LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FOURTH SEMESTER – **APRIL 2016**

ST 4814 - ADVANCED OPERATIONS RESEARCH

Date: 18-04-2016 Dept. No. Max. : 100 Marks

Time: 09:00-12:00

SECTION – A

Answer All the questions **(10 x 2 = 20)**

1) When a solution to an LPP is called unbound?
2) Write down the Gomory's constraint for MIPP.
3) Convert the following primal problem to its dual:

   Maximize $Z = 7x_1 + 6x_2 - 4x_3$

   Subject to the constraints:

   $x_1 + 2x_2 + 3X_3 \leq 4$, $x_1 - 2x_2 \leq 6$, $x_1 + 4x_2 - 6x_3 \leq 2$; $x_1, x_2 \geq 0$.
4) Write down the significance of integer programming problem.
5) Define quadratic programming problem.
6) Define dynamic programming problem.
7) Write down the steady state solution of (M/M/1) : (N/∞/FIFO).
8) Define simulation.
9) Define inventory control.
10) What is salvage cost?

SECTION – B

Answer any FIVE questions: **(5 X 8 = 40)**

11) Use the graphical method to solve the following LPP:

   Maximize $Z = 5x_1 + 3x_2$

   Subject to the constraints:

   $x_1 + x_2 \leq 6$, $2x_1 + 3x_2 \geq 3$, $x_1 \geq 3$, $3x_2 \geq 9$, $x_1 \geq 0$ and $x_2 \geq 0$.
12) Use simplex method to solve Maximize $Z = 3x_1 + 2x_2 + 5x_3$

   Subject to the constraints: $x_1 + 2x_2 + x_3 \leq 430$, $3x_1 + 2x_3 \leq 460$, $x_1 + 4x_3 \leq 420$

   $x_1, x_2, x_3 \geq 0$.
13) Explain the Gomory's constraint technique for solving pure integer programming problem.
14) The occurrence of rain in a city on a day is dependent upon whether or not it rained on the previous day. If it rained on the previous day, the rain distribution is

Event	No rain	1 cm rain	2 cm rain	3 cm rain	4 cm rain
Probability	0.5	0.25	0.15	0.06	0.04

If it did not rain on the previous day, the rain distribution is

Event	No rain	1 cm rain	2 cm rain	3 cm rain
Probability	0.75	0.15	0.07	0.03

Simulate the city's weather for 10 days and determine by simulation the total day without rain and with rain as well as the total rain fall during that period. Assume that for the first day of the simulation it had rained the day before.

15) Use dynamic programming to solve the following problem:

Minimize z = $y_1^2 + y_2^2 + y_3^2$

subject to the constraints: $y_1 + y_2 + y_3 \geq 15$ and

$y_1, y_2, y_3 \geq 0$.

16) Solve the following NLPP using the necessary and sufficient Kuhn-Tucker conditions

Maximize $Z = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$

subject to the constraints : $x_1 + x_2 \leq 2$, $2x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$

17) Explain the operating characteristics of queueing system.

18) Explain the costs associated with inventory control.

SECTION – C

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

19)(a) Use two-phase simplex method to

Maximize $Z = 12x_1 + 15x_2 + 9x_3$

Subject to the constraints:

$8x_1 + 16x_2 + 12x_3 \leq 250$, $4x_1 + 8x_2 + 10x_3 \geq 80$, $7x_1 + 9x_2 + 8x_3 = 105$; $x_1, x_2, x_3 \geq 0$

(b) Write the algorithm for solving dual simplex. **(12 + 8)**

20) (a) Solve the following integer programming problem using Gomory's constraints method:

Maximise $Z = x_1 + x_2$

Subject to

$3x_1 + 2x_2 \leq 5$, $x_2 \leq 2$, $x_1 \geq 0$ and $x_2 \geq 0$ and x_1 is an integer. **(12)**

(b) Explain the characteristics of dynamic programming problem. **(8)**

21) (a) What is simulation? What are the simulation models? and explain the Monte-Carlo simulation procedure.

(b) A vessel is to be loaded with stocks of 3 items. Each unit of item i has a weight w_i and value r_i. The maximum cargo weight the vessel can take is 5 and the details of the three items are as follows:

i	w_i	r_i
1	1	30
2	3	80
3	2	65

Develop the recursive equation for the above case and find the most valuable cargo load with out exceeding the maximum cargo weight by using dynamic programming **.** **(10+10)**

22) Derive the steady state equation for the (M/M/1) : (N/∞/FIFO) queueing model and its characteristics.

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