(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1434 Roll No.

M.C.A.

(SEM. III) EXAMINATION, 2008-09

COMPUTER BASED OPTIMIZATION TECHNIQUES

Time : 3 Hours] *[Total Marks : 100*

Note : *(1) Attempt* ***all*** *questions.*
(2) All questions carry ***equal*** *marks.*

1 Attempt any **two** of the following : **10×2=20**

(a) A company requires 2500 units of a special type of bolt per year. An offer has been received for supply of this at the rate of Rs. 2/- per piece. The supplier has also offered a discount of 3% for purchased lots of size between 1500 and 2499 units. Any order of 2500 units and above will be supplied at a discount of 5% on the base price. If the company expectes 20% return on its investment in working capital, and the cost of transport of each lot from the supplier's premises works out to Rs. 20 per lot, is it advantageous to change the order quantity and get discount ? If so how much ?

(b) Discuss the basic classification of inventory model.

(c) A manufacturer uses a component at the rate of 2500 units per year. The basic cost of the component is Re. 1.00 each and the marginal cost of carrying inventory is 20% of the cost of the item. The supply lots of the components

have to collected from the supplier involving an overall transport cost of Rs. 40/- per trip.

(i) Assuming that the actual consumption of the components during the year was 3000, as against the estimated 2500, to what extent will the manufactures lose by working out his order quantity for a demand of 2500 ?

(ii) If the actual transportation cost incurred per order is Rs. 30 and not Rs. 40 as estimated, determine the cost of this error.

2 Attempt any **two** of the following : **10×2=20**

(a) Discuss broad areas where computer based optimization techniques are applied.

(b) Maximize $z = 5x_1 + 2x_2 + 10x_3$

subject to $x_1 - x_3 \leq 10$

$x_2 - x_3 \geq 10$

$x_1 + x_2 + x_3 \leq 10$

$x_1, x_2, x_3 \geq 0$

(c) Discuss the ways to identify the following situations while solving linear programming problems :
(i) Infeasible problems (ii) Unbounded problems
(iii) Multiple optima (iv) Redundant constraints
(v) Degenerate problems.

3 Attempt any **two** of the following : **10×2=20**

(a) Compare Primal and Dual while solving L.P.P.

(b) Find the dual of

Maximize $30x_1 + 40x_2$

subject to $60x_1 + 120x_2 \leq 12,000$

$8x_1 + 5x_2 \leq 600$

$3x_1 + 4x_2 \leq 500$

$x_1, x_2 \geq 0$

Solve the foregoing dual problem by Simplex method.

(c) The following table shows all the necessary information :

Ware house	Market I	II	III	IV	Supply
A	5	2	4	3	12
B	4	8	1	6	15
C	4	6	7	5	8
Requirement	7	12	17	9	

On the available supply to each ware-house, the requirement of each market and the unit transportation cost from each warehouse to each market.

The shipping clerk has worked-out the following schedule from experience : 12 units from A to II, 1 unit from A to III, 9 units from A to IV, 15 units from B to III, 7 units from C to I and 1 unit from C to III.

(i) Check and see if the clerk has the optimal schedule.

(ii) Find the optimal schedule and minimum total shipping cost.

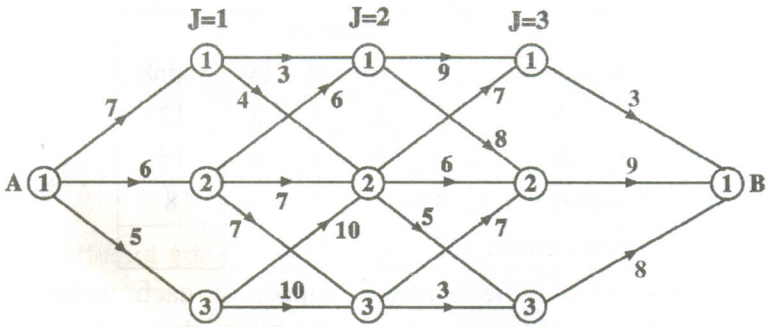
(iii) If the clerk is approached by a carrier of route C to II who offers to reduce his rate in the hope of getting some business, by how much must the rate be reduced before the clerk should consider giving him an order.

4 Attempt any **two** of the following : **10×2=20**

(a) What is dynamic programming and what sort of problems can be solved by it ?

(b) Write algorithm for Branch-and-Bound method for solving IPP.

(c) Find the shortest path from vertex A to vertex B.



along arcs joining various vertices lying between A and B, length of each path is given.

Attempt any **two** of the following : **10×2=20**

(a) Write short notes on :

(i) Practical solution of non linearities

(ii) Basic feasible solution and optimal solution

(b) List the factors that constitute the basic elements of a queueing model. For each of these enumerate the alternatives possible. Represent this diagramatically to cover all possible implementations of a queueing model.

(c) The Tool company's quality control department is manned by a single clerk, who takes an average of 5 minutes in checking parts of each of the machine coming for inspection. The machines arrive once in every 8 minutes on the average. One hour of machine valued at Rs. 15 and a clerk's time is valued at Rs. 4 per hour. What are the average hourly queueing system costs associated with the Quality Control Department ?

