Reg. No. :.....

Code No. : 20591 E **Sub. Code : SEMA 6 D**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Sixth Semester

Mathematics

Major Elective — OPERATIONS RESEARCH — II

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The size of the payoff matrix of a game can be reduced by using the principal of _____.

   (a) game inversion (b) rotation reduction

   (c) dominance (d) game transpose

2. When the sum of gains of one player is equal to the sum of losses to another player in a game, this situation is known as

   (a) biased game (b) zero-sum game

   (c) fair game (d) all of the above

3. The group replacement policy is suitable for identical law cost items which are likely to

(a) fail over a period of time

(b) fail suddenly

(c) fail completely and suddenly

(d) none of these

4. There problem of replacement is felt when job performing units fall.

(a) suddenly (b) gradually

(c) (a) and (b) both (d) none of these

5. Average number of customers in the queue

(a) $\frac{p}{1-p}$ (b) $\frac{p^2}{1-p}$

(c) $\frac{1-p}{p^2}$ (d) none of these

6. For the model $(M/M/1):(N/FIFO)$, $l=1$ if $P_0=$ _____.

(a) $N+1$ (b) N

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

7. In CPM, the difference between the latest finish time and earliest start time is defined as _____.

(a) slack time (b) finish time

(c) start time (d) none

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

(a) narrow (b) dummy

(c) circle (d) rectangle

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

(a) $\sqrt{2DC_SC_1}$ (b) $\sqrt{2DC_1/C_S}$

(c) $\sqrt{2DC_S/C_1}$ (d) None of these

10. In EOQ problem with shortages reorder level is

(a) $Q_1^o - Q^o$ (b) $Q^o - Q^o$

(c) $Q_0^o - Q_1^o$ (d) $\frac{Q^o - Q_1^o}{2}$

PART B — (5 × 5 = 25 marks)

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

11. (a) Explain the following terms in game theory : pure strategy, saddle point, value of the game and 2-person 0-sum game.

Or

(b) Explain the arithmetic method for $n \times n$ games.

12. (a) Describe the replacement policy of items with deteriorate time and give the formulae for the total cost $T(n)$ and average cost $A(n)$.

Or

(b) The maintenance cost and resale value per year of a machine whose purchase price is Rs. 8,000 is given above when should the machine be replaced?

Year	1	2	3	4	5	6	7	8
Maintenance cost in Rs.	1,000	1,300	1,700	2,000	2,900	3,800	4,800	6,000
Resale value in Rs.	4,000	2,000	1,200	600	500	400	400	400

13. (a) Discuss the basic characteristics of queueing.

Or

(b) A TV repairman finds that the time spend on the TV sets has an exponential distribution with mean 30 minutes of the TV sets are repaired in the order in which they come in and the arrival is approximately Poisson with an average rate of 10 for 8 hour days, what is the repairman's idle time each day? How many jobs are a head of the average set just brought in?

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) Arrivals at a telephone booth are considered to be Poisson with an average time of 5 minutes between one arrival and the next. The duration of the phone call is assumed to be distributed exponentially with mean 2 minutes.

(i) What is the probability that a person arriving at a booth will have to wait?

(ii) Find the average number of persons in the system.

(iii) What is the probability that the waiting time is more than 10 minutes?

Or

(b) A super market has two girls running up sales at the centers. If the service time for each customers is exponential with 4 minutes, and if people arrive in a Poisson fashion at the rate of 10 an hour

(i) What is the probability of having to wait for service?

(ii) What is the expected percentage of idle time for each girl?

(iii) If a customer has to wait, what is the expected length of his waiting time?

PART C — (5 × 8 = 40 marks)

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

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

$$A \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \\ A_5 \\ A_6 \end{matrix} \begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

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) Write a short note on group replacement policy.

Or

(b) There are 1,000 bulbs in the system. Survival rate is given below :

Week	0	1	2	3	4
Bulbs in operation at the end of the week	1000	850	500	200	100

The group replacement of 1,000 bulbs costs Rs. 100 and individual replacement is Rs.0.50 per bulb. Suggest suitable replacement policy.

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 is a day (8-10 a.m.) trains arrive at the yard every 20 minutes but the service time continuous to remain 36 minutes, then calculate for this 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.

19. (a) Describe the rules for drawing a network diagram, pointing out the role of dummy activities.

Or

(b) Draw the network and calculate the length, variance and square deviation of variance of the critical path for the following data.

Job	t_m	t_o	t_p
1-2	2	1	3
2-3	2	1	3
2-4	3	1	5
3-5	4	3	5
4-5	3	2	4
4-6	5	3	7
5-7	5	4	6
6-7	7	6	8
7-8	4	2	6
7-9	6	4	8
8-10	2	1	3
9-10	5	3	7

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

Or

(b) The demand for a particular item is 18,000 units per year. The holding cost per unit is Rs. 1.20 per year. The cost of procurement is Rs. 400. No shortages are allowed determine.

(i) Optimum order quantity

(ii) Number of orders per year

(iii) Time between orders.

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