LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – **APRIL 2014**

ST 4814 - ADVANCED OPERATIONS RESEARCH

Date : 29/03/2014 Dept. No. Max. : 100 Marks
Time : 01:00-04:00

SECTION A

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

1. Define feasible solution in an Linear Programming Problem.

2. Show that dual of dual is primal for the following LPP; Maximize $Z = 2\ X_1 + X_2$, subject to the constraints, $X_1 + 2\ X_2 \le 10$; $X_1 + X_2 \le 6$; and $X_1 , X_2 \ge 0$.

3. State the use of simulation analysis.

4. State the principal of optimality in dynamic programming.

5. Distinguish between Pure and Mixed Integer Programming Problems?

6. Define a Non Linear Programming Problem?

7. Define the mathematical formulation of a quadratic programming problem.

8. What are the costs associated with inventory?

9. What is reorder point in inventory control?

10. What do you understand by queue discipline?

SECTION B

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

11. Solve the following LPP; Maximize $Z = 5\ X_1 + 4\ X_2$, subject to the constraints, $4\ X_1 + 5\ X_2 \le 10$; $3\ X_1 + 2\ X_2 \le 9$; $8\ X_1 + 3\ X_2 \le 12$ and $X_1 , X_2 \ge 0$. 75

12. Describe the Gomory's constraint method, and derive Gomory's constraint for solving a Pure Integer Programming Problem.

13. Solve the following non linear programming Problem; Max $Z = X_1^2 + X_2^2 + X_3^2$ subject to the constraints, $X_1 + X_2 + X_3 = 1$; and $X_1 , X_2 , X_3 \ge 0$.

14. Using Dynamic Programming Problem to maximize $z = \{y_1.y_2.y_3\}$ subject to the constraints, $y_1 + y_2 + y_3 = 15$, and $y_j \ge 0$.

15. An electronic device consists of 4 components, each of which must function for the system to function. The system reliability can be improved by installing parallel units in one or more of the components. The reliability R of a component with 1, 2 or 3 parallel units and the corresponding cost C (in '000s) are given in the following table. The maximum amount available for this device is Rs. 1,00,000. Determine the number of Parallel units in each component.

	j=1		j=2		j=3		j=4	
No. of units	R_1	C_1	R_1	C_1	R_1	C_1	R_1	C_1
1	.7	10	.5	20	.7	10	.6	20
2	.8	20	.7	40	.9	30	.7	30
3	.9	30	.8	50	.95	40	.9	40

16. Solve the following Quadratic Programming Problem by Beale's method.

Max $Z = 10 X_1 + 25 X_2 - 4 X_1 X_2 - 10 X_1^2 - X_2^2$ subject to the constraints,

$X_1 + 2 X_2 \leq 10$; $X_1 + X_2 \leq 9$; and $X_1, X_2 \geq 0$.

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 elements of a queuing system.

SECTION C

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

19. Use Branch and Bound method to solve the following LPP: Mazimize $Z = 7 X_1 + 9 X_2$, subject to the constraints, $- X_1 + 3 X_2 \leq 6$, $7 X_1 + X_2 \leq 35$, $X_2 \leq 7$ and X_1, X_2 are non-negative integers.

20. Solve the following Non Linear Programming Problem using Khun-Tucker conditions:

Max $Z = 2 X_1 - X_1^2 + X_2$ subject to the constraints, $2 X_1 + 3 X_2 \leq 6$; $2 X_1 + X_2 \leq 4$;

and $X_1, X_2 \geq 0$,

21. Solve the following Quadratic programming Problem, by Wolfe's algorithm.

Max $Z = 4 X_1 + 6 X_2 - 2 X_1 X_2 - 2 X_1^2 - 2 X_2^2$ subject to the constraints,

$X_1 + 2 X_2 \leq 2$; $X_1, X_2 \geq 0$.

22. (i) A corporation is entertaining proposals from its 3 plants for possible expansion of its facilities. The corporation's budget is £ 5 millions for allocation to all 3 plants. Each plant is requested to submit its proposals giving total cost C and total revenue R for each proposal. The following table summarizes the cost and revenue in millions of pounds. The zero cost proposals are introduced to allow for the probability of not allocating funds to individual plants. The goal of the corporation is to maximize the total revenue resulting from the allocation of £ 5 millions to the three plants.

	Plant 1		Plant 2		Plant 3	
Proposal	C_1	R_1	C_2	R_2	C_3	R_3
1	0	0	0	0	0	0
2	1	5	2	8	1	3
3	2	6	3	9	-	-
4	-	-	4	12	-	-

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

(ii) 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. (10 + 10)

****