IE407 Assignment 1

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1 Question 1

We determined the decision variables as follows:

x_1 : # of copies awarded to Johnson Printing
x_2 : # of copies awarded to Lakeside Litho
x_3 : # of copies awarded to Benson Printing

Objective Function: **Minimizing the total cost**

Cost Equation: $2.5 \times x_1 + 2.75 \times x_2 + 2.45 \times x_3 = z$

Constraints:

$$x_1 \times 0.99 + x_2 \times 0.995 + x_3 \times 0.9 \geq 75000$$
$$x_1 \leq 50000$$
$$x_2 \geq 30000$$
$$x_2 \leq 50000$$
$$x_3 \leq 30000$$
$$x_3 \geq 0.1 \times x_1$$
$$x_1,\ x_2,\ x_3 \geq 0$$

2 Question 2

We determined the decision variables as follows:

x_{ij} : Cooley High student who is coming from i'th(i = 1,2,3) distinct and whether they are minority or not (j =1 $\rightarrow$ Minority, $j = 2 \rightarrow$ Nonminority).

y_{ij} : Whitman High student who is coming from i'th(i = 1,2,3) distinct and whether they are minority or not (j =1 $\rightarrow$ Minority, $j = 2 \rightarrow$ Nonminority).

Objective Function: **Minimizing total distance covered by students**

$$\sum_{j=1}^{2} x_{1j} + x_{2j} \times 2 + x_{3j} + y_{1j} \times 2 + y_{2j} + y_{3j} = z$$

District population equalities:

$$x_{11} + y_{11} = 50$$
$$x_{12} + y_{12} = 200$$
$$x_{21} + y_{21} = 50$$
$$x_{22} + y_{22} = 250$$
$$x_{31} + y_{31} = 100$$
$$x_{32} + y_{32} = 150$$

Constraints:

$$500 \geq \sum_{i=1}^{3} \sum_{j=1}^{2} x_{ij} \geq 300$$

$$500 \geq \sum_{i=1}^{3} \sum_{j=1}^{2} y_{ij} \geq 300$$

$$0.3 \geq \frac{\sum_{i=1}^{3} x_{i1}}{\sum_{i=1}^{3} \sum_{j=1}^{2} x_{ij}} \geq 0.2$$

Minority Constraint

$$0.3 \geq \frac{\sum_{i=1}^{3} y_{i1}}{\sum_{i=1}^{3} \sum_{j=1}^{2} y_{ij}} \geq 0.2$$

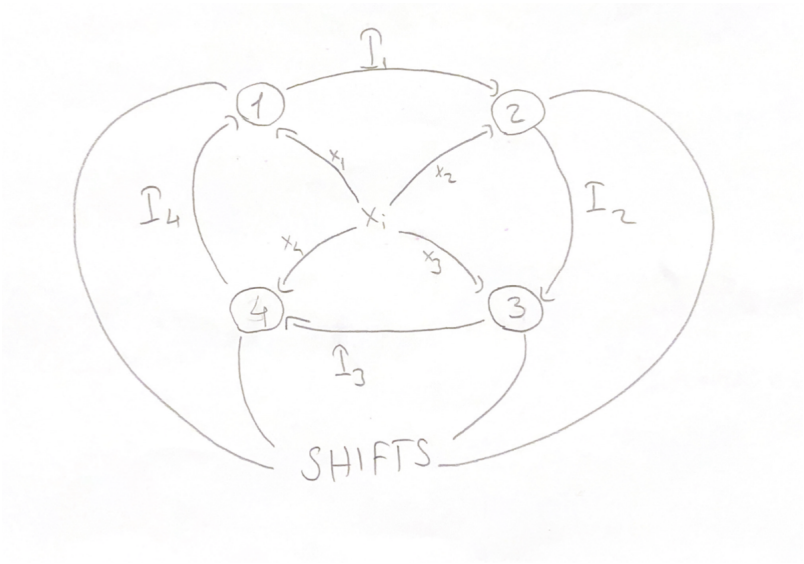
Minority Constraint

$$x_{ij} \geq 0 \text{ i} = 1,2,3 \text{ j} = 1,2$$
$$y_{ij} \geq 0 \text{ i} = 1,2,3 \text{ j} = 1,2$$

3 Question 3

We determined the decision variables as follows:

x_i : Amount workers has i'th(i = 1 $\rightarrow$ 12 A.M. to 6 A.M,i = 2 $\rightarrow$ 6 A.M. to 12 P.M, i = 3 $\rightarrow$ 12 P.M. to 6 P.M, i = 4 $\rightarrow$ 6 P.M. to 12 A.M) shift that don't have a consecutive shift.



I_i : Amount of workers that have i'th(i = 1 $\rightarrow$ 12 A.M. to 6 A.M and 6 A.M. to 12 P.M, i = 2 $\rightarrow$ 6 A.M. to 12 P.M and 12 P.M. to 6 P.M, i = 3 $\rightarrow$ 12 P.M. to 6 P.M and 6 P.M. to 12 A.M, i = 4 $\rightarrow$ 6 P.M. to 12 A.M and 12 A.M. to 6 A.M) consecutive shift combination.

Objective Function: **Minimize the cost of meeting the daily work- force demands**

Cost Equation:

$$\sum_{i=1}^{4} x_i \times 18 \times 6 + \sum_{i=1}^{4} I_i \times 12 \times 12 = z$$

Constraints:

$$x_1 + I_4 + I_1 \geq 15$$
$$x_2 + I_1 + I_2 \geq 5$$

$$x_3 + I_2 + I_3 \geq 12$$
$$x_4 + I_3 + I_4 \geq 6$$

$$x_i \geq 0 \text{ i} = 1,2,3,4$$
$$I_i \geq 0 \text{ i} = 1,2,3,4$$