Production Planning Problem & Sensitivity Analysis

We want to perform the Production Planning for an industrial factory among a 6 months period. There are some assumptions bellow:

1- The production process can take part in both normal & overtime work
2- We can hire new staff if necessary
3- We can store our products as inventory at the end of the month

parameters

I0 initial inventory which is 150 units

N number of initial work force which is 30 people

Tt normal production time each month which is 175 hours

W0 initial person-hour which is 5250 person-hours (W0 = N*Tt)

Cv cost of holding each remaining product which is 750000 Tomans

Cr cost of each person-hour for normal time work which is 17500 Tomans

Co cost of each person-hour for overtime work which is 24000 Tomans

Ch cost of recruitment of each new work force which is 600000 Tomans

PT needed person-hour for producing each product which is 7 person-hours

C cost of producing each product which is 8500000 Tomans

P allowable percentage of overtime work which is 25%

D(t) demand of product each month which was shown bellow

(1)	(2)	(3)	(4)	(5)	(6)
750	600	540	500	540	590

positive variables

Xt The amount of production in t^{th} month

It The amount of inventory at the end of t^{th} month

Ht The number of people hired in the t^{th} month

Wt The amount of normal time person-hour available in the t^{th} month

Ot The amount of overtime person-hour needed in the t^{th} month

Sensitivity analysis was performed on the demand of the product in the first month (D1) which is various from 750 to 774. According to the results, the cost (Z) increases 8500000 units per additional need for the first month's demand. The reason for this increase of cost is the need for Only a 1-unit increase in the number of production in the first month (X1) and due to the low volume of demand versus the abundant workforce available, there is no need for new workforce employment or overtime working.