**PSG COLLEGE OF ARTS & SCIENCE**
(AUTONOMOUS)

**MSc DEGREE EXAMINATION MAY 2018**
(First Semester)

Branch – **STATISTICS**

**OPERATIONS RESEARCH**

Time: Three Hours Maximum: 75 Marks

Answer **ALL** questions
**ALL** questions carry **EQUAL** marks (5 x 15 = 75)

1 a Given the linear programming problem
Max $z = 3x_1 + 5x_2$ subject to the constraints
$x_1 + x_2 \leq 1$, $2x_1 + 3x_2 \leq 1$, $x_1, x_2 \geq 0$
Obtain the variations in $C_j$ (j = 1, 2) which are permitted without changing the optimal solution.

b Find the optimum order quantity for a product for which the price breaks are as follows :

| Quantity | Unit cost (Rs.) |
|---|---|
| $0 \leq Q_1 < 800$ | Rs. 1.00 |
| $800 \leq Q_2$ | Rs. 0.98 |

The yearly demand for the product is 1,600 units per year, cost of placing an order is Rs. 5, the cost of storage is 10% per year.

OR

c Consider the LPP
Max $z = 3x_1 + 5x_2 + 4x_3$, subject to the constraints
$2x_1 + 3x_2 \leq 8$, $2x_2 + 5x_3 \leq 10$, $3x_1 + 2x_2 + 4x_3 \leq 15$, $x_1, x_2, x_3 \geq 0$
Find the ranges over which $c_3$, $c_4$ and $b_2$ can be changed maintaining the optimality of the current solution.

d Derive an EOQ formula with different rates of instantaneous demand and continuous units.

2 a Use dual simplex method to solve the LPP :
Min $z = 3x_1 + x_2$ subject to the constraints
(i) $x_1 + x_2 \geq 1$, (ii) $2x_1 + 3x_2 \geq 2$, $x_1, x_2 \geq 0$.

b Mr. X quite often flies from town A to town B. He can use the airport bus which costs Rs. 25 but if he takes it, there is a 0.08 chance that he will miss the flight. The stay in a hotel costs Rs. 270 with a 0.96 chance of being on time for the flight. For Rs. 350, he can use a taxi which will make 99 percent chance for being on time for the flight. If Mr. X catches the plane on time, he will conclude a business transaction which will produce a profit of Rs. 10,000 otherwise he will lose it. Which mode of transport should Mr. X use? Answer on the basis of the EMV criterion.

OR

c Use dual simplex method to solve LPP :
Max $z = -4x_1 - 6x_2 - 18x_3$
Subject to $x_1 + 3x_3 \geq 2$; $x_2 + 2x_3 \geq 5$; $x_1, x_2, x_3 \geq 0$.

**Cont...**

2 Cont...

d A producer of boats has estimated the following distribution of demand for a particular kind of boat :

| No. of demand : | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Probability : | 0.14 | 0.27 | 0.27 | 0.18 | 0.09 | 0.04 | 0.01 |

Each boat cost him Rs. 7000 and he sells them for Rs. 10,000 each boats left unsold of the end of the season must be disposed for Rs. 6000 each. How many boats should be in stock so as to maximize his expected profit?

3 a Explain the following terms in PERT / CPM :
(i) Earliest time (ii) Latest time (iii) Total activity time (iv) Event slack (v) Critical path.

b Critically comment on the assumptions on which PERT / CPM analysis is done for projects.

OR

c A project schedule has the following characteristics :

| Activity | Time (weeks) | Activity | Time (weeks) |
|---|---|---|---|
| 1-2 | 4 | 5-6 | 4 |
| 1-3 | 1 | 5-7 | 8 |
| 2-4 | 1 | 6-8 | 1 |
| 3-4 | 1 | 7-8 | 2 |
| 3-5 | 6 | 8-10 | 5 |
| 4-9 | 5 | 9-10 | 7 |

(i) Construct the network diagram.
(ii) Compute E and L for each event and find the critical path.

4 a Use dynamic programming to find the value at
Max $z = y_1, y_2, y_3$ subject to $y_1 + y_2 + y_3 = 5$; $y_1, y_2, y_3 \geq 0$.

b Explain the differences in solving linear programming very goal programming by the simplex method.

OR

c Solve the following LPP by dynamic programming approach :
Max $z = 8x_1 + 7x_2$ ; subject to the constraints $2x_1 + x_2 \leq 8$; $5x_2 + 2x_2 \leq 15$ and $x_1, x_2 \geq 0$.

d Solve the following LPP by dynamic programming approach :
Max $z = 2x_1 + 5x_2$ subject to
$2x_1 + x_2 \leq 430$, $2x_2 \leq 460$ and $x_1, x_2 \leq 0$.

5 a Determine $x_1$, $x_2$ and $x_3$ so as to
Max $z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$ subject to
$x_1 + x_2 \leq 2$; $2x_1 + 3x_2 \leq 12$; $x_1, x_2 \geq 0$

b Explain briefly the Monte Carlo Method of solving a problem using simulation.

OR

c Write the Kuhn – Tucker conditions for the following problem :
Min $f(x) = x_1^2 + x_2^2 + x_3^2$ subject to
$2x_1 + x_2 - x_3 \leq 0$; $1 - x_1 \leq 0$; $-x_3 \leq 0$

d Distinguish between solutions derives from simulation models and solutions derived from analytical models.