1	5	9
4 - 7	40	48	68
5 - 8	5	10	15
6 - 8	20	27	52
7 - 8	30	40	50

(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 125 days?

-- OR --

Q.4. Answer the following: **[14]**

(A) Define the following terms: **[04]**
(i) Predecessor activity, (ii) Crashing an activity, (iii) Dummy activity, (iv) Cost slope

(B) The following table gives the data on normal time, normal cost, crash time and crash cost for a small project. **[10]**

Activity	Time (days)		Cost (Rs.)	
	Normal	Crash	Normal	Crash
1 - 2	3	2	300	400
2 - 3	3	3	30	30
2 - 4	7	5	420	580
2 - 5	9	7	720	810
3 - 5	5	4	250	300
4 - 5	0	0	0	0
5 - 6	6	4	320	420
6 - 7	4	3	400	500
6 - 8	13	10	780	930
7 - 8	10	9	1000	1100

Indirect cost is Rs. 45 per day.
(i) Construct the network.
(ii) Find the critical path and normal cost and normal duration to complete the project.
(iii) Crash the relevant activity to find the optimum project time and corresponding minimum cost to complete the project.

Q.5. Answer the following: **[14]**

(A) A machine shop produces three products 1,2 and 3 in lots. The shop has a warehouse whose total floor area is 40 sq. meters. The relevant data for the three items are given below: **[04]**

Product	1	2	3
Annual demand (Units/year)	35	55	45
Holding cost/ unit (Rs.)	40	20	30
Set-up cost per lot (Rs.)	200	250	350
Floor area required (sq. meters)	1	1	1

Determine the optimal lot size for each item.

(B) The demand for an item in a company is 2000 units per month and the company can produce the item at the rate of 48000 units per year. The cost of one set-up is Rs. 400 and the holding cost of one unit per month is 35 paise. The shortage cost of one unit is Rs. 60 per year. Determine the optimum lot size and the minimum total cost per run. **[03]**

(C) Find the optimum order quantity for a product for which the breaks are as follows: [04]

Quantity Range	Purchasing cost
$0 \le Q < 100$	Rs. 200.00 per unit
$100 \le Q < 200$	Rs. 180.00 per unit
$200 \le Q < 300$	Rs. 160.00 per unit
300 and above	Rs. 140.00 per unit

The monthly demand for the product is 400 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.

(D) A baking company sells one of its type of cake by weight. If the product is not sold on the day it is prepared, it can be sold at a loss of 20 paise per Kg. and there is an unlimited market for one day old cake. The company makes a profit of 150 paise on every Kg. of cake sold on the day it is prepared. Past daily orders form a distribution with density function: [03]

$$f(x) = 0.02 - 0.0002x, \qquad 0 \le x \le 100.$$

How many Kg. of cake should the company prepare every day?

-- OR --

Q.5. Answer the following: [14]

(A) Define the following terms: [04]

(i) Set-up cost, (ii) Production cost, (iii) Shortage cost, (iv) Lead time.

(B) A company is producing three items and has limited storage space of averagely 700 items of all types. Determine the optimal production quantities for each item separately, for which the following information is given: [04]

Product	:	1	2	3
Annual demand (Units/year)	:	120	140	100
Holding cost/ unit (Rs.)	:	0.06	0.05	0.08
Set-up cost per lot (Rs.)	:	60	50	70

(C) The probability distribution of monthly sales of a certain item is as follows: [02]

Monthly Sales:	30	31	32	33	34	35	36	37	38	39	40	41
Probability :	0.03	0.05	0.05	0.10	0.15	0.15	0.12	0.10	0.10	0.07	0.06	0.02

The cost of carrying inventory is Rs. 1.60 per unit per month and the cost of unit shortage is Rs. 2.75 per month. Determine the optimum stock level which minimizes the total expected cost.

(D) The annual demand for a product is 500 units. The cost of storage per unit per year is 10% of the unit cost. The ordering cost is Rs. 180 for each order. The unit cost depends upon the amount ordered. The range of amount ordered and the unit cost price are as follows:

Quantity Range	Purchasing cost
$0 \le Q < 500$	Rs. 25.00 per unit
$500 \le Q < 1500$	Rs. 24.80 per unit
$1500 \le Q < 3000$	Rs. 24.60 per unit
3000 and above	Rs. 24.40 per unit

Find the optimal order quantity for a product which minimizes the total annual cost.