Q1

Variables:

Let Xi be the quarterly production in i-th quarter during regular-time labor, and Yi be the quarterly production in i-th quarter during over-time labor, where i = 1, 2, 3.

Let Zi be the quarterly inventory for i-th quarter, i = 1, 2, 3.

Objective: minimize total cost:

Constraints:

(Demand for quarter 1)

(Demand for quarter 2)

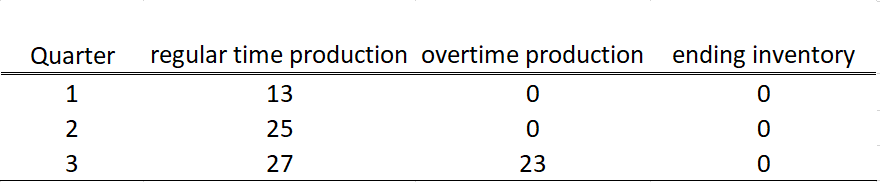
(Demand for quarter 3)

(regular time labor constraint)

(non-negativity constraint)

Solution:

Used Gurobipy in Python. Results are shown below



Optimal cost was minimized at a value of $3980.

Q2

Variables:

Let Xi be the number of product i produced in each week, where i = 1, 2, 3.

Let Yi be the number of workers working on machine i, where i = 1, 2, 3.

Objective: max profit: 6X1 + 8X2 + 10X3

Constraints:

(machine 1 operating constraint)

(machine 2 operating constraint)

(machine 3 operating constraint)

(worker constraint)

(Working time constraint)

Y1<= 5, Y2<=3, Y3<=4 (Upper bound)

(Working time for machine 1)

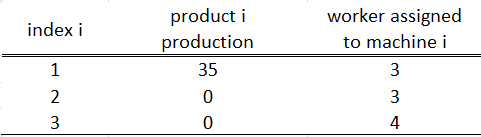
(Working time for machine 2)

(Working time for machines 3)

(non-negativity)

Solution:

Used Gurobipy in Python, Results are shown below.



Optimal profit was maximized at $210.

Q3

Variables:

Let Xi be the amount invested in 1 year investment for i-th year, and Yi be the amount invested in 3 years investment for i-th year, and Zi be the amount invested in 5 years investment for i-th year.

Objective: max sixth year return:

Constraints:

(constraint for initial investment)

(constraint for second year investment)

(constraint for third year investment)

(constraint for fourth year investment)

(constraint for fifth year investment)

(constraint for sixth year investment)

(non-negativity constraint)