

(8 pages)

Reg. No. :

Code No. : 10091 E Sub. Code : SEMA 6 D

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023

Sixth Semester

Mathematics — Major Elective

OPERATIONS RESEARCH—II

(For those who joined in July 2017-2019)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Two person Zero-sum game means that the
 - (a) Sum of losses to one player is equal to the sum of gains to other
 - (b) Sum of losses to one player is not equal to the sum of gains to other
 - (c) Both (a) and (b)
 - (d) None of the above

2. The size of the payoff matrix of a game can be reduced by using the principle of _____.
 - (a) game inversion
 - (b) rotation reduction
 - (c) dominance
 - (d) game transponce
3. What is concerned with the production of replacement costs and determination of the most economic replacement policy?
 - (a) Search theory
 - (b) Theory of replacement
 - (c) Probabilistic Programming
 - (d) none of the above
4. The problem of replacement is felt when job performing units fall _____.
 - (a) suddenly
 - (b) gradually
 - (c) both (a) and (b)
 - (d) none of these
5. Probability of queue size being greater than or equal
 - (a) $\frac{p}{1-p}$
 - (b) p^n
 - (c) $1-p$
 - (d) $\frac{p}{1+p}$

6. For model $(M|M|1):(N|F1F0)$, $i=1$ if $P_o =$

- (a) $N+1$ (b) N
 (c) $\frac{1}{N+1}$ (d) $\frac{1}{N}$

7. If activity (i,j) is on the critical path, then

- (a) $ES_i > LS_i$ (b) $ES_i < LS_i$
 (c) $ES_i = LS_i$ (d) $ES_i = 2LS_i$

8. The activity to maintain the proper logic in the network

- (a) narrow (b) dummy
 (c) circle (d) rectangle

9. The reorder level in EOQ problem with shortages is

- (a) $Q_1^0 - Q^0$ (b) $Q^0 + Q_1^0$
 (c) $Q_0^0 - Q_1^0$ (d) $\frac{Q_0 - Q_1^0}{2}$

10. For the fundamental EOQ problem, the minimum total annual inventory cost is _____.

- (a) $\sqrt{2DC_0C_1}$ (b) $\sqrt{2DC_1/C_s}$
 (c) $\sqrt{2DC_0/C_1}$ (d) None of these

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PART B — (5 × 5 = 25 marks)

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

11. (a) The following matrix represents the payoff to P_1 in a rectangular game between two persons P_1 and P_2 . Solve the game.

$$P_2 \begin{matrix} \\ \\ \end{matrix} \begin{matrix} 8 & 15 & -4 & -2 \\ 19 & 15 & 17 & 16 \\ 0 & 20 & 15 & 5 \end{matrix} P_1$$

Or

(b) Solve by graphical method

$$\begin{matrix} \text{Player A} \\ \text{Player B} \end{matrix} \begin{pmatrix} 2 & 2 & 3 & -2 \\ 4 & 3 & 2 & 6 \end{pmatrix}$$

12. (a) Describe the replacement policy of items that deteriorate with time and give the formulae for the total cost T_{cn} and average cost AC_n .

Or

(b) A truck owner finds from his past records that the maintenance cost per year, of a truck whose purchase price is Rs. 8,000 are as given below :

Year	1	2	3	4	5	6	7	8
Maintenance/cost Rs.	1,000	1,300	1,700	2,200	2,900	3,800	4,800	6,000
Next Sales Price	4,000	2,000	1,200	600	500	400	400	400

Determine at which time it is possible to replace the truck.

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[P.T.O.]

13. (a) If $\lambda = 6$, $\mu = 12$, $N = 3$, find $E(n)$, $E(W)$, and $E(m)$.

Or

- (b) In the $(M/M/1) : (\infty/FCFS)$ model, derive the formula for finding the average number of customers in the system.

14. (a) A project has the following characteristics.

Activity: 1-2 1-3 2-3 2-4 3-4 4-5

Duration (Days): 20 25 10 12 6 10

Draw the network for the project and find the critical path.

Or

- (b) Write briefly on PERT.

15. (a) The demand for a particular item is 18000 units per year. The holding cost per unit is Rs.1.20 per year and the cost of one procurement is Rs. 400. No shortages are allowed and the replacement rate is instantaneous. Determine.

- (i) Optimum order quantity.
- (ii) Number of orders per year
- (iii) Time between orders and
- (iv) Total cost per year when the cost of one unit is Re.1.

Or

- (b) What are the types of inventory? Why they are maintained?

PART C — (5 × 8 = 40 marks)

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

16. (a) Solve graphically the 6×2 game

		B	
		B ₁	B ₂
A	A ₁	1	-3
	A ₂	3	5
	A ₃	-1	6
	A ₄	4	1
	A ₅	2	2
	A ₆	-5	0

Or

- (b) State and prove the theorem for determining the optimum mixed strategies and value of the game of a 2-person zero sum game without saddle point.

17. (a) A machine costs Rs. 10,000. Operating costs are Rs. 500 per year for the first five years. In the sixth and succeeding years operating cost increases by Rs. 100 per year. Assuming a 10% discount rate of money per year, find the optimum length of time to hold the machine before we replace it?

Or

- (b) A manufacturer is offered two machines A and B. A is priced at Rs. 5,000 and running costs are estimated at Rs. 800 for each of the first five years, increasing by Rs. 200 per year in the sixth and subsequent years. Machine B, which has the same capacity as A, costs Rs. 2,500 but will have running costs of Rs. 1,200 per year for six years, increasing by Rs. 200 per year thereafter.

If money is worth 10% per year, which machine should be purchased?

18. (a) Define queueing system and explain its basic characteristics. Also give some important applications of queueing theory.

Or

- (b) (i) Explain $(M/M/1)(N/FCFS)$
 (ii) If for a period of 2 hours in a day (8:10 am) trains arrive at the yard every 20 minutes but the service time continues to remain 36 minutes, then calculate for the period
 (1) The probability that the yard is empty
 (2) Average queue length, on assumption that the line capacity of the yard is limited to 4 trains only.

20. (a) Discuss the inventory model with uniform rate of demand, infinite production and no shortages and obtain EOQ.

Or

- (b) (i) A contractor has to supply an article 20000 units per day. He can produce 30000 units per day. The cost of holding one unit in stock is Rs. 3 per year and the set up cost per run is Rs. 50. How frequently and what size the product run be made?
 (ii) Find the optimum order quantity for a product for which the price breaker are as follows.

Quantity	Unit cost (Rs.)
$0 \leq Q_1 < 500$	1.000
$500 \leq Q_2 < 750$	9.25
$700 \leq Q_3$	8.75

The monthly demand for the product is 200 unit, the cost of storage is 2% of the unit cost and the cost of ordering is Rs. 350.

19. (a) Explain the rules of network construction.

Or

(b) Write the algorithm for PERT.