ASSIGNMENT 3 DESCRIPTION

Since it is given that any amount of stock can be stored, means supply is unlimited or there is no restriction on the supply.

Let

S1= supply in month 1 which is purchased with no discount.

D1= Supply in month 1 with discount of $2

L1= Leftover after the month 1 is over

S2= supply in month 2 which is purchased with no discount.

D2= Supply in month 2 with discount of $2

L2= Leftover after the month 2 is over

S3= supply in month 3 which is purchased with no discount.

D3= Supply in month 3 with discount of $2

L3= Leftover after the month 3 is over

S4= supply in month 4 which is purchased with no discount.

D4= Supply in month 4 with discount of $2

L4= Leftover after the month 1 is over which will be zero because no one will buy extra after the purpose is solved.

So objective function is,

Min: 12S1 + 14S2 + 16S3 + 18S4 + 10D1 + 12D2 + 14D3 + 16D4 + 2L1 +2L2 + 2L3;

Now, demand in every month will be equal to the supply (With and without discount) + the leftover of previous month – Leftover of current month.

DE1= Demand in month 1 = S1+ D1-L1=150

DE2= Demand in month 2 = S2+ D2+L1-L2=200

DE3= Demand in month 3 = S3+ D3+L2-L3=250

DE4= Demand in month 4 = S4+D4+L3=150

And since S are supplies without discount,

0 <= S1 <= 200;

0 <= S2 <= 200;

0 <= S3 <= 200;

0 <= S4 <= 200;

After 200, any number of products will cost $2 less. So, D values can be very large. Using Big M method,

D1 – 1000J1=0;

D2 – 1000J2=0;

D3 – 1000J3=0;

D4 – 1000J4=0;

Where J = 1 or 0 based on whether the purchase in that specific month is more than 200 units. If the purchase is less than 200 units, J=0 and hence D=0.

Now since J can be 1 only if we purchase more than 200 units in one month, we have constraints:

S1 - 200J1 >=0;

S2 - 200J2 >=0;

S3 - 200J >=0;

S4 - 200J4 >=0;

So as defined previously, S cannot be more than 200, so if S=200, J=1, if S<200, J must be 0 and so D will not exist.

Solving the problem on R via linear programming model, the values of constraints are:

Objective function = $10200

S1= supply in month 1 which is purchased with no discount= 200

D1= Supply in month 1 with discount of $2=550

L1= Leftover after the month 1 is over=600

S2= supply in month 2 which is purchased with no discount=0

D2= Supply in month 2 with discount of $2=0

L2= Leftover after the month 2 is over=400

S3= supply in month 3 which is purchased with no discount=0

D3= Supply in month 3 with discount of $2=0

L3= Leftover after the month 3 is over=150

S4= supply in month 4 which is purchased with no discount=0

D4= Supply in month 4 with discount of $2=0

Sensitivity Analysis:

The solution obtained is optimum since there is no extra money spent on purchase from month 2 and all the stock used in months 2nd,3rd and 4th is bought in first month itself with discounted price.

Now, even if the demand in any month increases, the solution remains same, i.e. we will buy the stock in month 1 itself and store as per the increased requirement in subsequent months.

Hence there won’t be any solution change or in other words there won’t be any shadow price, i.e. will be equal to zero.