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Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Operations Research

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
atleast TWO questions from each part.**

PART – A

- 1 a. What is operations research? Explain briefly its methodology. (06 Marks)
 b. Explain the features and applications of OR. (08 Marks)
 c. A nutrition scheme for babies is proposed by a committee of doctors. Babies can be given two types of food (I and II) which are available in standard sized packets weighing 50 grams. The cost per packet of these foods are Rs.2 and Rs.3 respectively. The vitamin availability in each type of food per packets and the minimum vitamin requirement for each type of vitamin are summarized in table 1.

Vitamin	Vitamin availability per packet		Minimum daily required vitamin
	Food type 1	Food type II	
1	1	1	6
2	7	1	14
Cost packet (Rs.)	2	3	

Table Q1(c) Details of Food Types

Develop a linear programming model to determine the optimal combination of food types with the minimum cost such that the minimum requirement of vitamin in each type is satisfied. (06 Marks)

- 2 a. Write the standard form of a LPP model by defining each variable. (05 Marks)
 b. Solve by simplex method :
 Maximize $Z = 10x_1 + 15x_2 + 20x_3$
 Subject to constraints $2x_1 + 4x_2 + 6x_3 \leq 24$
 $3x_1 + 9x_2 + 6x_3 \leq 30$
 x_1, x_2 and $x_3 \geq 0$. (15 Marks)

- 3 a. Form the dual of the following primal problem.
 Minimize $Z = 20x_1 + 40x_2$
 Subject to $2x_1 + 20x_2 \geq 40$
 $20x_1 + 3x_2 \geq 20$
 $4x_1 + 15x_2 \geq 30$
 x_1 and $x_2 \geq 0$. (06 Marks)
- b. Solve the linear programming problem using the result of its dual problem.
 Minimize $Z_1 = 24x_1 + 30x_2$
 subject to $2x_1 + 3x_2 \geq 10$
 $4x_1 + 9x_2 \geq 15$
 $6x_1 + 6x_2 \geq 20$
 x_1 and $x_2 \geq 0$. (14 Marks)

- 4 a. Describe unbalanced and degeneracy in transportation problem. (05 Marks)
 b. Solve the transportation problem and find only basic optimal solution by North –West corner method and VAM method.

		Distribution				Supply
		1	2	3	4	
Source	1	3	1	7	4	300
	2	2	6	5	9	400
	3	8	3	3	2	500
Demand		250	350	400	200	

(15 Marks)

PART – B

- 5 a. Define Queue and given characteristics of a queue. (05 Marks)
 b. The arrival rate and service rate of customers at single window booking counter of a two wheeler agency follows Poisson's distribution. The arrival rate and service rate are 25 customers per hour and 35 customers per hour respectively. Find the following :

- i) Utilization
- ii) Average number of waiting customers in queue
- iii) Average number of waiting customers in system
- iv) Average waiting time per customer in queue
- v) Average waiting time per customer in system.

(15 Marks)

- 6 a. Define the following : i) critical path ii) total float iii) event
 iv) optimistic time v) pessimistic time. (05 Marks)
 b. A project consists of activities from A to J shown in table with the immediate predecessor (s) and the duration in weeks of each of the activities. Draw the project network and find the critical path and the corresponding project completion time. Also find the total float as well as free float for each of the non-critical activities.

Activity	Immediate predecessor (s)	Duration (weeks)
A	–	4
B	–	3
C	A, B	2
D	A, B	5
E	B	6
F	C	4
G	D	3
H	F, G	7
I	F, G	4
J	E, H	2

(15 Marks)

- 7 a. Explain the elements of crashing in project management. (10 Marks)
 b. Explain and determine the maximum flow in project management networks. (10 Marks)
- 8 a. Consider pay off matrix with respect to player A and solve it optimally. (08 Marks)

		B	
		1	2
A	1	6	9
	2	8	4

- b. Consider the pay off matrix of player A and solve it optimally using graphical method.

(12 Marks)

		Player B				
		1	2	3	4	5
Player A	1	3	0	6	-1	7
	2	-1	5	-2	2	1