LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **STATISTICS**

THIRD SEMESTER – **NOVEMBER 2024**

PST3ME01 – ADVANCED OPERATIONS RESEARCH

Date: 19-11-2024 Dept. No. Max. : 100 Marks

Time: 01:00 pm-04:00 pm

	SECTION A – K1 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
1	**MCQ/Definitions**	
a)	What is the need for integer programming?	
b)	Define a Quadratic programming model.	
c)	What do you mean by jockeying in a queue?	
d)	Which of the following are not associated with an LPP? a) Proportionality b) Uncertainty c) Additivity d) Divisibility	
e)	As simulation is not an analytical model, therefore, result of simulation must be viewed as a) approximation b) Exact c) Unrealistic d) Simplified	
	SECTION A – K2 (CO1)	
	Answer ALL the questions	**(5 x 1 = 5)**
2	**Fill in the blanks**	
a)	A basic solution to the system is called degenerate if one or more of basic variables----------	
b)	An IPP which has only one constraint is known as ---------- Problem.	
c)	If f(x) is strictly concave, the Kuhn–Tucker conditions are sufficient conditions for an absolute -------.	
d)	The time period between placement of two successive orders is known as ----------.	
e)	The random numbers which are generated by the computer sometime named as----------.	
	SECTION B – K3 (CO2)	
	Answer any THREE of the following	**(3 x 10 = 30)**
3	Use graphical method to solve the following LP problem Maximize $Z = 2x + y$ subject to the constraints $x + 2y \leq 10$ $x + y \leq 6$ $x - y \leq 2$ $x - 2y \leq 1$ and $x , y \geq 0$	
4	Explain how Gomory's cutting plane Algorithm works.	
5	Derive the Kuhn – Tucker necessary condition for an optimal solution to a quadratic programming problem.	
6	a) A manufacturing company purchases 9,000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part costs Rs. 20. The ordering cost per order is Rs. 15 and the carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy foe the company. What advice would you offer and how much would it save the company per year? (6) b) Mention the different types of inventory (4)	
7	What are the advantages and limitations of simulation models?	

	SECTION C – K4 (CO3)	
	Answer any TWO of the following	**(2 x 12.5 = 25)**
8	Use dynamic programming to solve the following problem Minimize $Z = y_1^2 + y_2^2 + y_3^2$ Subject to the constraints $y_1 + y_2 + y_3 = 10$ and $y_1, y_2, y_3 \geq 0$	
9	Explain the role of variance reduction techniques in improving simulation efficiency in operations research	
10	Explain briefly the Wolfe's algorithm for solving quadratic programming problem	
11	A road transport company has one reservation clerk on duty at a time. He handles information of bus schedules and makes reservations. Customers arrive at a rate of 8 per hour and the clerk can service 12 customers on an average per day. After stating your assumptions, answer the following (i) What is the average number of customers waiting for the service of the clerk? (ii) What is the average time a customer has to wait before getting service? (iii) The management is contemplating to install a computer system to handle the information and reservations. This is expected to reduce the service time from 5 to 3 minutes. The additional cost of having the new system works out to Rs. 50 per day. If the cost of goodwill of having to wait is estimated to be 12 paise per minute spent waiting before being served. Should the company install the computer system? (Assume 8 hours working/day).	
	SECTION D – K5 (CO4)	
	Answer any ONE of the following	**(1 x 15 = 15)**
12	Use two penalty (Big M) method to solve the following LLP Minimize $Z = 5x_1 + 3x_2$ Subject to the constraints $2x_1 + 4x_2 \leq 12$ $2x_1 + 2x_2 = 10$ $5x_1 + 2x_2 \geq 10$ and $x_1, x_2 \geq 0$	
13	For a (M/M/1) : (∞/FIFO) queuing model in the steady-state case, derive the steady state difference equations and obtain expressions for the mean and variance of queue length in terms of the parameters λ and μ.	
	SECTION E – K6 (CO5)	
	Answer any ONE of the following	**(1 x 20 = 20)**
14	Use branch and bound method to solve the following LPP Minimize $Z = 4x_1 + 3x_2$ Subject to the constraints $5x_1 + 3x_2 \geq 30$ $x_1 \leq 4$ $x_2 \leq 6$ $x_1, x_2 \geq 0$ and are all integers.	
15	a) What is meant by quadratic programming? How does quadratic programming problem differ from linear programming problem? (6) b) Bright Bakery keeps stock of popular brand of cake. Previous experience indicates the daily demand as given below: Daily Demand : 0 10 20 30 40 50 Probability: 0.01 0.20 0.15 0.50 0.12 0.02 Consider the following sequence of random numbers: 48 78 19 51 56 77 15 14 68 09 Use this sequence to simulate the demand for the next 10 days. Find out the stock situation if the owner of the bakery decides to make 30 cakes every day. Also estimate the daily average demand for the cakes on the basis of simulated data. (14)	

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