 LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

**M.Sc.** DEGREE EXAMINATION - **STATISTICS**

FOURTH SEMESTER – APRIL 2011

# ST 4811/4807 - ADVANCED OPERATIONS RESEARCH

Date : 09-04-2011 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

**Section A**

**Answer ALL questions. (10 x 2 =20 marks)**

1. Define General Linear Programming Problem.
2. Define Pure Integer Programming Problem.
3. What is the need for inventory control?
4. What is the behaviour of customers in a queue?
5. Define dynamic Programming Problem.
6. What do you mean by Non Linear Programming Problem?
7. Define a chance constrained model.
8. Show that Q = 2 x12 + 2 x22 + 3 x32 + 2 x1 x2+ 2 x2 x3is positive definite.
9. Write the significance of Goal Programming.
10. State the use of simulation analysis.

**SECTION B**

**Answer any FIVE questions. (5 x 8 =40 marks)**

1. Apply the principle of duality to solve the following: Min Z = 2 x1 + 2 x2, subject to the constraints, 2 x1+ 4 x2 ≥ 1, x1+ 2 x2 ≥ 1, 2 x1+ x2 ≥ 1, x1 , x2 ≥ 0.
2. Explain Generalized Poisson queuing model.
3. Explain the classical EOQ model.
4. Derive Gomory’s constraint for solving a Mixed Integer Programming Problem.
5. Use Dynamic Programming Problem to solve the following LPP; Max Z = 3 x1+ 5 x2 subject to the constraints, x1 ≤ 4, x2 ≤ 6, 3 x1+ 2 x2 ≤ 18, x1 , x2 ≥ 0.
6. Derive the KTNC for solving a GNLPP with one inequality constraint.
7. Find the deterministic equivalent of the following problem: Min Z = 3 x1+ 4 x2 subject to the constraints, P[ 3 x1– 2x2 ≤ b1] ≥ ¾, P[ x1/7 + 2x2 ≥ b2;  x1 + x2/9 ≥ b3] = 1/4 , x1 , x2 ≥ 0, where b1, b2, and b3 are independent random variables uniformly distributed in the intervals (-2, 2), (0, 2), (0, 4) respectively.
8. 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 000’s) are given in the following table. The maximum amount available for this device is Rs. 1,00,000. Use DPP to maximize the reliability of the entire system.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **j = 1** | | **j = 2** | | **j = 3** | | **j = 4** | |
| **Uj** | **R1** | **C1** | **R2** | **C2** | **R3** | **C3** | **R4** | **C4** |
| **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 |

**SECTION C**

**Answer any TWO questions. (2 x 20 =40 marks)**

1. Explain Branch and Bound algorithm for solving MIPP and hence solve the following problem:

Max z = 3 x1+ x2  + 3 x3 subject to the following constraints, - x1+ 2 x2  + x3 ≤ 4,

4 x2 - 3 x2  ≤ 2, x1 - 3 x2  + 2 x3 ≤ 3, x1 , x2 , x3 ≥ 0, x1 , x3 are integers.

**20.** Solve the following GNLPP using KTNC, Max Z = 2 x1 - x12 + x2 subject to the constraints, 2 x1+ 3 x2 ≤ 6, 2 x1+ x2 ≤ 4, x1, x2 ≥ 0.

**21.** Max Z = 6 x1+ 3 x2 - 4 x1 x2- 2 x12  - 3 x22 subject to the constraints, x1+ x2 ≤ 1,

2 x1+ 3 x2 ≤ 4, x1 , x2 ≥ 0. Show that z is strictly concave and then solve the problem by Wolfe’s algorithm.

**22. (i)** Derive steady state measures of performance for (M│M│1) : (GD│∞│∞) queue system.

**(ii)** Explain multi-item EOQ model with storage limitation.

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