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(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2024-2026 ONLY)

SUBJECT CODE 24 PCO 207

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS): POLLACHI

END-OF-SEMESTER EXAMINATIONS: MAY – 2025

M.Com. **MAXIMUM MARKS: 75**

SEMESTER: II **TIME: 3 HOURS**

OPERATIONS RESEARCH

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS. (K1)

1. In Linear Programming, the objective function is always……..
   a) Linear b) Non-linear
   c) Exponential d) Quadratic
2. The North-West Corner Method is used to……..
   a) Find the optimal solution b) Determine an initial feasible solution
   c) Reduce transportation cost d) Assign jobs to workers
3. The strategy where a player minimizes the possible maximum loss is called…….
   a) Maximin strategy b) Nash equilibrium
   c) Zero-sum strategy d) Cooperative strategy
4. In CPM, the path with the longest duration is called the……..
   a) Shortest Path b) Critical Path
   c) Dummy Path d) Independent Path
5. Monte-Carlo Simulation is based on…….
   a) Linear Equations b) Random Sampling
   c) Trial and Error d) Deterministic Modeling

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES (K2)

6. Define linear programming.
7. Specify the term North – West corner method
8. Identify the significance of game theory
9. What do you mean by independent float?
10. Give a brief note on simulation

SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) Retail store stocks two types of shirts *A* and *B*. These are packed in attractive cardboard boxes. During a week the store can sell a maximum of 400 shirts of type *A* and a maximum of 300 shirts of type *B*. The storage capacity, however, is limited to a maximum of 600 of both types combined. Type *A* shirt fetches a profit of Rs. 2/- per unit and type *B* a profit of Rs. 5/- per unit. How many of each type the store should stock per week to maximize the total profit? Formulate a mathematical model of the problem.

(CONTD …. 2)

(OR)

b) Solve graphically the given linear programming problem. (Minimization Problem).

Minimize $Z = 3a + 5b$ S.T

$-3a + 4b \leq 12$

$2a - 1b \geq -2$

$2a + 3b \geq 12$

$1a + 0b \geq 4$

$0a + 1b \geq 2$

And both a and b are ≥ 0.

12. a) A manager has 4 jobs on hand to be assigned to 3 of his clerical staff. Clerical staff differs in efficiency. The efficiency is a measure of time taken by them to do various jobs. The manager wants to assign the duty to his staff, so that the total time taken by the staff should be minimum. The matrix given below shows the time taken by each person to do a particular job. Help the manager in assigning the jobs to the personnel.

Jobs.	***Men (time taken to do job in hours).***		
	X	**Y**	**Z**
A	10	27	16
B	14	28	7
C	36	21	16
D	19	31	21

(OR)

b) Solve the traveling salesman problem by using the data given below:

$C_{12} = 20$, $C_{13} = 4$, $C_{14} = 10$, $C_{23} = 5$, $C_{34} = 6$, $C_{25} = 10$, $C_{35} = 6$, $C_{45} = 20$ and $C_{ij} = C_{ji}$, And there is no route between cities 'i' and 'j' if a value for C_{ij} is not given in the statement of the problem. (i and j are = 1,2,..5)

13. a) Solve the game given below:

Players A	**Players B**		
	I	**II**	**III**
I	1	9	2
II	8	5	4

(OR)

b) In a certain game player has three possible courses of action L, M and N, while B has two possible choices P and Q. Payments to be made according to the choice made.

(CONTD …. 3)

Choices	*Payments.*
L,P	A pays B Rs.3
L,Q	B pays A Rs. 3
M,P	A pays B Rs.2
M,Q	B pays A Rs.4
N,P	B pays A Rs.2
N,Q	B pays A Rs.3

What are the best strategies for players *A* and *B* in this game? What is the value of the game for *A* and *B*?

14. a) Distinguish between PERT and CPM.

(OR)

b) A small project has 7 activities and the time in days for each activity is given below:

Activity	*Duration in days*
A	6
B	8
C	3
D	4
E	6
F	10
G	3

Given that activities *A* and *B* can start at the beginning of the project. When *A* is completed *C* and *D* can start. *E* can start only when *B* and *D* are finished. *F* can start when *B, C* and *D* are completed and is the final activity. *G* can start when *E* is finished and is the final activity. Draw the network and find the project completion time.

Activity	***Immediate predecessor***	***Time in days***
A	–	6
B	–	8
C	A	3
D	A	4
E	B , D	6
F	B, C or D	10
G	E	3

Draw the network and enter the times and find T_E

(CONTD …. 4)

15. a) Briefly explain the Monte-Carlo simulation with a suitable example

(OR)

b) With the help of a single server queuing model having inter-arrival and service times constantly 1.4 minutes and 3 minutes respectively, explain discrete simulation technique taking 10 minutes as the simulation period. Find from this average waiting time and percentage of idle time of the facility of a customer. Assume that initially the system is empty and the first customer arrives at time t = 0.

