15ME81

Eighth Semester B.C. Degree Examination, June/July 2019
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.

Module-1

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

b. A paper manufacturing company produces two grades of papers grade `R' and grade 'S'. Because of raw material restrictions, not more than 450 tonnes of grade R and 240 tonnes of grade S papers can be produced per week. It requires 0.2 hours to produce 1 tonne of grade R paper and 0.4 hours to produce 1 tonne of grade S paper. There are 108 production hours per week. The profit per tonne of grade R paper is Rs 400 and per tonne of grade S paper it is Rs. 500. Formulate a mathematical model to determine how many tones of grade R and grade S papers the company has to produce per week to maximize its profit. Solve graphically. (10 **Marks)**

OR

2 a. Discuss the limitations of operations research. **(06 Marks)**

b. Solve the following **LPP** by graphical method and indicate the solution :

Maximize Z = 2x] + 3x2

Subject to constraints : xi - 2x, .. 0

$2x_1 - x2\ 0$

$x_1 - x, .. 0$

with x], x2 0. (10 **Marks)**

Module-2

3 a. What is **the** significance of introducing slack, surplus and artificial variables in LPP? **(04 Marks)**

b. Solve the following LPP by Simplex Method :

Maximize $Z = 6x_1 + 4x$,

Subject to constraints: $-2x_1 + x2\ 2$

$xi - xi\ 2$

$3x\ 1 + 2x-) ._. 9$

with xi, x, __ O. **(12 Marks)**

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4 a. Solve the following LPP by either Big-M method or two phase method :

Minimize $Z = x_1 - 2x_2 - 3x_3$

Subject to constraints : -2x1 + x2 + 3x3 = 2

$2x_1 + 3x_2 + 4x_3 = 1$

with x,x,, x_3 O. **(08 Marks)**

b. Solve the following by Dual Simplex Method :

Maximize $Z = -2x_1 - 2x, -- 4x_3$

Subject to constrains: $2x_1 + 3x, + 5x_3\ 2$

$3x1 + x_2 + 7x3\ 3$

$x_1 + 4x_2 + 6x3\ 5$

with x_1, xi, x3 O. **(08 Marks)**

Module-3

5 a. What is degeneracy in transportation problem? Discuss its consequence and how it is over come. **(04 Marks)**

b. Obtain the optimum solution to the following transportation problem to minimize the total transportation cost. Initial solution by Vogel's approximation method. (VAM).

		Destination				
		D1	D2	D3	D4	Suppl
Origin	01	42	48	38	37	16
	02	40	49	52	51	15
	03	39	38	40	43	19
	Demand	8	9	11	16	

(12 Marks)

OR

6 a. Explain the differences between assignment problem and transportation problem. **(05 Marks)**

b. A small machine shop has five jobs to be assigned to five machines. The following matrix indicates the cost of assigning each of the five jobs to each of the five machines. Obtain the optimum assignment of jobs to machines, in order to minimize the total assignment cost.

		Machines				
		1	2	3	4	5
Jobs	A	11	17	8	16	20
	B	9	7	12	6	15
	C	13	16	15	12	16
	D	21	24	17	28	26
	E	14	10	12	11	15

Q6(b) Cost Matrix **(11 Marks)**

Module-4

7 a. Explain the Kendall and Lee's notations for representing queuing models. **(04 Marks)**

b. A small project consists of activities from 'A' to 'I'. The following table indicates the precedence relationship among activities and the three time estimates — optimistic, most — likely and pessimistic time for each activity in days.

Activity	Predecessor Relationship	Optimistic time t_o	Most likely time `tin'	Pessimistic time 1_p,'
A		2	5	8
B	A	6	9	12
C	A	6	7	8
D	B, C	1	4	7
E	A	8	8	8
F	D, E	5	14	17
G	C	3	12	21
H	F, G	3	6	9
I	H	5	8	11

i) Draw the project network. Determine the expected time and variance for each activity
ii) Obtain the total expected duration of the project and critical path
iii) What is the probability of completing the project in 50 days? **(12 Marks)**

OR

8 a. For the following set of activities of a project, draw the network and obtain Early Start [ES], Early Finish [EF], Late Start [LS] and Late Finish [LF] for each activity. Also, indentify the critical path and projec

Activity	Predecessor	Duration in days
A		5
B	A	8
C	A	6
D	C	5
E	B, D	9

(08 Marks)

b. The mean arrival rate to a service centre is 3 per hour. The mean service time is found to be 10 minutes per service. Assuming Poisson arrival and exponential service time, find :

i) Utilization factor for the service facility
ii) Probability of two units in the system
iii) Queue length
iv) Expected waiting time in the system

(08 Marks)

Module-5

9 a. Apply the rules of dominance to reduce the game to (2 x 2) and solve the game to obtain game value and optimum strategies for both the players.

		Player B		
		1	2	3
Player A	1		–2	4
	2	–1	4	
	3		1	6

(08 Marks)

b. Solve the following (2 x 4) game graphically.

		Player B		
		1	2	
Player A			3	**12**
	2	8	6	02

(08 Marks)

OR

10 a. There are seven jobs to be processed on a single machine. The following table indicates the jobs and corresponding processing time in hours. Obtain the optimum sequence of jobs by Shortest Processing Time [SPT] rule that minimizes the mean flow time. Also obtain average in process **(06 Marks)**

Jobs (j)	A	B	C	D	E	F	G
Processing time (0 in hr	8	3	5	4	3	9	6

b. There are six jobs to be processed on three machines A, B and C in the order CAB. The following table indicates the processing time in hours for the six jobs on the three machines. Obtain optimum sequence of jobs that minimizes the total elapsed time for completing all the jobs on the three machines. Also indicate the idle time of each machine.

Jobs	1	2	3	4	5	6
Processing time in hours on M/C A	4	6	7	4	5	3
Processing time in hours on M/C B	8	10	7	8	11	8
Processing time in hours on M/C C	5	6	2	3	4	9

(10 Marks)