LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2022**

PST 3601 – ADVANCED OPERATIONS RESEARCH

Date: 02-12-2022 Dept. No. Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

SECTION A

Answer ALL questions. Each carries two marks. **(10 X 2 = 20 Marks)**

1. Define basic feasible solution in a LPP.
2. How is two phase method used to solve a LPP?
3. Define Pure integer programming problem with an example.
4. Define a NLPP.
5. Give the mathematical representation of a QPP.
6. What are the applications of quadratic programming?
7. State Bellman's principal of optimality.
8. What is the mechanism of a queuing process?
9. What are stochastic inventory models?
10. What are the various queue disciplines?

SECTION B

Answer any FIVE questions. Each carries eight marks. **(5 X 8 = 40 Marks)**

11. Solve the following LPP using suitable method: Maximize $Z= 40 x_1 +30 x_2$
    Subject to: $x_1 + x_2 \leq 12$, $2 x_1 + x_2 \leq 16$, $x_1 \geq 0$; $x_2 \geq 0$.
12. Solve the following IPP by Branch and Bound method,Max $Z = 2 x_1 +3 x_2$
    Subject to: $6 x_1 + 5 x_2 \leq 25$, $x_1 + 3 x_2 \leq 10$, x_1 and x_2 are non-negative integers,
    with the following non integer solution: $x_1 = 25/13$ and $x_2 = 35/13$.
13. Describe the Gomory's constraint method, and derive Gomory's constraint for solving a Pure Integer Programming Problem.
14. Derive the Necessary conditions for solving a Quadratic Programming Problem and explain the method of solving using Wolfe's algorithm.
15. Test for extreme values of $f\left(x_1,x_2,x_3\right)=x_1^2+x_2^2+x_3^2$, subject to the constraints,
    $x_1 + x_2 + 3x_3=2$ and $5 x_1 + 2 x_2 + x_3=5$.

16. A manufacturing company has three sections producing automobile parts, bicycle parts and sewing machine parts. The management has allocated Rs. 2,00,000 for expanding the production facilities. In the automobile parts, bicycle parts sections, the production can be increased either by adding new machines or by replacing some old inefficient machines by automatic machines. The sewing machine parts section was started only a few years back and thus the additional amount can be invested only by adding new machines to this section. The cost of adding and replacing the machines along with the associated returns is given below. Select a set of expansion plans which may yield the maximum return.

Alternatives	AP Section		BP Section		SMP Section	
	Cost	Return	Cost	Return	Cost	Return
1.No Expansion	0	0	0	0	0	0
2.Add new machines	40,000	80,000	80,000	1,20,000	20,000	80,000
3.Replace old machines	60,000	1,00,000	1,20,000	1,80,000	-	-

Use Dynamic Programming Problem to obtain the optimal policy for the above problem.

17. Explain the classical static Economic Order Quantity model and derive the expressions for Total Cost per Unit, order quantity, ordering cycle and effective lead time.

18. Explain the various classification of queuing models and probability distribution in queuing system.

SECTION C

Answer any TWO questions. Each carries twenty marks. (2 X 20 = 40 Marks)

19. Find an optimum integer solution for the following LPP: Maz $Z = 3X_2$, subject to the constraints, $3X_1 + 2X_2 \leq 7$; $X_1 - X_2 \geq -2$ and X_1, X_2 are non-negative integers.

20. Solve the following Non Linear Programming Problem: Min $Z = (X_1 + 1)^2 + (X_2 + 2)^2$ subject to the constraints, $X_1 \leq 2$; $X_2 \leq 1$; and $X_1, X_2 \geq 0$,

21. Solve the following Quadratic programming Problem, by Wolfe's algorithm.
Max $Z = 4X_1 + 6X_2 - 2X_1X_2 - 2X_1^2 - 2X_2^2$ subject to the constraints,
$X_1 + 2X_2 \leq 2$; $X_1, X_2 \geq 0$.

22. Consider a model where only arrivals are counted and no departure takes place and using the steady state difference equations, derive the mean arrival rate.

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