Seventh Semester B.E. Degree Examination, July/August 2021
Operations Research

Time: 3 hrs.

Max. Marks:100

Note: Answer any FIVE full questions.

1 a. Briefly explain various phases of Operations Research. **(04 Marks)**

b. Graphically represent the following LPPs:
(i) Feasible solution (ii) Unbounded solution **(04 Marks)**

c. A sweet manufacturing company is getting an order from university for 220 kgs of sweet called "KUNDA", which comprises of two raw materials milk and sugar. The cost of milk is Rs.14/kg and that of sugar is Rs.21/kg. The specifications of Kunda sweet are as follows:
  (i) The sweet should not contain more than 85 kg of milk.
  (ii) The sweet should contain atleast 65 kg of sugar.
Determine the least cost to manufacture 220 kgs of Kunda using graphical method of LPP. **(12 Marks)**

2 a. Write the dual of the following LPP:
Minimize $Z_x = x_1 - 3x_2 - 2x_3$
Subject to $3x_1 - x_2 + 2x_3 \leq 7$; $2x_1 - 4x_2 \geq 12$; $-4x_1 + 3x_2 + 8x_3 = 10$
$x_1, x_3 \geq 0$, x_2 - unrestricted in sign **(05 Marks)**

b. Solve the following LPP by dual Simplex method.
Minimize $Z = 6x_1 + 7x_2 + 3x_3 + 5x_4$
Subject to $5x_1 + 6x_2 - 3x_3 + 4x_4 \geq 12$; $x_2 + 5x_3 - 6x_4 \geq 10$
$2x_1 + 5x_2 + x_3 + x_4 \geq 8$; $x_1, x_2, x_3, x_4 \geq 0$ **(15 Marks)**

3 a. Find the basic feasible solution for the following transportation problem using:
(i) North-West corner rule (ii) Matrix Minima Method (iii) Penalty method **(10 Marks)**

Factory \ Warehouse	W_1	W_2	W_3	W_4	Capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Demand	5	8	7	14	

b. A city corporation office employs typists on hourly basis of their daily work. There are five typists and their charges and speed are different. According to contract, only one job is given to one typist and the typist is paid for full hour even if he works for a fraction of an hour. Find the least cost allocation for the following data: **(10 Marks)**

Typist	Rate per Hour (Rs.)	No. of pages types per hour	Job	No. of pages
A	5	12	P	199
B	6	14	Q	175
C	3	8	R	145
D	4	10	S	298
E	4	11	T	178

4 a. Explain the procedure of solving integer programming problem by Gomory's cutting plane method. **(04 Marks)**

b. Solve the following LPP:
Maximize $Z = 5x_1 + 7x_2$
Subject to $-2x_1 + 3x_2 \leq 6$; $6x_1 + x_2 \leq 30$; $x_1, x_2 \geq 0$ and integers **(16 Marks)**

5 a. List any two similarities and two differences between PERT and CPM techniques. **(04 Marks)**

b. A project consists of a series of tasks labeled as A, B, C …..H, I with the following relationship: (W < XY means X and Y cannot start until W is completed)

    (i)   With this notation construct the network diagram having the following constraints:

        A < D, E;   B, D < F;   C < G;   B < H;   E, G < I

    Table below shows the time taken by each task in days.

Task	A	B	C	D	E	F	G	H	I
Time	23	8	20	16	24	18	19	4	10

    (ii)   Find the minimum time required to complete the project.

    (iii)   How many critical paths exists in this network and indicate both the critical paths?

    (iv)   Calculate EST, EFT, LST, LFT, Total float, free float and Independent float for all the non-critical activities (tasks). **(16 Marks)**

6 a. With reference to queuing system, explain briefly:

(i) Arrival pattern   (ii) Service pattern **(06 Marks)**

b. Aircraft requests permission to land at a single runway airport on an average of one in every five minutes. Planes are landed on FCFS basis, with those not able to land immediately due to traffic congestion put in a holding pattern. The time required by the traffic controller to land the planes is expected to be exponentially distributed with a mean of 3 minute. Determine:

    (i)   The average number of planes in a holding pattern.

    (ii)   The average number of planes that have requested permission to land, but are still in motion.

    (iii) The probability that an arriving plane will be on ground in less than 10 minutes after first requesting permission to land. **(14 Marks)**

7 a. With reference to game theory, explain the following:

(i) Modified dominance rule   (ii) Fair game **(04 Marks)**

b. Find the range of P and Q in the following game to retain saddle point at (2, 2) location.

Player B

		1	2	3
	1	1	Q	6
Player A	2	P	5	10
	3	6	2	3

(04 Marks)

c. Two players P and Q play a matching coins game in which each has 4 coins 1Rs., 2Rs., 5Rs. And Rs.10. If the sum of the coins is odd when they show each time without the knowledge of other, player P wins Q's amount. If coins sum is an even amount, player Q wins P's amount. Formulate the problem a game theory problem and find the best strategy for each player and game value. **(12 Marks)**

8 a. List out the assumptions made while solving sequencing problem. **(04 Marks)**

b. Four jobs 1, 2, 3 and 4 are to be processed on each of the five machines A, B, C, D and E in the order A, B, C, D and E. Find the total minimum elapsed time for machining all the four jobs. Also find the idle time of each machine in hours. **(16 Marks)**

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

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