# Problem 1

## Results of the program:

Coloring Solutions(Vertex -> Color):

1 -> red, 2 -> green, 3 -> red, 4 -> green, 5 -> red, 6 -> green,

1 -> red, 2 -> green, 3 -> red, 4 -> green, 5 -> red, 6 -> white,

1 -> red, 2 -> green, 3 -> red, 4 -> green, 5 -> white, 6 -> green,

1 -> red, 2 -> green, 3 -> red, 4 -> white, 5 -> red, 6 -> green,

1 -> red, 2 -> green, 3 -> red, 4 -> white, 5 -> red, 6 -> white,

1 -> red, 2 -> green, 3 -> white, 4 -> green, 5 -> red, 6 -> green,

1 -> red, 2 -> green, 3 -> white, 4 -> green, 5 -> white, 6 -> red,

1 -> red, 2 -> green, 3 -> white, 4 -> green, 5 -> white, 6 -> green,

1 -> red, 2 -> green, 3 -> white, 4 -> white, 5 -> red, 6 -> green,

1 -> red, 2 -> white, 3 -> red, 4 -> green, 5 -> red, 6 -> green,

1 -> red, 2 -> white, 3 -> red, 4 -> green, 5 -> red, 6 -> white,

1 -> red, 2 -> white, 3 -> red, 4 -> white, 5 -> red, 6 -> green,

1 -> red, 2 -> white, 3 -> red, 4 -> white, 5 -> red, 6 -> white,

1 -> red, 2 -> white, 3 -> red, 4 -> white, 5 -> green, 6 -> white,

1 -> red, 2 -> white, 3 -> green, 4 -> green, 5 -> red, 6 -> white,

1 -> red, 2 -> white, 3 -> green, 4 -> white, 5 -> red, 6 -> white,

1 -> red, 2 -> white, 3 -> green, 4 -> white, 5 -> green, 6 -> red,

1 -> red, 2 -> white, 3 -> green, 4 -> white, 5 -> green, 6 -> white,

1 -> green, 2 -> red, 3 -> green, 4 -> red, 5 -> green, 6 -> red,

1 -> green, 2 -> red, 3 -> green, 4 -> red, 5 -> green, 6 -> white,

1 -> green, 2 -> red, 3 -> green, 4 -> red, 5 -> white, 6 -> red,

1 -> green, 2 -> red, 3 -> green, 4 -> white, 5 -> green, 6 -> red,

1 -> green, 2 -> red, 3 -> green, 4 -> white, 5 -> green, 6 -> white,

1 -> green, 2 -> red, 3 -> white, 4 -> red, 5 -> green, 6 -> red,

1 -> green, 2 -> red, 3 -> white, 4 -> red, 5 -> white, 6 -> red,

1 -> green, 2 -> red, 3 -> white, 4 -> red, 5 -> white, 6 -> green,

1 -> green, 2 -> red, 3 -> white, 4 -> white, 5 -> green, 6 -> red,

1 -> green, 2 -> white, 3 -> red, 4 -> red, 5 -> green, 6 -> white,

1 -> green, 2 -> white, 3 -> red, 4 -> white, 5 -> red, 6 -> green,

1 -> green, 2 -> white, 3 -> red, 4 -> white, 5 -> red, 6 -> white,

1 -> green, 2 -> white, 3 -> red, 4 -> white, 5 -> green, 6 -> white,

1 -> green, 2 -> white, 3 -> green, 4 -> red, 5 -> green, 6 -> red,

1 -> green, 2 -> white, 3 -> green, 4 -> red, 5 -> green, 6 -> white,

1 -> green, 2 -> white, 3 -> green, 4 -> white, 5 -> red, 6 -> white,

1 -> green, 2 -> white, 3 -> green, 4 -> white, 5 -> green, 6 -> red,

1 -> green, 2 -> white, 3 -> green, 4 -> white, 5 -> green, 6 -> white,

1 -> white, 2 -> red, 3 -> green, 4 -> red, 5 -> green, 6 -> red,

1 -> white, 2 -> red, 3 -> green, 4 -> red, 5 -> green, 6 -> white,

