PROBLEM FORMULATION – II (CONTD.)

DECISION VARIABLES:

x_1 : number of single family housing units
x_2 : " " double " " "
x_3 : " " triple " " "
x_4 : " " recreation areas

MP FORMULATION

Maximize $Z = 10000x_1 + 15{,}000x_2 + 20000x_3$ — [objective function]

Subject to:

$2x_1 + 3x_2 + 4x_3 + x_4 \leq 680$ — [Total land availability constraint. 15% goes in roads]

$x_1 \geq 0.5(x_1 + x_2 + x_3)$ — [single family homes should be at least 50% of total]

$x_4 \geq (x_1 + 2x_2 + 3x_3)/200$ — [Recreation area must be 1 unit for every 200 fam.]

$1000x_1 + 1200x_2 + 1400x_3 + 800x_4 \geq 100{,}000$ — [Feasibility of providing water connection]

$400x_1 + 600x_2 + 840x_3 + 450x_4 \leq 200{,}000$ — [Limit on water works expansion]

$x_1 \geq 0;\ x_2 \geq 0;\ x_3 \geq 0;\ x_4 \geq 0;$ — [Non-negativity constraint]

MP FORMULATION (STANDARD FORMULATION: First Step)

Maximize $Z = 10000x_1 + 15000x_2 + 20000x_3$

Subject to:

$$2x_1 + 3x_2 + 4x_3 + x_4 \leq 680$$
$$0.5x_1 - 0.5x_2 - 0.5x_3 \geq 0$$
$$x_1 + 2x_2 + 3x_3 - 200x_4 \leq 0$$
$$1000x_1 + 1200x_2 + 1400x_3 + 800x_4 \geq 100{,}000$$
$$400x_1 + 600x_2 + 840x_3 + 450x_4 \leq 200{,}000$$
$$x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0,\ x_4 \geq 0$$