Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M.E –I$^{st}$ SEMESTER–EXAMINATION – JULY- 2012**

**Subject code: 711306N** **Date: 11/07/2012**

**Subject Name: Decision Models in Management**

**Time: 2:30 pm – 05:00 pm** **Total Marks: 70**

## Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** Define the following: **07**

(i) Unbounded solution (ii) Infeasible solution
(iii) Slack variable (iv) Surplus variable
(v) Artificial variable (vi) Basic variable
(vii) Operation Research

**(b)** Solve the following LP problem graphically **07**

Minimize $Z = 20X_1 + 10X_2$

Subject to $X_1 + 2X_2 \leq 40$

$3X_1 + X_2 \geq 30$

$4X_1 + 3X_2 \geq 60$

$X_1$ and $X_2 \geq 0$

**Q.2** **(a)** Solve the following LP problem using Simplex method **07**

Maximize Z = 3X1 + 4X2

Subject to X1 + X2 $\leq$ 450

2X1 + X2 $\leq$ 600

X1, X2 $\geq$ 0

**(b)** Find the initial basic feasible solution of the following transportation problem using Northwest corner cell method **07**

| | | To 1 | 2 | 3 | Supply |
|---|---|---|---|---|---|
| From | 1 | 2 | 7 | 4 | 5 |
| | 2 | 3 | 3 | 1 | 8 |
| | 3 | 5 | 4 | 7 | 7 |
| | 4 | 1 | 6 | 2 | 14 |
| Demand | | 2 | 9 | 18 | |

**OR**

**(b)** Find an initial basic solution to the following using Vogel's approximation method **07**

| | | Destinations 1 | 2 | 3 | 4 | Availability |
|---|---|---|---|---|---|---|
| Origins | A | 7 | 2 | 5 | 5 | 30 |
| | B | 4 | 4 | 6 | 5 | 15 |
| | C | 5 | 3 | 3 | 2 | 10 |
| | D | 4 | -1 | 4 | 2 | 20 |
| Requirement | | 20 | 25 | 15 | 15 | |

**Q.3** **(a)** Consider the problem of assigning four sales persons to four different sales regions as shown below such that a total sale is maximized. Find the optimal allocation of the sales persons to different regions. **07**

| | | Sales Region | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| Salesman | 1 | 5 | 11 | 8 | 9 |
| | 2 | 5 | 7 | 9 | 7 |
| | 3 | 7 | 8 | 9 | 9 |
| | 4 | 6 | 8 | 11 | 12 |

**(b)** Consider the details of a distance network as shown below **07**

| Arc | Distance | Arc | Distance |
|---|---|---|---|
| 1-2 | 10 | 3-6 | 8 |
| 1-3 | 6 | 4-5 | 10 |
| 1-4 | 9 | 4-6 | 14 |
| 1-5 | 20 | 5-8 | 8 |
| 2-3 | 16 | 6-8 | 10 |
| 2-6 | 4 | 6-9 | 16 |
| 2-7 | 5 | 7-9 | 10 |
| 3-4 | 3 | 8-9 | 8 |

Find the shortest path from node 1 to node 9 using the systematic method.

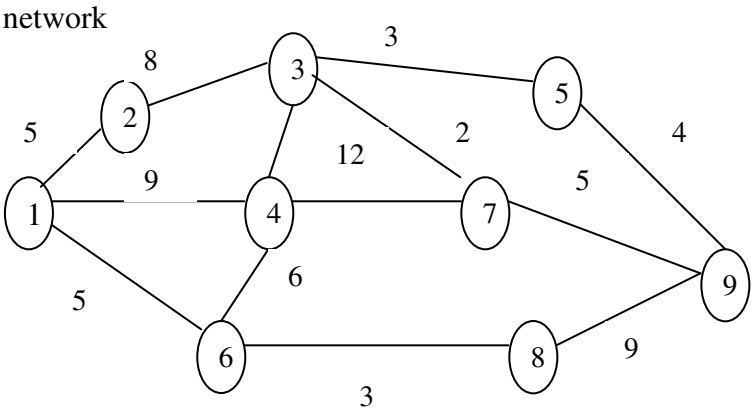
**OR**

**Q.3** **(a)** Find the optimal assignment for the assignment problem with the following cost matrix. **07**

| | I | II | III | IV |
|---|---|---|---|---|
| A | 5 | 3 | 1 | 8 |
| B | 7 | 9 | 2 | 6 |
| C | 6 | 4 | 5 | 7 |
| D | 5 | 7 | 7 | 6 |

**07**

**(b)** Find the minimum spanning tree using Kruskal's algorithm for the given network




**Q.4** **(a)** The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 60 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 70 per hour. Find the (a) Probability of having 0 customer in the system (b) Probability of having 12 customers in the system (c) Average number of customers waiting in the queue (d) Average waiting time of customers in the queue (d) Average waiting time of customers in the system. **07**

**(b)** At a central warehouse, vehicles arrive at the rate of 24 per hour and the arrival rate follows Poisson distribution. The unloading of the vehicles follows exponential distribution and the unloading rate is 18 vehicles per hour. There are 4 unloading crews. Find the $p_0$, $p_3$, $L_q$, $L_s$, $W_q$ *and* $W_s$. **07**

**OR**

**Q.4** **(a)** Define simulation and its advantages. Discuss various application areas of simulation. **07**

**(b)** Discuss the steps of simulation. **07**

**Q.5** **(a)** Distinguish between integer programming problem and linear programming problem. Give examples. **07**

**(b)** Solve the following integer linear programming optimally. **07**

Maximize $Z = 8X_1 + 6X_2$

Subject to $8X_1 + 4X_2 \leq 85$

$3X_1 + 6X_2 \leq 95$

$X_1, X_2 \geq 0$ and integers.

**OR**

**Q.5** **(a)** Solve the following integer programming problem using branch- and-bound technique. **07**

Maximize $Z = 10X_1 + 10X_2$

Subject to $6X_1 + 8X_2 \leq 56$

$X_1 + 3X_2 \leq 15$

$X_1, X_2 \geq 0$ and integers.

**(b)** Define the dynamic programming problem. What are the application areas of dynamic programming? Explain. **07**

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