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Total Number of Pages: 02

Course: M.Sc.I  
Sub\_Code: FMCC601

6<sup>th</sup> Semester Regular Examination: 2024-25

SUBJECT: OPERATIONS RESEARCH

BRANCH(S): M.Sc.I(MC)

Time: 3 Hours

Max Marks: 70

Q.Code: S110

Answer Question No.1 (Part-I) which is compulsory, any five from rest (Part-II)  
The figures in the right hand margin indicate marks.

**Part-I**

Q1 Answer the following questions : (2 x 10)

- Use the graphical method to solve the LPP  $Minimize z = -x_1 + 2x_2$  subject to  $-x_1 + 3x_2 \leq 10, x_1 + x_2 \leq 6, x_1 - x_2 \leq 2$  and  $x_1 \geq 0, x_2 \geq 0$ .
- What are the variations considered in Sensitivity analysis?
- Discuss the existence of feasible solution of a transportation problem.
- When Transportation problems have alternative optimal solutions
- In an assignment problem there are 4 workers and 3 jobs. Find the total number of possible assignments.
- Define simulation as stated by Shannon.
- Write any two characteristics of Markov Process,
- Write first 10 Fibonacci numbers.
- What is the difference between constrained and unconstrained optimization problems?
- Write two operational characteristics of a queueing system.

**Part-II**

**Long Answer Type Questions (Answer Any five)**

- Q2 a) A company has three operational departments weaving, processing, and packing with capacity to produce three different types of clothes namely suiting's, shirting's, and woolens yielding a profit of Rs. 2, Rs. 4, and Rs. 3 per meter respectively. One meter of suiting requires 3 minutes in weaving, 2 minutes in processing, and 1 minute in packing. Similarly one meter of shirting requires 4 minutes in weaving, 1 minute in processing and 3 minute in packing. One meter of woolen requires 3 minutes in each department. In a week, total run time of each department is 60, 40, and 80 hours for weaving, processing, and packing respectively. Formulate the linear programming problem to find the product mix to maximize the profit. (5 + 5)
- b) Solve the LPP:  $Minimize z = 3x_1 + x_2$  subject to the constraints:  $x_1 + x_2 \geq 1, 2x_1 + 3x_2 \geq 2; x_1, x_2 \geq 0$  by dual simplex method.

**Q3 a)** Find the optimum solution of the following transportation problem: **(5 + 5)**

	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	
<i>A</i>	11	13	17	14	250
<i>B</i>	16	18	14	10	300 Available
<i>C</i>	21	24	13	10	400
	200	225	275	250	
	Demand				

**b)** Solve the LPP  $Max z = 107x_1 + x_2 + 2x_3$  subject to  $14x_1 + x_2 - 6x_3 + 3x_4 \leq 7$ ,  
 $16x_1 + x_2 - 6x_3 \leq 5, 3x_1 - x_2 - x_3 \leq 0, x_1, x_2, x_3, x_4 \geq 0$ .

**Q4 a)** **(5 + 5)**

			<b>Men</b>			
			<i>M</i> <sub>1</sub>	<i>M</i> <sub>2</sub>	<i>M</i> <sub>3</sub>	<i>M</i> <sub>4</sub>
	<i>T</i> <sub>1</sub>	18	26	17	11	
	<i>T</i> <sub>2</sub>	13	28	14	26	
	<i>T</i> <sub>3</sub>	38	19	18	15	
	<i>T</i> <sub>4</sub>	19	26	24	10	

Solve the assignment problem      **Tasks**

**b)** Consider the LPP Maximize  $z = 3x_1 + 5x_2$  subject to  $x_1 \leq 4, 3x_1 + 2x_2 \leq 18; x_1, x_2 \geq 0$ . If a new variable is introduced, with  $c_5 = 7$  and  $a_5 = [1,2]$ ; discuss the effect of adding the new variable and obtain the revised solution, if any.

**Q5 a)** Use Branch and bound method the LPP:  $Max z = 7x_1 + 9x_2$  subject to  $-x_1 + 3x_2 \leq 6, 7x_1 + x_2 \leq 35, x_2 \leq 0, x_1, x_2 \geq 0. x_1, x_2$  are integers. **(5 + 5)**

**b)** What are the methods to solve an assignment problem? Which one is suitable and why?

**Q6 a)** Describe about four types of simulation models. **(5 + 5)**

**b)** Write short note on  $n$ -step transition probabilities.

**Q7 a)** Solve the nonlinear programming problem:  $Max z = 7x_1^2 + 6x_1 + 5x_2^2$ , subject to  $x_1 + 2x_2 \leq 10, x_1 - 3x_2 \leq 9; x_1, x_2 \geq 0$ . **(5 + 5)**

**b)** Explain the single channel and multi-channel queuing models.

**Q8 a)** Discuss the importance of Kuhn-Tucker conditions in nonlinear programming. **(5 + 5)**

**b)** Using Fibonacci Search method minimize the function  $f(x) = x^2 + \frac{54}{x}$ .