

Assignment No. 5

Question 1

Solution:

The longest path is the critical path

Critical Path Method:

Objective Function:

$$\text{Max } Z = 3X_{13} + 5X_{12} + 3X_{35} + 2X_{25} + 2X_{58} + 4X_{24} + X_{46} + 4X_{47} + 6X_{57} + 4X_{79} + 7X_{89} + 5X_{69}$$

St.

Starting Node:

$$X_{12} + X_{13} = 1$$

Intermediate Node:

$$X_{13} - X_{35} = 0$$

$$X_{12} - X_{25} - X_{24} = 0$$

$$X_{24} - X_{47} - X_{46} = 0$$

$$X_{35} + X_{25} - X_{57} - X_{58} = 0$$

$$X_{46} - X_{69} = 0$$

$$X_{47} + X_{57} - X_{79} = 0$$

$$X_{58} - X_{89} = 0$$

Finish Node:

$$X_{69} + X_{79} + X_{89} = 1$$

$$X_{ij} \geq 0$$

Running the LP formulation on LP solver, the critical path is:

From node 1 to 2

From node 2 to 5

From node 5 to 7

From node 7 to 9

The duration of the project is, therefore 17-time units.

Question 2

Solution:

Question 2a)

Returns = [(Price per share * Growth rate) * No of share] + [Dividend * No of share]

Objective Function:

$$\text{Max } Z = 4 X_{S1} + 6.5 X_{S2} + 5.9 X_{S3} + 5.4 X_{H1} + 5.15 X_{H2} + 10 X_{H3} + 8.4 X_{C1} + 6.25 X_{C2}$$

St.

$$40 X_{S1} + 50 X_{S2} + 80 X_{S3} + 60 X_{H1} + 45 X_{H2} + 60 X_{H3} + 30 X_{C1} + 25 X_{C2} \leq 2500000$$

$$1000 X_{SJ} \geq 0 \quad (J=1,2,3)$$

$$1000 X_{HJ} \geq 0 \quad (J=1,2,3)$$

$$1000 X_{CJ} \geq 0 \quad (J=1,2,3)$$

At least USD 100,000 must be invested in each of the eight stocks

$$40 X_{S1} \geq 100000;$$

$$50 X_{S2} \geq 100000;$$

$$80 X_{S3} \geq 100000;$$

$$60 X_{H1} \geq 100000;$$

$$45 X_{H2} \geq 100000;$$

$$60 X_{H3} \geq 100000;$$

$$30 X_{C1} \geq 100000;$$

$$25 X_{C2} \geq 100000;$$

No more than 40% investment be allocated to any of these three sectors

$$40 X_{S1} + 50 X_{S2} + 80 X_{S3} \leq 1000000$$

$$40 X_{H1} + 50 X_{H2} + 80 X_{H3} \leq 1000000$$

$$40 X_{C1} + 50 X_{C2} \leq 1000000$$

$$X_{SJ}, X_{HJ}, X_{CJ} \geq 0$$

Using lpSolve the with integer restriction we get the objective function = **487145.2**.

The number of stocks is follows:

$$S1 = 2500$$

$$S2 = 6000$$

$$S3 = 1250$$

H1=1667
H2=2223
H3= 3332
C1= 30000
C2= 4000

The amount invested in each stock are as follows:

S1= 100000
S2= 300000
S3= 100000
H1= 100020
H2= 100035
H3= 799920
C1= 900000
C1= 100000

Question 2b)

Using lpSolve the without integer restriction we get the objective function = **487145.8**

The number of stocks

S1 = 2500.0
S2= 6000.0
S3= 1250.0
H1=1667.667
H2=2222.222
H3= 3333.333
C1= 30000.0
C2= 4000.0

The percentage difference between with and without integer restriction is **0.0056**