KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

THOOTHUKUDI – 628 003

(9 Pages)   **Reg. No……………………………………**

Question. Code No : 24O0074   **Sub Code :   24PECO12**

PG Degree - End Semester Examinations, November 2024

First Semester

M.Com

Elective - OPERATIONS RESEARCH

(For those who joined in July 2024 onwards)

Time : 3 Hours   **Maximum : 75 Marks**

PART A – (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

1. Linear programming is ----------
   (a) A constrained optimization model
   (b) A constrained decision-making model
   (c) A mathematical programming model
   (d) All of the above

2. A restriction on the resources available in the operations research m of an inequality operations research an equation is called ---------.
   (a) Feasible region   (b) Constraint
   (c) Feasible decision   (d) Infeasible solution

3. When the number of occupied cells is less than m + n-1 in transportation problems it is ___
   (a) Degeneracy   (b) Balanced
   (c) Non degeneracy   (d) Unbalanced

4. --------- is reached when there is exactly one assignment in each column and in each row.
   (a) Feasibility   (b) Opportunity
   (c) Optimality   (d) Unbounded solution

5. In case of a mixed strategy , if the matrix is 2xn operations research m x 2, the problem can be solved -------.
   (a) Algebraically   (b) Graphically
   (c) Two person game   (d) Aall of the above

6. The numbers of competitive actions that are available for a player are called ----- to that player.
   (a) Pay-off   (b) Saddle point
   (c) Dominance   (d) Strategy

7. The replacement policy that is imposed on an item irrespective of its failure is____ replacement
   (a) Group   (b) Individual
   (c) Repair spares   (d) Successive

8. The _____ is the difference between both the allotted time and the actual time needed to execute a task.
   (a) Free float   (b) Half float
   (c) Independent float   (d) Total float

9. As per queue discipline the following is not a negative behavior of a customer:
   (a) Balking   (b) Boarding
   (c) Reneging   (d) Collusion

10. The minimum expected opportunity loss (EOL) is _____.
   (a) Equal to EVPI   (b) Minimum regret
   (c) Equal to EMV   (d) Both (a) and (b)

PART – B   (5X5=25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

11. (a) Explain the phases of operations research.

(OR)

(b) Solve graphically:

Minimise $Z = -x + 2y$

Subject to the constraints:

$-0.5x + y \leq 2$

$x - y \leq -1$

$x, y \geq 0$

12. (a) Find the initial solution and transportation cost by using NWC

Origin / Destination	I	II	III	Supply
A	2	7	4	5
B	3	3	7	7
C	5	4	1	8
D	1	6	2	14
Demand	7	9	18	

(OR)

(b) Assign the jobs

Machines /Jobs	1	2	3	4	5
A	11	17	8	16	20
B	9	7	12	6	15
C	13	16	15	12	16
D	21	24	17	28	26
E	14	10	12	11	13

13. (a) State the assumptions in sequencing problem.

(OR)

(b) Find the ranges of values of p and q which will render the entry (2,2) a saddle point for the game.

Player A/B	B1	B2	B3
A1	2	4	5
A2	4	**7**	Q
A3	10	p	6

14. (a) The cost of a machine is Rs. 6100 and its scrap value is only Rs.100. The maintenance costs are found to be

Year:	1	2	3	4	5	6	7	8
Maintenance Cost (in Rs.):	100	250	400	600	900	1250	1600	2000

When should the machine be replaced?

(OR)

(b) Draw a network diagram of the following schedule of activities and find its critical path.

Activity	A	B	C	D	E	F	G	H	I
Duration (in days)	8	10	8	10	16	17	18	14	9

15. (a) Describe the structure of queuing system.

(OR)

(b) The milk plant at a city distributes its products by trucks, loaded at the loading dock. It has own fleet of trucks plus trucks of a private transport company. This transport company has complained that sometime its trucks have to wait in line and thus the company loses money paid for a truck and driver that is only waiting. The company has asked the milk plant management to go in for a second loading dock or discount prices equivalent to the waiting time. The lowing data are available:

Average arrival rate (all trucks) = 3 per hour,

Average service rate = 4 per hour:

The transport company has provided 40% of the total number of trucks. Assuming that these are random according to Poisson distribution, determine

    1. The probability that a truck has to wait.

    2. The waiting time of a truck that waits.

    3. The expected waiting time of company trucks per day.

PART C – (5×8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 600 words.

16. (a) Maximise $Z = 2x_1 + x_2$

        Subject to $4x_1 + 3x_2 \leq 12$,

                $4x_1 + x_2 \leq 8$,

                $4x_1 - x_2 \leq 8$,

                $x_1, x_2 \geq 0$.

        Use simplex method.

(OR)

  (b) Maximise graphically $Z = 2x_1 + 3x_2$

        Subject to $x_1 + x_2 \leq 30$,

                $x_2 \geq 8$,

                $x_2 \leq 12$,

                $x_1 - x_2 \geq 0$,

                $0 \leq x_1 \leq 20$.

17. (a) Find the optimum solution to the following transportation problem in which the cells contain the transportation cost in rupees: (Use Vogel's approximation method)

	W1	W2	W3	W4	W5	Available
F1	7	6	4	5	9	40
F2	8	5	6	7	8	30
F3	6	8	9	6	5	20
F4	5	7	7	8	6	10
Required (Total)	30	30	15	20	5	100

(OR)

(b) Assign the job using Hungarian method

Machines /Jobs	1	2	3	4
A	5	7	11	6
B	8	5	9	6
C	4	7	10	7
D	10	4	8	3

18. (a) 6 jobs A, B, C, D, E. F have arrived at one time to be processed on a single machine assuming that no new jobs arrived thereafter, determine:

Job	A	B	C	D	E	F
Processing Time (minutes)	7	6	8	4	3	5

i. Optimal sequence as per shortest processing time rule (SPT).

ii. Completion times of the jobs.

iii. Mean flow time (Mean - Average)

iv. Average in process Inventory

(OR)

(b) Describe the theory of games.

19. (a) Following table given, the running cost and resale price of a certain equipment whose purchase price Rs. 52 000. Installation charges Rs.14400. Scrap value Rs. 6400.

Year: 1   2   3   4   5   6   7   8

Maintenance cost Rs.:

1000 2000 4000 6000 8400 11600 16000 19200

After how many years should the maintenance be replaced? Assume that the machine replacement can be done only at the year ends.

(OR)

(b) State and explain the terminologies used in network analysis

20. (a) A self-service store employs one cashier at its counter. Nine customers arrive on an Average 5 minutes while the cashier can serve 10 customers in 5 minutes. Assuming Poisson distribution for arrival rate and exponential distribution for service time, find

    i. Average number of customers in the system.
    ii. Average number of customers in the queue or average queue length.
    iii. Average time a customer spends in the system. Average time a customer waits before being served.

(OR)

(b) Mr. Sinha had to decide whether or not to drill a well on his farm. In his village, only 40% of the wells drilled were successful at 200 feet of depth. Some of the farmers who did not get water at 200 feet, drilled further up to 250 feet but only 20 % struck water at 250 feet. Cost of drilling is 50 per foot. Mr. Sinha estimated that he would pay 18,000 during a 5-year period in the present value terms, if he continues to buy water from the neighbour rather than go for the well which would have a life of 5 years. Mr. Sinha has three decisions to make: (a) should he drill up to 200 feet and (b) if no water is found at 200 feet, should he drill up to 250 feet? (c) Should he continue to buy water from his neighbour?