SECTION – C (5 X 8 = 40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) A company manufactures three products namely *X*, *Y* and *Z*. Each of the product require processing on three machines, Turning, Milling and Grinding. Product *X* requires 10 hours of turning, 5 hours of milling and 1 hour of grinding. Product *Y* requires 5 hours of turning, 10 hours of milling and 1 hour of grinding, and Product Z requires 2 hours of turning, 4 hours of milling and 2 hours of grinding. In the coming planning period, 2700 hours of turning, 2200 hours of milling and 500 hours of grinding are available. The profit contribution of *X*, *Y* and Z are Rs. 10, Rs.15 and Rs. 20 per unit respectively. Find the optimal product mix to maximize the profit.

(OR)

b) A company produces three products A, B and C by using two raw materials *X* and *Y*. 4000 units of *X* and 6000 units of *Z* are available for production. The requirement of raw materials by each product is given below:

Raw material	***Requirement per unit of product***		
	A	***B***	***C***
X	2	3	5
Y	4	2	7

The labour time for each unit of product *A* is twice that of product *B* and three times that of product *C*. The entire labour force of the company can produce the equivalent of 2500 units of product. A market survey indicates the minimum demand of the three products are 500, 500 and 375 respectively for *A*, *B* and *C*. However, their ratio of number of units produced must be equal to 3: 2: 5. Assume that the profit per units of product *A*, *B* and *C* are Rupees 60/–, 40/– and 100 respectively. Formulate the L.P.P. for maximizing the profit. **(CONTD …. 5)**

17. a) Solve the following transportation problem:

		To			Supply
From	6	1	9	8	**70**
	11	5	2	8	**55**
	10	12	4	7	**90**
Demand	**85**	**35**	**50**	**45**	

(OR)

b) Determine an initial basic feasible solution to the following transportation problem by using North-West corner rule.

			TO			Supply
From	**D1**	**D2**	**D3**	**D4**	**D5**	
A	2	11	10	3	7	4
B	1	4	7	2	1	8
C	3	9	4	8	12	9
Demand	3	3	4	5	6	21

18. a) Describe briefly the various applications of game theory in business problems.

(OR)

b) Solve the game whose payoff matrix is:

		B		
A	**I**	1	7	2
	II	6	2	7
	III	5	1	6

19. a) There are seven activities in a project and the time estimates are as follows

Activities	***Time in weeks***		
	t_O	t_L	t_P
A	2	6	10
B	4	6	12
C	2	3	4
D	2	4	6
E	3	6	9
F	6	10	14
G	1	3	5

(CONTD …. 6)

The logical of activities are:

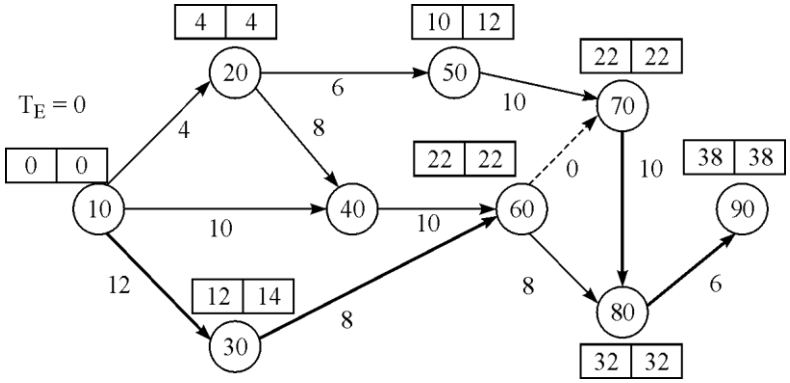
1. Activities *A* and *B* start at the beginning of the project.
2. When *A* is completed *C* and *D* start.
3. *E* can start when *B* and *D* are finished.
4. *F* can start when *B*, *C* and *D* are completed and is the final activity.
5. *G* can start when *F* is finished and is final activity.

(a) What is the expected time of the duration of the project?

(b) What is the probability that project will be completed in 22 weeks?

(OR)

b) Find the slack of each event



20. a) Enumerate in detail the various advantages of simulation.

(OR)

b) A coffee house in a busy market operates counter service. The proprietor of the coffee house has approached you with the problem of determining the number of bearers he should employ at the counter. He wants that the average waiting time of the customer should not exceed 2 minutes. After recording the data for a number of days, the following frequency distribution of inter-arrival time of customers and the service time at the counter are established. Simulate the system for 10 arrivals of various alternative number of bearers and determine the suitable answer to the problem.

Inter-arrival time in mins.	***Frequency (%)***	***Service time in mins.***	***Frequency (%)***
0	5	1.0	5
0.5	35	2.0	25
1.0	25	3.0	35
1.5	15	4.0	20
2.0	10	5.0	15
2.5	7		
3.0	3		

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