**Assignment-2**

Q1(a) :

In the given problem, the full-time consultants work for eight consecutive hours in any of the following shifts:

morning (8 am – 4 pm) : **F1**

afternoon (noon – 8 pm) : **F2**

evening (4 pm – midnight) : **F3**

Full-time consultants are paid $14 per hour.

Part-time consultants can be hired to work any of the four shifts. Part-time consultants are paid $12 per hour.

8am – 12pm : **P1**

12pm – 4pm : **P2**

4am – 8pm : **P3**

8 am – midnight : **P4**

Hence there are 7 decision variables.

Full time employees get paid for 8 hrs., 14\*8 = 112

Half time employees get paid for 4 hrs., 12\*4 = 48

**Objective function**

To minimize the cost, **Minimize Z = 112(F1+F2+F3) + 48(P1+P2+P3+P4)**

Subject to constraints,

F1 + P1 >= 4 F1 >= P1

F1 + P2+ F2 >= 8 F1 + F2 >= P2

F2 + P3 + F3 >= 10 F2 + F3 >= P3

P4 + F3 >= 6 F3 >= P4

P­I, Fj  >= 0, part time shifts, i = 1,2,3,4

Full time shifts, j= 1,2,3

Q1(b) :

Since full time consultants are entitled to the lunch break for one hour during the time period, hence the minimum cost can be determined by reducing the cost of 1 hour. $112 - $14 = $98.

Hence the objective function is given by,

**Cost Minimize, Z = 98( F1 + F2 + F3) + 48( P1 + P2 + P3 + P4)**

Q2:

Please find the below file for the graphical representation.



Q3 (a):

The decision variables can be denoted and defined as follows:

P depicts number of products produced per day

i =1,2,3. where i is the plant number

j = 1,2,3. Where j is the size of the products produced per day. 1: small, 2: Medium, 3: Large

Therefore, the decision variables are given by

P11 = number of small products produced per day at Plant 1,

P12 = number of medium products produced per day at Plant 1,

P13 = number of large products produced per day at Plant 1,

P21 = number of small products produced per day at Plant 2,

P22 = number of medium products produced per day at Plant 2,

P23 = number of large products produced per day at Plant 2,

P31 = number of small products produced per day at Plant 3,

P32 = number of medium products produced per day at Plant 3,

P33 = number of large products produced per day at Plant 3.

Q3(b):

**Total net profit** is given by,

**Maximize, Z = 420 P11 + 360 P12 + 300 P13 + 420 P21 + 360 P22 + 300 P23 + 420 P31 + 360 P32 + 300 P33**

subject to constraints,

Excess capacity produced by each plant

P11 + P12 + P13 ≤ 750

P21 + P22 + P23 ≤ 900

P31 + P32 + P33 ≤ 450

Storage limitations for the new product

20P11 + 15P12 + 12P13 ≤ 13000

20P21+ 15P22+ 12P23 ≤ 12000

20P31 + 15P32 + 12P33 ≤ 5000

Sales forecast per day

For large products, P13 + P23 + P33 ≤ 900

For medium products, P12 + P22 + P32 ≤ 1200

For small products, P11 + P21 + P31 ≤ 750

and

Pij ≥ 0, where i,j= 1,2,3.

The below set of constraints are the layoffs of the plants

(P11 + P12 + P13) - ( P21 + P22 + P23) = 0

(P11 + P12 + P13) - (P31 + P32 + P33) = 0

Q3(C) :