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PAPER ID : 1434 Roll No.

M.C.A.

(SEM. III) EXAMINATION, 2007-08

COMPUTER BASED OPTIMIZATION TECHNIQUES

Time : 3 Hours] *[Total Marks : 100*

Note : *(1) Attempt all questions.*
(2) All questions carry equal marks.

1 Attempt any two parts : **10×2=20**

(a) A company is presently having a production run of 500 units every 3 months. It is considering a review of its production lot size decision. The relevant information is given below :
Annual demand : 2000 units
Rate of production : 8000 units / year
Set-up cost : Rs. 300/run
Inventory holding cost : Rs. 1.60 / unit / year.
Would you recommend a change in the current production lot size ? Why ? What will the cost saving be, if any as a result of the change.

(b) Establish the economic order quantity EOQ for the classical EOQ inventory model.

(c) Obtain (1) Economic order quantity, (2) Number of orders, (3) Re-order level (4) Safety stock, for the following inventory problem :
Annual demand : 36,000 units
Cost per unit : Re. 1.00
Ordering cost : Rs. 25

Cost of capital : 15%
Store charge : 5%
Lead time : $\frac{1}{2}$ month
Safety stock : 1 month consumption.

2 Attempt any **two** parts : **10×2=20**

(a) Solve the following using the dual Simplex method

Maximize $Z = 8x_1 + 10x_2 + 5x_3$

Subject to

$$x_1 - x_3 \leq 4$$

$$2x_1 + 4x_2 \leq 12$$

$$x_1 + x_2 + x_3 \geq 2$$

$$3x_1 + 2x_2 - x_3 = 8$$

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

(b) Write algorithm for graphical method for solving linear programming problem.

(c) Give a proof or a counter example. Let $\bar{x}^*$ be a basic feasible solution, suppose that for every basis corresponding to $\bar{x}^*$, the associated basic solution to the dual is infeasible. Then the optimum cost must be strictly less then $\bar{C}^T\ \bar{x}^*$ for any cost vector $\bar{C}$.

3 Attempt any two parts : **10×2=20**

(a) Solve

Max $Z = 36x_1 + 50x_2$

subject to

$$3x_1 + 5x_2 \leq 100$$

$$4x_1 + 2x_2 \leq 96$$

$$6x_1 + 5x_2 \leq 146$$

$$x_1,\ x_2 \geq 0$$

(b) A salesman has to visit 5 cities, starting from A and returning to A. Find the route with the minimum distance. The distance table is

	A	B	C	D	E
A	–	17	16	18	14
B	17	–	18	15	16
C	16	18	–	19	17
D	18	15	19	–	18
E	14	16	17	18	–

(c) Write short note on the following :
(1) Degeneracy in transportation problem.
(2) 0-1 integer programming problem.

4 Attempt any two parts : **10×2=20**

(a) Solve the following quadratic program and illustrate it geometrically

$$\max\ f(x) = 2x_1 + 3x_2 + 4x_1^2 + 2x_1x_2 + x_2^2$$

Subject to

$$x_1 - x_2 \geq 0$$
$$x_1 + x_2 \leq 4$$
$$x_1 \leq 3$$

(b) Discuss the dynamic programming technique, illustrate with examples.

(c) Find the solution to the problem

$$\max\ (x_1\ \ x_2)\begin{pmatrix} 3 & 4 \\ 0 & 3 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

subject to $x_1^2 + x_2^2 = 1$.

5 Attempt any two parts : **10×2=20**

(a) Describe the following queueing systems

(1) M/M/1

(2) M/M/C

(3) M/G/1

(5) M/M/1/K

(b) Define the following terms :

(1) Erlangian distribution

(2) Markov process

(3) Exponential distribution

(4) Poisson distribution.

(c) Show that for a steady state M/M/1 queue system

$$\mathbf{Var}\left[N_q\right] = \frac{\rho^2(1+\rho-\rho^2)}{1-\rho^2}$$

where N_q = Numbers of customers in queue

ρ = Server utilization

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MCA

THIRD SEMESTER EXAMINATION, 2006 - 07

COMPUTER BASED OPTIMIZATION TECHNIQUES

Time : 3 Hours *Total Marks : 100*

Note : *(i) Attempt ALL questions.*
(ii) All questions carry equal marks.
(iii) In case of numerical problems assume data wherever not provided.
(iv) Be precise in your answer.

1. Attempt ***any two*** parts of the following : **(10x2=20)**

(a) A company has a demand of 12000 units/year for an item and it can produce 2000 such items per month. The cost of one setup is Rs. 400 and the holding cost per unit/month is Rs. 0.15. The shortage cost of one unit is Rs. 20 per year. Find the optimum lot size and the total cost per year assuming the cost of 1 unit Rs. 4.00. Also, find the maximum inventory, manufacturing time and total time interval.

(b) Discuss the importance of stochastic inventory models. If the demand for a certain product has a rectangular distribution between 4000 and 5000. Find the optimal order quantity if the storage cost is Rs. 1.00/unit and shortage cost is Rs. 7.00/unit.

