Reg. No. : .....

Code No. : 6367 **Sub. Code : ZMAM 14**

M.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2022.

First Semester

Mathematics — Core

OPERATIONS RESEARCH

(For those who joined in July 2021 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. The unit "transportation" cost from period i to period j is computed as C_{ij} =

   (a) Production cost is i, $i = j$

   (b) Production cost is i + holding cost from i to j, $i < j$

   (c) Production cost is i + penality cost from to i to j, $i < j$

   (d) All the above

2. Which method yields the best starting solutions of the transportation problem

(a) North west-corner method

(b) Least-cost method

(c) Vogel approximation method

(d) None

3. A circuit is a loop in which all the branches are oriented in the ————.

(a) Opposite direct (b) Same direction

(c) Both direction (d) None

4. Total float of an activity is TF_{ij} = ————.

(a) $LC_j - ES_i - D_{ij}$ (b) $LC_j + ES_i - D_{ij}$

(c) $LC_j - ES_i + D_{ij}$ (d) none

5. Which one of the following is IP

(a) Zero-one (b) Mixed zero -one

(c) Pure integer (d) Mixed

6. Additive algorithms required presenting the 0–1 problem in a convenient form that satisfies ———— requirement

(a) 1 (b) 2

(c) 3 (d) none

7. During the classic EOQ model, the reorder point occurs when the ———— to LD units.

(a) inventory level drops

(b) inventory level increases

(c) all the above (a) and (b)

(d) none

8. In constant rate demand with instantaneous replenishment and no shortage model Y^* = ————

(a) $\frac{DK}{Y} + \frac{YK}{2}$ (b) $\sqrt{\frac{2DK}{h}}$

(c) $\frac{Yh}{2}$ (d) $\sqrt{2DKh}$

9. The expected waiting time in the model $(M/M/1)$: $(G_D/\infty/\infty)$ is

(a) $\frac{\rho}{1-\rho}$ (b) $\frac{1}{\mu(1-\rho)}$

(c) $\frac{\rho}{\mu(1-\rho)}$ (d) $\frac{\rho^2}{1-\rho}$

10. In $(M/M/\infty) : (G_D/\infty/\infty)$ model $P_0 =$ _____.

(a) $1-\rho$ (b) $e^{-\rho}$

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

PART B — ($5 \times 5 = 25$ marks)

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

11. (a) Show that in a symmetric TSP, any three distinct cost elements $C(i\ j), C(j, k), C(k,i)$ can be set to infinity without eliminating a minimum length tours.

Or

(b) Solve the 4-city TSP whose distance matrix is given in the following table :

City	1	2	3	4
1	–	12	10	14
2	12	–	13	8
3	10	13	–	12
4	14	8	12	–

12. (a) Explain Maximal Flow algorithm.

Or

(b) Explain Dijkstra's algorithm.

13. (a) Solve the following zero-one problem using implicit enumeration algorithm.

Maximize $4x_1 + 3x_2 - 2x_3$

Subject to

$x_1 + x_2 + x_3 \leq 8$

$2x_1 - x_2 - x_3 \leq 4$

$x_2, x_3 = 0, 1$

Or

(b) Solve the MILP :

Maximize $2x_1 + 3x_2$

Subject to

$3x_1 + 4x_2 \leq 10$

$x_1 + 3x_2 \leq 7$

$x_1 \geq 0$

$x_2 \geq 0$

and are integers.

14. (a) An item is consumed at the rate of 30 items per day. The holding cost per unit per day is \$. 05 and the set up cost in \$ 100. Suppose that no shortage is allowed and that the purchasing cost per unit is \$10 for any quantity not exceeding 500 units and \$ 8 otherwise. Determine the optimal inventory policy given a 21-day lead time.

Or

(b) A music store sells a best-selling compact disc. The daily demand for the disc in approximately normally distributed with mean 200 disc and a standard deviation of 20 disc. The cost of keeping the disc in the store is \$. 04 per disc per day. It cost the store \$ 100 to place a new order. The supplier normally specifies a 7-day lead time for delivery. Assuming that the store wants so limit the probability of running out of disc during the lead time to no more than .02, determine the stores optimal inventory policy.

15. (a) Consider the production - consumption inventory model with back orders. The data are D = 10000 / year, P = 16000 / year, C_0 = 350 / set up, C_c = 3.6 / unit / year and D = 100 unit / year. Find the batch quantity Q and the total cost.

Or

(b) Explain the model $(M/M/1):(GD/\infty/\infty)$.

PART C — (5 × 8 = 40 marks)

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

16. (a) Solve the transportation model.

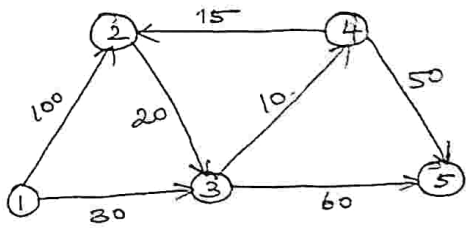
\$	0	2	1	6
	2	1	5	7
	2	4	3	7
	5	5	10	

Or

(b) Solve the assignment model

1	4	6	3
9	7	10	9
4	5	11	7
8	7	8	5

17. (a) D Find the shortest path from 1 to 5 using Dijkstra's algorithm.



Or

(b) Discuss the computations of critical path method.

18. (a) Solve the following 0-1 problem

Maximize $w = 3y_1 + 2y_2 - 5y_3 - 2y_4 + 3y_5$

Subject to

$y_1 + y_2 + y_3 + 2y_4 + y_5 \leq 4$
$7y_1 + 3y_3 - 4y_4 + 3y_5 \leq 8$
$11y_1 - 6y_2 + 3y_4 - 3y_5 \geq 3$
$y_1, y_2, y_3, y_4, y_5 = (0, 1)$

Or

(b) Solve the following by using fractional cut

Maximize $z = 3x_1 + x_2 + 3x_3$

Subject to :

$x_1 + 2x_2 + x_3 \leq 4$
$4x_2 - 3x_3 \leq 2$
$x_1 - 3x_2 + 2x_3 \leq 2$
$x_1, x_2, x_3 \geq 0$

and are integers.

19. (a) The following data describe four inventory items. The company wishes to determine the economic order quantity for each of the four items such that the total number of orders per year (365 days) is atmost 150.

Item	K_i	D_i	h_i
	\$	units/d	
1	100	10	.1
2	50	20	2
3	90	5	.2
4	20	10	.1

Or

(b) Explain the model Multi-item with storage Limitations.

20. (a) Explain $(M/M/C):(GD/N/\infty)$, $C \leq N$.

Or

(b) Patients arrive at a clinic according to a Poisson distribution at the rate of 20 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patients is exponential with mean of 8 minutes

(i) What is the probability that an arriving patient will not wait?

(ii) What is the probability that a patient to find a vacant seat in the room?

(iii) What is the expected waiting time until a patient leaves the clinic?
