**CS/IS6F3**

**Reg. No.** | | | | | | | | | | |

# Sixth Semester B.E. Degree Examination, August 2001

## Computer Science and Engineering

## Operations Research

Time: 3 hrs.] [Max.Marks : 100

**Note:** *Answer any FIVE full questions.*

**1.** (a) Briefly the various applications of OR. **( 6 Marks)**

(b) Solve the following game problem using Linear Programming.

| | | B | | | |
|---|---|---|---|---|---|
| A | 2 | -1 | 5 | -2 | 6 |
| | -2 | 4 | -3 | 1 | 0 |

**(14 Marks)**

**2.** (a) A scientist lives in town B and has to be in town A next sunday. On each of the days Thursday, Friday and Saturday he can give one talk in any of the towns A,B,C except that he cannot talk in town B on Friday. (He can give more than one talk in the same town. These talks must be on different days). The fee offered to him for one talk is Rs.120 in A, Rs. 160 in B and Rs.190 in C plus expences for an overnight stay in a town where he gave his talk. Where should he spend the last three days and nights of the week so as to maximize his income from talks less the cost of travel between towns? Travel costs are given in the table below.

| | | *To* | | |
|---|---|---|---|---|
| | | *A* | *B* | *C* |
| *From* | *A* | — | 50 | 20 |
| | *B* | 50 | — | 70 |
| | *C* | 20 | 70 | — |

answer using Dynamic Programming. **(11 Marks)**

(b) Briefly describe the following

i) Nonexisting feasible solutions

ii) Unbounded solution

iii) Alternative optimal solutions. **(9 Marks)**

**3.** (a) A man who wants to keep some hens has Rs. 200 with him. The young hens which are available for Rs. 10 each, lay 5 eggs per week. The old hens which are available for Rs. 5 each lay 3 eggs per week. He has capacity to keep 30 hens. Each egg is sold at 40 paise. The feed for young and old hens costs respectively Re. 1 and Rs.0.60 per hen per week. How many young and old hens should he buy so that the profit per week is maximized? Formulate it as Linear Programming Problem and solve using Simplex method. **(14 Marks)**

(b) In a maximization problem, there is a tie between the entering variables $x_1$ and $s_2$. For the columns of $x_1$ and $s_2$ the value of $\theta$ are $\theta_1$ and $\theta_2$ $(\theta_1 \neq \theta_2)$ respectively. Which variable should be preferred as the entering variable in order to have layer increase in the value of objective function? **(6 Marks)**

**4.** (a) Use Dynamic programming to find the point in the first quadrant nearest to the origin on the straight line. $2x + 3y = 6$ **(6 Marks)**

*Contd.... 2*

(b) An Institute has purchased sufficient quantity of curtain cloth to meet the curtain requirement of the Institute. The curtain cloth is in pieces each of length 14 feet. the curtain requirement is as follows

| Curtains of length (in feet) | Number required |
|---|---|
| 4 | 1500 |
| 6 | 1000 |
| 8 | 3000 |

How to cut the pieces to meet the above requirement so that the trim loss is minimized? Assume that the width of required curtains is the same as that of available pieces. Formulate it as a Linear Programming Problem and solve using dual simplex method. **(14 Marks)**

**5.** (a) Solve the following LPP using Revised Simplex method

Max $x_0 = -x_1 + 3x_2 - 2x_3$

subject to

$3x_1 - x_2 + 2x_3 \leq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$(x_1, x_2, x_3 \geq 0)$ **(20 Marks)**

**6.** (a) Solve the following transportation problem. The demand at destination 1 must be shipped only from source 4

| | $D_1$ | $D_2$ | $D_3$ | Availability |
|---|---|---|---|---|
| $S_1$ | 5 | 1 | 0 | 20 |
| $S_2$ | 3 | 2 | 4 | 10 |
| $S_3$ | 7 | 5 | 2 | 15 |
| $S_4$ | 9 | 6 | 0 | 15 |
| Requirement | 5 | 10 | 15 | |

The entries in the table give the cost of transportation of one unit from source $S_i$ to destination $D_j$ **(10 Marks)**

(b) Solve the following assignment problem (minimization problem)

| | $a$ | $b$ | $c$ | $d$ | $e$ |
|---|---|---|---|---|---|
| $A$ | 160 | 130 | 175 | 190 | 200 |
| $B$ | 135 | 120 | 130 | 160 | 175 |
| $C$ | 140 | 110 | 155 | 170 | 185 |
| $D$ | 50 | 50 | 80 | 80 | 110 |
| $E$ | 55 | 35 | 70 | 80 | 105 |

**(10 Marks)**

**7.** (a) Write a note on degeneracy in transportation problem. **(6 Marks)**

(b) Consider the network of the following figure.

*Contd.... 3*

The normal and crash points for each activity are given in the table. Find the different minimum crash schedules (32 days schedule) that can occur between normal and crash times.

| Activity | Normal duration | Normal cost | Crash duration | crash cost |
|---|---|---|---|---|
| (1,2) | 20 | 2000 | 15 | 3000 |
| (1,3) | 10 | 1500 | 7 | 2400 |
| (2,5) | 15 | 1000 | 10 | 1500 |
| (3,4) | 16 | 3000 | 12 | 4000 |
| (3,5) | 22 | 4500 | 16 | 5700 |
| (4,5) | 14 | 1500 | 10 | 2100 |

**(14 Marks)**

**8.** (a) In a barber's shop with a single barber, there are three chairs. Out of these one chair is for haircutting and the other two for waiting inside the shop. If there are more than three customers in the shop at any time then three will occupy the chairs and rest wait outside. The customers come according to Poisson distribution with average 2 customers per hour. the service time T (per customer) is exponentially distributed with mean 20 minutes.

i) Find the probability that an arriving customer has to wait outside the shop.

ii) Find the probability that an arriving customer gets a chair to sit.

iii) How long is an arriving customer expected to wait before start of service?

iv) How many chairs should be provided so that arriving customer can wait on the chair at least 25 percent of the time? **(12 Marks)**

(b) Find the solution of the following LPP by solving the dual problem.

Max $x_0 = 2x_1 + 3x_2$

subject to

$-4x_1 + 6x_2 \leq 4$

$-5x_1 + 6x_2 \leq 30$

$-x_1 + 5x_2 \leq 30$

$x_1 + x_2 \leq 15$

$x_1 \leq 10, x_2 \leq 7$

$(x_1, x_2 \geq 0)$

**(8 Marks)**

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