

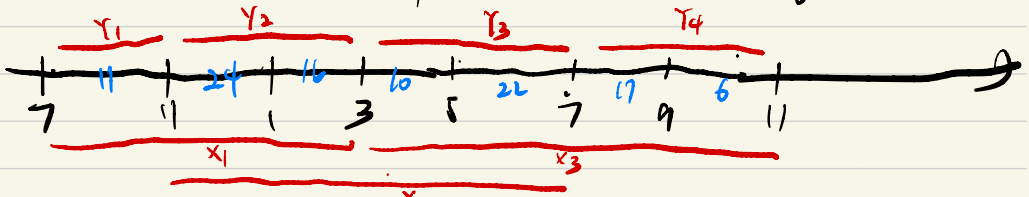
Question 1

$I = [1, 2, 3]$ which are the 3 8-hour shifts.

$J = [1, 2, 3, 4]$ which are the 4 4-hour shifts.

Define X_i = number of full time in 3 shifts, $i \in I$

Y_j = number of part time in 4 shifts, $j \in J$



Obj. $\forall i \in I \quad \forall j \in J$
 Min $80 \sum_{i \in I} X_i + 32 \sum_{j \in J} Y_j$

st. $X_1 + Y_1 \geq 11$ $X_2 + X_3 + Y_3 \geq 22$
 $X_1 + X_2 + Y_2 \geq 24$ $X_3 + Y_4 \geq 17$
 $X_1 + X_2 + Y_2 \geq 16$ $X_3 + Y_4 \geq 6$
 $Y_2 + X_3 + Y_3 \geq 10$

$X_1, X_3 \geq 1$

$(X_1 + X_2) \geq 0.3(X_1 + X_2 + Y_2)$

$(X_2 + X_3) \geq 0.3(X_2 + X_3 + Y_3)$

$X_2, Y_1, Y_2, Y_3, Y_4 \geq 0$

Question 2.

x_1 : number of Eff built

x_2 : number of 1 bed built

x_3 : number of 2 bed built

x_4 : number of 3 bed built

$$\text{Max } 350x_1 + 450x_2 + 550x_3 + 750x_4$$

$$\text{s.t. } 500x_1 + 700x_2 + 800x_3 + 1000x_4 \leq 40000$$

$$x_1 + x_2 + x_3 + x_4 \leq 40$$

$$0 \leq x_1 \leq 40$$

$$5 \leq x_2 \leq 15$$

$$8 \leq x_3 \leq 22$$

$$0 \leq x_4 \leq 10$$

$$x_1, x_2, x_3, x_4 \geq 0$$

Question 3

x_1 : pattern 1

x_4 : pattern 4

x_2 : pattern 2

x_5 : pattern 5

x_3 : pattern 3

x_6 : pattern 6

$$\text{Min } x_1 + x_2 + x_3 + x_4 + x_5 + x_6$$

$$\text{s.t. } 3x_1 + 2x_2 + 2x_3 + x_4 \geq 5000$$

$$x_2 + 2x_4 + x_5 \geq 1200$$

$$x_3 + x_5 + 2x_6 \geq 300$$

$$x_1, x_2, x_3, x_4, x_5, x_6 \geq 0$$