CBCS SCHEME

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15MA71

Seventh Semester B.E. Degree Examination, Aug./Sept. 2020
Operations Research

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Use of statistical tables is permitted.
3. Missing data, if any, may be suitably assumed.

Module-1

1 a. List and explain the phases of operations research. **(06 Marks)**

b. A farmer has 100 acre farm. He can sell all tomattos, lettuce or radish he raise. The price he can obtain is Rs.1 per kg of tomatoes, Rs. 0.75 ahead of lettuce and Rs.2 per kg of radish. The average yield per acre is 2,000 kg of tomattoes, 300 heads of lettuce and 1000kg of radishes. Fertilisers available at Rs. 0.50 per kg and the amount required per acre is 100kg each for tomattoe and lettuce and 50 kg for radishes. Labour required for sowing, cultivating and harvesting per acre is 5 man–days for tomatoes and radishes and 6 man days for lettuce. The total of 400 man–days of labour are available at Rs.20 per man–day. Formulate LPP to maximize the profit. **(10 Marks)**

OR

2 a. What are the models in operations research? Briefly explain the classification of models with examples. **(04 Marks)**

b. A manager of an oil refinery must decide on the optimal mix of two possible blending processes of which the input and output per production run are as follows :

Process	Input units		Output units	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	5	3	5	8
2	4	5	4	4

The maximum available of crude A and B are 200 units and 150 units respectively. Market requirements shows that atleast 100 units of gasoline X and 80 units of gasoline Y must be processed. The profit per production runs from process 1 and 2 are Rs. 300/- and Rs. 400/- respectively solve LPP graphically. **(12 Marks)**

Module-2

3 a. What is degeneracy in simplex? How to resolve it. **(04 Marks)**

b. Solve the following LPP by Simplex Method :

Maximize $Z = 3x_1 + 2x_2 + 5x_3$

subject to constraints, $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0$. **(12 Marks)**

OR

4 a. Resolve the degeneracy and solve by Simplex.
Maximize $Z = 3x_1 + 9x_2$
Subject to, $x_1 + 4x_2 \leq 8$
$x_1 + 2x_2 \leq 4$
$x_1, x_2 \geq 0$. **(04 Marks)**

b. Use Two – phase Simple method to solve, the LPP.
Minimize $Z = x_1 - 2x_2 - 3x_3$
subjected to, $-2x_1 + x_2 + 3x_3 = 2$
$2x_1 + 3x_2 + 4x_3 = 1$
$x_1, x_2, x_3 \geq 0$. **(08 Marks)**

Module-3

5 a. Define :
i) Feasible solution
ii) Initial basic feasible solution
iii) Optimal solution. **(04 Marks)**

b. Find the initial solution by North West corner rule and optimal solution by MODI method. For the following TP when unit costs are in rupees.

		Destination			
		D_1	D_2	D_3	Supply
Origin	O_1	2	2	3	10
	O_2	4	1	2	15
	O_3	1	3	1	40
	Demand	20	15	30	

(12 Marks)

OR

6 a. A project consists of four major jobs for which four contractors have submitted tender. The tender amount quoted in lakhs of rupees are given below. Find the assignment that minimizes the total cost of the project. Each contractor has to be assigned only one job.

		Jobs			
		A	B	C	D
Contractor	1	10	24	30	15
	2	16	22	28	12
	3	12	20	32	10
	4	09	26	34	16

(08 Marks)

b. Products 1, 2, 3, 4 and 5 are to be processed on a machine. The setup costs in rupees per change depends upon the product presently on the machine and the set up to be made and are given by the following data :
$C_{12} = 16$, $C_{13} = 4$, $C_{14} = 12$, $C_{23} = 6$, $C_{34} = 5$, $C_{25} = 8$, $C_{35} = 6$, $C_{45} = 20$, $C_{ij} = C_{ji}$, $C_{ij} = \infty$, for all the values of I and j are not given in the data. Find the optimum sequence of products in order to minimize the total setup. **(08 Marks)**

Module-4

7 a. Draw the network and find the critical path.

Activity	A	B	C	D	E	F	G	H	I	J
Predecessor	–	–	A	A	B C	B C	E	E	D G	F H I
Duration	15	15	3	5	8	12	1	14	3	14

(06 Marks)

b. A small project is composed of activities whose time estimates are listed in the below table. Activities are identified by their beginning and end node numbers. Draw the project :

i) Find the expected duration and variance.
ii) What is the exacted project length
iii) Calculate variance and standard deviation of project.
iv) What is the probability that the project will be completed 4 weeks earlier than expected? And no more than 4 weeks later than expected time?

Activity	Estimated duration (weeks)		
	Optimistic	Most likely	Pessimistic
1 – 2	1	1	7
1 – 3	1	4	7
1 – 4	2	2	8
2 – 5	1	1	1
3 – 5	2	5	14
4 – 6	2	5	8
5 – 6	3	6	15

(10 Marks)

OR

8 a. Explain briefly the characteristics of queuing system. **(06 Marks)**

b. A bank has two teller working on saving accounts, the first teller handles withdrawal only. While second teller handles deposits only. It has been found that the service time distribution for deposits and withdrawals both in exponential with mean service time of 3 minutes per customers. Deposits are found to arrive in a Poisson fashion throughout the day with mean arrival rate of 16 per hour. Withdrawals also arrive in a Poisson fashion with mean arrival rate of 14 per hour.

i) What would be the effect on the average waiting time for depositors and withdrawers? If each teller would handle both withdrawals and deposits?
ii) What would be the effect, if this could only be accomplished by increasing the service time to 3.5 minutes? **(10 Marks)**

Module-5

9 a. Briefly explain :
i) Saddle point
ii) Two–person zero sum game
iii) Pure and mixed strategies. **(06 Marks)**

b. Solve the following game by dominance rule.

	I	II	III	IV	V
I	3	5	4	9	6
II	5	6	3	7	8
III	8	7	9	8	7
IV	4	2	8	5	3

(10 Marks)

OR

10 a. List and explain any four sequencing priority rules. **(04 Marks)**

b. Use graphical method to minimize the time required to process the following jobs on the machines i.e for each machine specify the job which should be done first. Also calculate the total elapsed time to compute both jobs and idle times of each job.

Job 1	Sequence	A	B	C	D	E
	Time	3	4	2	6	2
Job 2	Sequence	B	C	A	D	E
	Time	5	4	3	2	6

(12 Marks)

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