Reg. No. : .....

(8 pages)

Code No. : 7366 **Sub. Code : HMAM 34**

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2015.

Third Semester

Mathematics

OPERATIONS RESEARCH

(For those who joined in July 2012 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The Bender's partitioning algorithm is a popular method to solve ———— problems.

   (a) Zer-one (b) Integer

   (c) Pure integer (d) MILP

2. A graph G is a collection of

   (a) nodes (b) vertices

   (c) arcs (d) (a) and (c)

3. The sum of the degrees of the vertices of a graph is ————.

   (a) 2 (b) 4

   (c) an even number (d) an odd number

4. Optimization problems that are modelled and represented in the form of a ———— are called network problems.

   (a) Directed graph (b) Bi-partite graph

   (c) Weighted graph (d) Connected graph.

5. The word NP stands for ———— polynomial.

   (a) Deterministic (b) Monic

   (c) Non-deterministic (d) Irreducible.

6. TSP is ———— problem.

   (a) an NP complete (b) assignment problem

   (c) a shortest path (d) a network.

7. The branch and bound algorithm was developed by ————.

   (a) Little

   (b) Small

   (c) Land and Doig (1960)

   (d) Golden.

8. FCFS stands for ————————.

(a) Fast Come First Served

(b) First Come First Served

(c) First Come Fast Served

(d) Fast Come Fast Served.

9. An arrival chooses not to join the queue even if there is space to join. This phenomenon is called ————————.

(a) Balking (b) Reneging

(c) Jockeying (d) Jockeying.

10. For infinite queue length situations, it is necessary that

(a) $\frac{\lambda}{\mu} > 1$ (b) $\frac{\lambda}{\mu} < 1$

(c) $\frac{\mu}{\lambda} < 1$ (d) $\lambda = \mu$.

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Describe the assignment problem.

Or

(b) Explain the types of integer programming problems.

12. (a) Explain the Kruskal's algorithm.

Or

(b) Explain the Dijkstra's algorithm.

13. (a) Write about NP complete problems.

Or

(b) Explain the branch and bound algorithm to find optimal solution to TSP.

14. (a) Derive an expression $L_s = L_q + \rho$ for a $M/M/1/\infty/\infty$ model.

Or

(b) Derive an expression $\lambda_e = (1 - \rho_N)\lambda$ for a $M/M/C/N/\infty$ model.

15. (a) Let Q^* be the optimal order quantity in the simple ECQ model (constant rate of demand, instantaneous supply, no shortages). Let the actual order quantity be Q given by $Q = kQ^*$, $k > 0$.

(i) Derive an expression for the ratio of the actual total cost/unit time to the optimal cost.

(ii) If the holding cost/unit/unit time is overestimated by 20%, what is the percentage increases in the total cost over optimal cost?

Or

(b) Let $D = 10000$/year, C_o = Rs. 300/order and C_c = Rs. 4/unit/year. Find Q^* and TC^*.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Solve the following IP problem :

Maximize $3x_1 + 3x_2 + 13x_4$

Subject to $-3x_1 + 6x_2 + 7x_3 \leq 8$,

$6x_1 - 3x_2 + 7x_3 \leq 8$,

$x_i \geq 0$.

Using the cutting plane algorithm.

Or

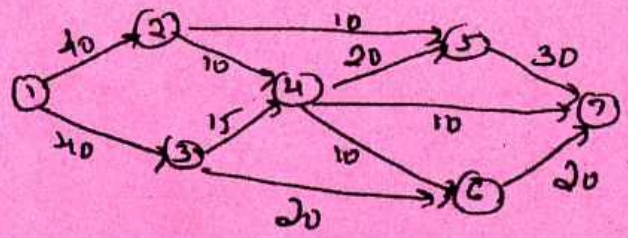
(b) Solve the following Zero-one problem.

Minimize $4x_1 + 6x_2 + 8x_3 + 3x_4$

Subject to $2x_1 + 3x_2 + 4x_3 + 4x_4 \geq 6$,

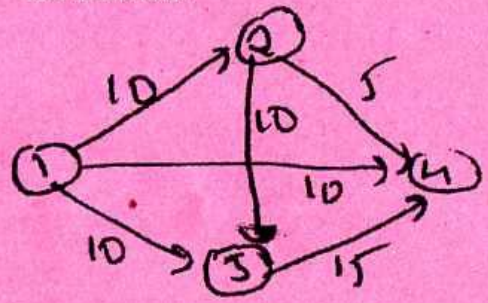
$7x_1 - 5x_2 + 2x_3 - x_4 \geq 7$.

17. (a) Find the maximum flow that is possible.



Or

(b) Using a labelling algorithm for flow augmenting path, find the maximum flow for the network.



18. (a) Using the nearest neighborhood algorithm solve the following TSP with the distance matrix.

–	10	8	9	7
10	–	10	5	6
8	10	–	8	9
9	5	8	–	6
7	6	9	6	–

Or

(b) Consider a single depo VRP with six cities. If the distance from the depot doi is the same for all the cities and if all the demand are equal to 15 units and if the vehicle capacity is 30, use clark-wright heuristic to set a solution to the VRP.

–	10	7	8	9	6
	–	7	8	10	12
		–	8	7	9
			–	10	5
				–	9
					–

19. (a) Discuss multiple server infinite queue length model.

Or

(b) A car garage has a single mechanic and has a parking space for 12 cars (including one that is being attended to). Customers arrive at the rate of 6/hour (Poisson) and are served at the rate of 8/hour (exponential). What is the probability that a person does not find a parking space for his car on arrival? What happens to this probability if the service rate is increased to 8/hour? What is the utilization of the server in both the cases?

20. (a) Shankar has to supply 10,000 bearing per day to a manufacturer. He begins a production run every 10.5 days. The carying cost is 2 paise per bearing per year and the set up cost is Rs. 18. What should be the optimum production rate to meet the demand?

Or

(b) Consider a single item inventory model with back ordering with D = 30000/year, C_o = 500/order C_c = 10% of Rs. 60/unit/year.

(i) Find the value of C_s for which $Q^* = 2500$.

(ii) The supplier is willing to give a 1% discount if the order quantity exceeds 3000 unit. Is it advantageous to accept the discount.

———————