Assignment 5

1)

In this network diagram we must get the maximum objective function because longest path is the critical path.

Here P_{ij} (i=starting node, j= ending node)

Objective function:

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

Starting node:

Node 1: $3P_{13} + 5P_{12} = 1$

Ending node:

Node 9: $7P_{89} + 4P_{79} + 5P_{69} = 1$

Intermediate nodes:

Node 2: $5P_{12} = 2P_{25} + 4P_{24}$
Node 3: $3P_{13} = 3P_{35}$
Node 4: $4P_{24} = 1P_{46} + 4P_{47}$
Node 5: $3P_{35} + 2P_{25} = 2P_{58} + 6P_{57}$
Node 6: $1P_{46} = 5P_{69}$
Node 7: $6P_{57} + 4P_{47} = 4P_{79}$
Node 8: $2P_{58} = 7P_{89}$

Where P_{ij} are binary.

Using lp solve we got the maximum objective function as 17, So it is the critical path.

So, the arcs between the objective function is

P_{12} - P_{25} – P_{57} – P_{79}.

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)

Objective function

Max Z = 4 PS1 + 6.5 PS2 + 5.9 PS3 + 5.4 PH1 + 5.15 PH2 + 10 PH3 + 8.4PC1 + 6.25 PC2

Constraints

Investment constraint:

40 PS1 + 50 PS2 + 80 PS3 + 60 PH1 + 45 PH2 + 60 PH3 + 30 PC1 + 25 PC2 <= 2500000

Stock must be a multiple of 1000

1000 PSI >= 0 (I = 1,2,3)

1000 PHI >= 0 (I = 1,2,3)

1000 PCI >= 0 (I = 1,2)

At least $100,000 must be invested in the 8 stocks

40 PS1 >= 100000

50 PS2 >= 100000

80 PS3 >= 100000

60 PH1 >= 100000

45 PH2 >= 100000

60 PH3 >= 100000

30 PC1 >= 100000

25 PC2 >= 100000

Not more than 40% must be allocated to the 3 sectors

40 PS1 + 50 PS2 + 80 PS3 <= 1000000

60 PH1 + 45 PH2 + 60 PH3 <= 1000000

30 PC1 + 25 PC2 <= 1000000

Where PSI, PHI, PCI >= 0 are integers.

Using lpsolve with integer restriction we get the objective function, maximum returns as 487145.2

Number of stocks are:

S1= 2500, S2=6000, S3= 1250, H1= 1667, H2= 2223, H3= 3332, C1=30000, C2= 4000.

The amount invested in each stock are

S1= 100000, S2= 300000, S3= 100000, H1= 100020, H2= 100035, H3= 799920, C1= 900000, C2= 100000.

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 are:

S1= 100000, S2= 300000, S3= 100000, H1= 100000, H2=100000, H3= 800000, C1= 900000, C2=100000.

Difference between objective functions between with and without integer restriction is **$7.6**

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