M.E. Second Semester (Production Technology \& Management) (P.T.) (CBS)

## 13536 : Operations Research Techniques : 2 SPTM 3

P. Pages: 3

AW - 3696
Time : Three Hours
Max. Marks : 80

Notes: 1. Answer any three question from Section $A$ and any three question from Section B.
2. Assume suitable data wherever necessary.
3. Use of pen Blue/Black ink/refill only for writing the answer book.

## SECTION - A

1. a) Explain the advantages and limitation of linear programming.
b) An aircraft company, which operates out of a central terminal has 8 aircrafts of type I, 15 aircrafts of type II and 12 aircrafts of type III available for today's flights. The tonnage capacities are 45 for type I, 70 for type II and 40 for type III.
The company dispatches its planes to cities A and B. Tonnage requirements are 200 at city A and 300 at city B; excess tonnage capacity supplied to a city has no value. A plane can fly only once during the day. The cost of sending a plane from the terminal to each city is given in the following table:

|  | Type I | Type II | Type III |
| :--- | :---: | :---: | :---: |
| City A | 23 | 5 | 1.4 |
| City B | 58 | 10 | 3.8 |

Formulate the LP model to minimize the air transportation cost.
2. a) Solve the following LPP by using simplex method
minimize, $Z=16 \mathrm{x}_{1}+17 \mathrm{x}_{2}+10 \mathrm{x}_{3}$
subject to the constraints,
$\mathrm{x}_{1}+\mathrm{x}_{2}+4 \mathrm{x}_{3} \leq 20$;
$2 \mathrm{x}_{1}+\mathrm{x}_{2}+\mathrm{x}_{3} \leq 36$;
$\mathrm{x}_{1}+2 \mathrm{x}_{2}+2 \mathrm{x}_{3} \leq 24$; and
$\mathrm{x}_{1}, \mathrm{x}_{2}, \mathrm{x}_{3} \geq 0$
b) Write the dual of the following LPP

Min. $Z=2 x_{1}+3 x_{2}-4 x_{3}$
Subject to,

$$
\begin{aligned}
& x_{1}-x_{2}+x_{3} \geq 10 ; \\
& 2 x_{1}+x_{2}-x_{3} \leq 5 ; \text { and } \\
& x_{1} \geq 0, x_{2} \text { unrestricted; } x_{3} \leq 0
\end{aligned}
$$

3. Solve the following LPP.
Minimize, $Z=x_{1}-2 x_{2}-3 x_{3}$
Subject to, $2 x_{1}+x_{2}+3 x_{3}=2$;
$2 x_{1}+3 x_{2}+4 x_{3}=1$; and

$x_{1}, x_{2}, x_{3} \geq 0$
4. Solve the following all-integer programming problem using the branch and bound method.
Maximize: $\mathrm{Z}=2 \mathrm{x}_{1}+3 \mathrm{x}_{2}$
Subject to: $6 \mathrm{x}_{1}+5 \mathrm{x}_{2} \leq 25$;
$\mathrm{x}_{1}+3 \mathrm{x}_{2} \leq 10$; and
$\mathrm{x}_{1}, \mathrm{x}_{2}$ are non-negative integers
5. a) Explain the principle of dominance with reference to game theory.
b) Use the graphical method to solve the following game and find the value of the game.

> Player B


## SECTION - B

6. A bicycle repairman has an opportunity to purchase a stock of discontinued bicycles. They were originally supposed to be sold for ₹ 400 each: The repairman is offered all four bicycles for ₹ 400 , which makes his cost for each bicycle ₹ 100 . If he sells them, he believes, he can get ₹ 250 for each bicycle, thereby making a profit of ₹ 150 . He has two options: either to buy all the discontinued bicycles or not to buy at all. There are five states of nature; these being the demand for $0,1,2,3$, and 4 bicycles.
Prepare the payoff as well as regret tables for the problem. If the repairman has the option of buying any number of bicycles ( 0 to 4 ), find the average expected payoff and average expected regret for each stock action.
7. a) What are the advantages and limitations of the simulation technique?
b) The director of finance for a farm cooperative is concerned about the yield per acre she can expect from this year's com crop. The probability distribution of the yields for the current weather conditions is given below:

| Yield in kg per acre | Probability |
| :---: | :---: |
| 120 | 0.18 |
| 140 | 0.26 |
| 160 | 0.44 |
| 180 | 0.12 |

Simulate the average yield she might expect per acre, over the next 10 years, using the following set of random numbers:
$20,72,34,54,30,22,48,74,76,02$
8. a) Explain the basic characteristics of a queuing model.
b) A tax consulting firm has 3 counters in its office to receive people who have problems concerning their income, wealth and sales taxes. On an average 48 persons arrive in an 8 hour day. Each tax adviser spends 15 minutes on an average on an arrival. If the arrivals are Poissonly distributed and service time are exponentially distributed. Find:
i) The average number of customers in the system;
ii) Average number of customers waiting to be served; and
iii) Average time a customer spends in the system.
9. a) Explain the important characteristics of dynamic programming.
b) Solve the following 'travelling salesman problem' by using dynamic programming approach. The salesman starts from city 1 and has to reach city 10 . The figures on the arrows indicate the travelling time in days.

10. Use the revised simplex method to solve the following LPP:

Maximize, $Z=2 \mathrm{x}_{1}+\mathrm{x}_{2}$
Subject to, $3 \mathrm{x}_{1}+4 \mathrm{x}_{2} \leq 6$,

$$
\begin{aligned}
& 6 x_{1}+x_{2} \leq 3, \text { and } \\
& x_{1}, x_{2} \geq 0
\end{aligned}
$$

