DEPARTMENT OF MATHEMATICS
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE
MAN 010: OPTIMIZATION TECHNIQUES

Tutorial 6: Integer Programming Spring 2020

1. Solve the following ILPP/ Mixed ILPP using cutting plane method:

(i) Maximize $z = x_1 + x_2$
Subject to: $3x_1 + 5x_2 \leq 10$
$x_2 \leq 7$
$x_1, x_2 \geq 0$ and integers

(ii) Maximize $z = 7x_1 + 9x_2$
Subject to: $-x_1 + 3x_2 \leq 3$
$14x_1 + 2x_2 \leq 35$
$x_1, x_2 \geq 0$ and x_1 is integer

Ans.(i) $x_1=3$, $x_2=0$, $z=3$ (ii) $x_1=2$, $x_2=5/2$, $z=29$

2. A manufacturing process requires three different inputs via, A, B and C. A sandal soap of first type requires 30 gm of A, 20 gm of B and 6 gm of C, while the data for the second type of soap is 25, 5 and 15 respectively. The maximum availability of A, B and C are 6000, 3000 and 3000 gm, respectively. The selling price of sandal soap of the first and second type are \$14 and \$15 respectively. The profit is proportional to the amount of the soaps manufactured. How many soaps of first and second kind should be manufactured to maximize the profit? Assume that the market has unlimited demand.

Ans. First type of soap =50, Second type of soap =180, Profit = 3400.

3. Solve the following ILPP using Branch and Bound method:

(i) Maximize $z = 3x_1 + 4x_2$
Subject to: $2x_1 + 4x_2 \leq 13$
$-2x_1 + x_2 \leq 2$
$2x_1 + 2x_2 \geq 1$
$6x_1 - 4x_2 \leq 15$
$x_1, x_2 \geq 0$ and integers

(ii) Maximize $z = 11x_1 + 21x_2$
Subject to: $4x_1 + 7x_2 + x_3 = 13$
$x_1, x_2, x_3 \geq 0$ and integers

Ans. (i) $x_1=1$, $x_2=2$, $z=7$ (ii) $x_1=3$, $x_2=0$, $x_3=1$, $z=33$.

4. Solve the following 0-1 Integer Programming problem:
Maximize $3x_1 – 5x_2 + 10x_3$
Subject to: $– x_1 + 2x_2 + x_3 \geq 2$
$x_1 + x_2 + 2x_3 \leq 3$
$x_1, x_2, x_3 = 0$ or 1.

Ans. $x_1=0$, $x_2=1$, $x_3=0$, Optimum value is -5.

5. Consider three different projects, each has a life span of two months. The project can either be selected or not selected. The cost for the 1st month for project 1, 2 and 3 is Rs. 58/-, Rs. 44/-, Rs. 36/- and for 2nd month is Rs. 43/-, Rs. 30/, Rs. 23/- respectively. The available funds is Rs. 100/- and Rs. 85/- for 1st and 2nd month respectively. If net return for project 1 is Rs. 207/-, project 2 is Rs.120/- and project 3 is Rs 88/-. Maximize the net return.

Ans. Project 1 and 3 are included with net return of Rs. 295.