(c) A system has a large number of light bulbs, all of which we must keep in working order. If a bulb fails in service, it costs Rs. 1.00 to replace, but if we replace all the bulbs in the same operation, we can do for only Rs. 0.35 a bulb. Find the optimum period for group replacement policy. The life distribution of the bulbs is as follows :

Week	: 1	2	3	4	5	6
Prob. of the bulb failing in the week	: 0.09	0.16	0.24	0.36	0.12	0.03

2. Attempt *any two* parts of the following : **(10x2=20)**

(a) Write down the advantages of LP models. What are the limitations of these ? An animal feed manufacturer has to produce 200 kg of a feed mixture consisting of two ingredients x_1, x_2. x_1 cost Rs. 6 per kg while x_2 costs Rs. 16 per kg. Not more than 80 kg of x_1 and not less than 60 kg of x_2 can be used. Solve graphically so as to minimize the total cost.

(b) Use Charnes' big-M method to

maximize $z = 3x_1 + 2x_2$

subject to constraints $2x_1 + x_2 \leq 1$

$3x_1 + 4x_2 \geq 4$

$x_1, x_2 \geq 0$

(c) State the advantages of revised simplex method. Use revised simplex method to

maximize $z = 6x_1 + 3x_2 + 4x_3 - 2x_4 + x_5$

subject to $2x_1 + 3x_2 + 3x_3 + x_4 = 10$

$x_1 + 2x_2 + x_3 + x_5 = 8$

$x_1, x_2, x_3, x_4, x_5 \geq 0$

3. Attempt *any four* parts of the following : (5x4=20)

(a) Explain some of the practical applications of Integer Linear Programming Problems.

(b) Write down the Branch-and-Bound algorithm to solve Integer Programming Problems.

(c) What is degeneracy in transportation problem ? How the problem of degeneracy arises in TP ? Explain how to overcome it.

(d) Use Vogel's Approximation Method to obtain an initial basic feasible solution to the following T.P. :

	1	2	3	4	Supply
1	10	2	20	11	15
2	12	7	9	20	25
3	4	14	16	18	10
Demand	5	15	15	15	

(e) Determine an inital B.F.S. to the following T.P. using the row minima method :

	TO				Supply
	5	2	4	3	22
From	4	8	1	6	15
	4	6	7	5	8
Demand	7	12	17	9	

(f) Solve the following maximal assignment problem.

Salesman	District 1	2	3	4
A	16	10	14	11
B	14	11	15	15
C	15	15	13	12
D	13	12	14	15

4. Attempt *any four* parts of the following : **(5x4=20)**

(a) Consider the NLPP :

Minimize $z = x_1^4 + 2x_2 + x_3^2$

Subject to : $x_1^2 + x_2 + x_3^2 \leq 4$

$x_1 + x_2 | \leq 0$

$x_1, x_3 \geq 0$

x_2 unrestricted in sign

Is this NLPP a convex programming problem ?

(b) Write down matrix form of quadratic programming problem. Also write wolfe's method of solving it.

(c) Obtain the set of Kuhn-Tucker conditions for NLPP :

maximize $z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$

subject to $x_1 + x_2 \leq 2,\ 2x_1 + 3x_2 \leq 12,\ x_1, x_2 \geq 0.$

(d) What are the applications of dynamic programming ? State the differences between LP and DP.

(e) Obtain the functional equations of dynamic programming for solving the problem :

Maximize $z = \sum_{i=1}^{n} m_i \left(\frac{p_i}{m_n} \right)^{\alpha}$

Subject to $m_1 + m_2 + \text{----} + m_n = M$ and $m_i \geq 0$ $[i = 1, 2, \text{---}, n]$.

(f) Use dynamic programming to solve the L.P. problem :

maximize $z = 3x_1 + 4x_2$

subject to $2x_1 + x_2 \leq 40$

$2x_1 + 5x_2 \leq 180$

$x_1, x_2 \geq 0.$

5. Attempt *any four* parts of the following : **(5x4=20)**

(a) State some important applications of queuing models.

(b) What do you mean by queue discipline ? Explain four queue disciplines.

(c) Find the distribution of inter-arrival time for Poisson arrivals in a queuing system.

(d) Explain the following queuing models :

(i) $M|M|C : GD|m|n$.

(ii) $M|M|1 : SIRO|\infty|\infty$.

(e) In a cafeteria, the customers have to pass through three counters. They buy coupons at the first counter, select and collect the snacks at the second counter and collect tea at the third. The server at each counter takes on an average 1.5 minutes although the distribution of service is approximately exponential. If the arrival of customers to the cafeteria is approximately Poisson at an average rate of 6 per hour. Calculate :

(i) Average waiting in the cafeteria

(ii) the most probable time in getting the service.

f) Patients arrive at a clinic according to a Poisson distribution at the rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate 20 per hour. Find :

(i) the effective arrival rate at the clinic.

(ii) Expected waiting time until a patient is discharged from the clinic.

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