1 -> white, 2 -> red, 3 -> green, 4 -> red, 5 -> white, 6 -> red,

1 -> white, 2 -> red, 3 -> green, 4 -> green, 5 -> white, 6 -> red,

1 -> white, 2 -> red, 3 -> white, 4 -> red, 5 -> green, 6 -> red,

1 -> white, 2 -> red, 3 -> white, 4 -> red, 5 -> white, 6 -> red,

1 -> white, 2 -> red, 3 -> white, 4 -> red, 5 -> white, 6 -> green,

1 -> white, 2 -> red, 3 -> white, 4 -> green, 5 -> white, 6 -> red,

1 -> white, 2 -> red, 3 -> white, 4 -> green, 5 -> white, 6 -> green,

1 -> white, 2 -> green, 3 -> red, 4 -> red, 5 -> white, 6 -> green,

1 -> white, 2 -> green, 3 -> red, 4 -> green, 5 -> red, 6 -> green,

1 -> white, 2 -> green, 3 -> red, 4 -> green, 5 -> red, 6 -> white,

1 -> white, 2 -> green, 3 -> red, 4 -> green, 5 -> white, 6 -> green,

1 -> white, 2 -> green, 3 -> white, 4 -> red, 5 -> white, 6 -> red,

1 -> white, 2 -> green, 3 -> white, 4 -> red, 5 -> white, 6 -> green,

1 -> white, 2 -> green, 3 -> white, 4 -> green, 5 -> red, 6 -> green,

1 -> white, 2 -> green, 3 -> white, 4 -> green, 5 -> white, 6 -> red,

1 -> white, 2 -> green, 3 -> white, 4 -> green, 5 -> white, 6 -> green,

Total number of solutions is 54.

# Problem 2

Results of the program:

Best set:

i: 1, p: 20, w: 2

i: 3, p: 35, w: 7

Maximum profit: 55

# Problem 3

Results of the three test cases:

Test Case 1:

Graph 1

1 : [2, 4]

2 : [1, 4, 3, 5]

3 : [2, 4, 5]

4 : [1, 2, 3]

5 : [2, 3]

Graph 2

1 : [2, 4, 5]

2 : [1, 4]

3 : [4, 5]

4 : [1, 2, 5, 3]

5 : [1, 4, 3]

isomorphic

The orderings of the vertices for which their adjacency matrices are equal:

1 -> 2

2 -> 4

4 -> 1

3 -> 5

5 -> 3

Test Case 2:

Graph 1

1 : [2, 3, 5]

2 : [1, 3, 6]

3 : [1, 2, 4]

4 : [3, 5, 6]

5 : [1, 6, 4]

6 : [2, 5, 4]

Graph 2

1 : [2, 4, 5]

2 : [1, 3, 6]

3 : [2, 4, 5]

4 : [1, 3, 6]

5 : [1, 3, 6]

6 : [2, 4, 5]

not isomorphic

Test Case 3:

Graph 1

1 : [2, 4, 5]

2 : [1, 5, 3]

3 : [2, 4, 6]

4 : [1, 3, 7]

5 : [1, 2, 6, 7]

6 : [5, 3, 7]

7 : [4, 5, 6]

Graph 2

1 : [2, 4, 6]

2 : [1, 3, 5]

3 : [2, 4, 6]

4 : [1, 3, 7]

5 : [2, 6, 7]

6 : [1, 3, 5, 7]

7 : [4, 6, 5]

not isomorphic

Link for the code for Problem 3:

<https://github.com/lanoueben/CSC340Isomorphism/blob/96523d5c02a4cda59f2c5c13059e0e09db926766/CSCE340Project3BenLanoue/GraphIso/src/graphiso/>

Time complexity analysis:

The inner function “static boolean compatible(LinkedList<Integer> p, int v, boolean[][] g, boolean[][] h)”:

Time complexity

The outer function “static boolean extend(LinkedList<Integer> p, boolean[][] g, boolean[][] h)”:

Time complexity

The time complexity of function extend without the recursion is :

The number of recursion for calling extend() function is n.

Overall: