Exam Date & Time: 28-Sep-2020 (02:00 PM - 05:45 PM)

PSG COLLEGE OF ARTS AND SCIENCE

Note: Writing 3hrs: Checking & Inserting Image : 30mins

MA DEGREE EXAMINATION MAY 2020
(Fourth Semester)

Branch - ECONOMICS
OPERATIONS RESEARCH [19ECP17]

Marks: 75   **Duration: 210 mins.**

SECTION - A

Answer all the questions.

1)   The scientific method in O.R. study generally involved
       (i) Judgment phase   (ii) Research phase
       (iii) Action phase   (iv) All of the above   (1)

2)   Which of the following is not a major requirement of a linear programming problem?
       (i)   There must be alternative courses of action among which to decide
       (ii) An objective for the firm must exist   (1)
       (iii) The problem must be of the maximization type
       (iv) Resource must be the maximization type

3)   The north west be limited
       (i)   Is used to find an initial feasible solution
       (ii) Is used to find an optimal solution
       (iii) Is based on the concept of minimizing opportunity cost   (1)
       (iv) None of the above

4)   Te assignment problem
       (i)   Is a special case of the transportation problem
       (ii) Can be solved with the simplex algorithm
       (iii) When treated as an LP. always has an optimal integer solution   (1)
       (iv) All of the above

5)   Characteristics of queues such as "Expected number in the system"
       (i)   Are relevant after the queue has reached a steady state
       (ii) Are probabilistic statements
       (iii) Depend on the specific model   (1)
       (iv) All of the above

6)   Each player should follow the same strategy regardless of the other player's   (1)
       strategy in which of the following games?
       (i)   Constant strategy   (ii) Mixed strategy
       (iii) Pure strategy   (iv) Dominance strategy

7)   The optimal number of orders per year increase when
      (i)   Price increases   (ii) Carry cost decreases   (1)
      (iii) Total annual rupee value decreases (iv) None of the above

8)   In the EOQ model with backlogging the optimal number of orders to backlog is
      (i)   Directly proportional to
      (ii) Directly proportional to the square root of   (1)
      (iii) Not depend on
      (iv) Directly proportional to the reciprocal of

9)   Of all paths through the network the critical path
      (i)   Has the maximum expected time   (ii) Has the minimum expected time
      (iii) Has the maximum actual time   (iv) Has the minimum actual time   (1)

10)   Estimating expected activity times in a PERT network
      (i)   Makes use of three estimates
      (ii) Puts the greatest weight on the most likely time estimate
      (iii) Is motivated by a beta distribution   (1)
      (iv) All of the above

SECTION - B

Answer all the questions.

11)   Explain the various models in operations research.

a)   (5)

[OR]
b)   Put the following program in the standard linear programming form:
      $2x_1 + 5x_2 + S_1 = 80$
      $x_1 - x_2 - S_2 = 20.$ (5)

12)   A project work consists of four major jobs for which four contractors have
      submitted tenders. The tender amounts quoted in lakh of rupees are given in
      the matrix below. Each contractor has to be assigned at least one job.
a)   Determine which job is to be assigned to which contractor.

	A	B	C	D
1	10	24	30	15
2	16	22	28	12
3	12	20	32	10
4	9	26	34	16

(5)

[OR]   (5)
b)

A commodity has to be supplied to 3 warehouses A, B and C whose requirements are 70, 100 and 40 tons respectively. It is available at 3 places X, Y and Z in quantities of 55, 80, and 70 tons respectively. Transportation cost between different places are shown below.

	A	B	C
X	5	10	10
Y	20	30	20
Z	10	20	30

Find the least – cost transportation schedule.

13)

a) Find the range of values P and q, which will render (2, 2) as a saddle point.   (5)

		Player B		
		1	2	3
Player A	1	2	4	5
	2	-10	7	Q
	3	4	P	6

[OR]
b) In a railway yard goods train arrive at a rate of 30 trains / day. Assuming that the inter-arrival time follows as exponential distribution and the service time distribution is also exponential with an average 36 minutes.
Calculate the following: (5)
(a) The average number of trains in the queue
(b) The average number of trains in the system
(c) The probability that number of train in the system exceeds 10.

14)

a) A stock list has to supply 400 units of product every Monday to his customers. He gets the product at Rs. 50/ unit from the manufacturer. The lost of ordering and transportation from the manufacture is Rs. 75/ order. The cost carrying inventory is 7.5% unit / year of the cost of the product. Find (a) The economic lot size   (b) The total optimal cost.   (5)

[OR]
b) The cost of a machine is Rs. 6,100 and its set-up value is Rs. 100. The maintenance cost found from experience are as follow.

Year :	1	2	3	4	5	6	7	8
Cost in Rs. :	100	250	400	600	900	1200	1600	2000

When should the machine be replaced?   (5)

15)

a) Write the steps in solving the minimum span problem.   (5)

[OR]
b) What are the rules for drawing the network diagram?   (5)

SECTION - C

Answer all the questions.

16)   (8)

a)   Find the solution for the LPP given below graphical method:

      Minimize $Z = 2x_1 - x_2$

    Subject to

$$x_1 - x_2 \leq 10$$
$$2x_1 \leq 40$$
$$x_1 \geq 0$$
$$x_2 \geq 0$$

[OR]
b)   A farmer is attempting to decide which of three crops he should plant on his one hundred acres firm. The profit from each crop is strongly depent on the rainfall during the growing season. He categorized the amount of rainfall as substantial, moderate or light. He estimated his profit for each crop as construct the decision tree.

Rainfall	Profit for crops Estimated profit (Rs.)		
	Crop A	Crop B	Crop C
Substantial	7,000	2,500	4,000
Moderate	3,500	3,500	4,000
Light	1,000	4,000	3,000

(8)

Estimate of the probability of the substantial rainfall is as 0.2, that of the moderate rainfall as 0.3 and that of the light rainfall as 0.5. From the available data determine the optimal solution.

17)   Write down the dual of the following problem:

      Maximize $Z = 3x_1 + x_2 + x_3 - x_4$

a)   Subject to

$$x_1 + 5x_2 + 3x_3 + 4x_4 \leq 5$$
$$x_1 + x_2 \leq -1$$
$$x_3 - x_4 \leq -15$$
$$x_1 \geq 0; \ x_2 \geq 0; \ x_3 \geq 0; \ x_4 \geq 0.$$

(8)

[OR]
b)   Solve the following assignment problem for minimizing the cost:

job \ machine	D_1	D_2	D_3
J_1	20	27	30
J_2	10	18	16
J_3	14	16	12

(8)

18)   Use the concept of dominance to solve the following game:

		B			
		I	II	III	IV
A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

a)

(8)

[OR]
b)

(8)

A petrol pumb station has two pumps. The service time follows the exponential distribution with a mean of 4 minutes and the cars arrive for service in a Poisson process at a rate of 10 cards per hour. Find the probability that a customer has to wait for service and what proportion of time the pumbs remain idle?

19)

a)   A particular item has demand of 9000 units / year. The cost of procurement is Rs. 100 and the holding cost unit is Rs. 2.40 / year. The replacement is instantaneous and no shortage are allowed. Determine:
(a) The economic lot size   (b) The time between order   (8)
(c) The number of orders per year
(d) The total cost per year if the cost of one unit Rs. 1.

[OR]
b)   A truck owner finds from his past records that the maintenance cost per year and resale value of a truck whose purchase price is Rs. 8000 are as follows:

Year :	1	2	3	4	5	6	7	8	
Maintenance cost :	1000	1300	1700	2200	2900	3800	4800	6000	(8)
Resale value :	4000	2000	1200	600	500	400	400	400	

When should the truck be replaced?

20)   Explain the terms used in PERT and CPM.

(8)

a)

[OR]
b)   The following tables gives the details of the project

Job	Immediate predecessor	Duration days
A	-	5
B	-	10
C	A	6
D	B	8
E	C, D	7
F	C	4
G	C	8
H	E, F, B	7
I	G, H, D	6

(8)

i) Draw the network
ii) List all the paths and identify the critical path.

-----End-----