Assignment – 5

Q 1:

In the given problem from the network diagram, the longest path is the critical path,

$$Max, Z= 3X_{13} + 5X_{12} + 3X_{35} + 2X_{25} + 2X_{58} + 4X_{24} + 6X_{57} + 4X_{47} + 1X_{46} + 7X_{89} + 4X_{79} + 5X_{69}$$

Starting node:

$$3X_{13} + 5X_{12} = 1$$

Ending node:

$$7X_{89} + 4X_{79} + 5X_{69} = 1$$

Intermediate nodes:

$$5X_{12} - 2X_{25} - 4X_{24} = 0$$

$$3X_{13} - 3X_{35} = 0$$

$$4X_{24} - 1X_{46} - 4X_{47} = 0$$

$$3X_{35} + 2X_{25} - 2X_{58} - 6X_{57} = 0$$

$$1X_{46} - 5X_{69} = 0$$

$$6X_{57} + 4X_{47} - 4X_{79} = 0$$

$$2X_{58} - 7X_{89} = 0$$

Where X_{IJ} are binary

Q 2a:

In the given problem, the objective function includes the price per share, the projected annual growth rate in the share price, and the anticipated annual dividend payment per share. The expression is as below

Returns = (Price per share) * (Growth rate of share) + (Dividend per share)

Hence the objective function is

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

Subject to the constraints,

Investment constraint:

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

The number of shares invested in any stock must be a multiple of 1000

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

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

$$1000X_{CJ} >= 0\ (J = 1,2)$$

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

$$40X_{S1} >= 100000;\ 50X_{S2} >= 100000;\ 80X_{S3} >= 100000;\ 60X_{H1} >= 100000;$$

$$45X_{H2} >= 100000;\ 60X_{H3} >= 100000;\ 30X_{C1} >= 100000;\ 25X_{C2} >= 100000$$

The client has stipulated that no more than 40 percent of the investment be allocated to any one of these three sectors

$$40X_{S1} + 50X_{S2} + 80X_{S3} <= 1000000$$

$$60X_{H1} + 45X_{H2} + 60X_{H3} <= 1000000$$

$$30X_{C1} + 25X_{C2} <= 1000000$$

Where $X_{SJ}, X_{HJ}, X_{CJ} >= 0$ are integers.

Using lpsolve with integer restriction we get the objective function, maximum returns as ***487145.2*** and number of stocks are S1= ***2500,*** *S2=* ***6000,*** *S3=* ***1250,*** *H1=* ***1667,*** *H2=* ***2223,*** *H3=* ***13332,*** *C1=* ***30000,*** *C2=* ***4000.***

The amount invested in each stock S1= **100000**, S2= **300000**, S3= **100000**, H1= **100020**, H2= **100035**, H3= **799920**, C1= **900000**, C2= **100000**.

Q 2b:

Using lpsolve without integer restriction we get the objective function, maximum returns as ***487152.8*** and number of stocks are S1= ***2500.0,*** *S2=* ***6000.0,*** *S3=* ***1250.0,*** *H1=* ***1667.667,*** *H2=* ***2222.222,*** *H3=* ***13333.333,*** *C1=* ***30000.0,*** *C2=* ***4000.0***

The amount invested in each stock S1= **100000**, S2= **300000**, S3= **100000**, H1= **100000**, H2= **100000**, H3= **800000**, C1= **900000**, C2= **100000**.

Percentage difference in objective functions with and without integer restriction is **0.00156**