Analysis of Algorithms: Assignment 7 (Programming)

Due date: March 23 (Tuesday)

If you submit the assignment by 11am on March 18 (Thursday), then you will earn 2 bonus points toward your grade for this assignment (not toward the final grade for the course). If you submit it by 11am on March 20 (Saturday), you will get 1 bonus point.

Your task is to implement breadth-first search and depth-first search, in a programming language of your choice; both programs must be in the same language. Represent the vertices of an input graph by natural numbers, from 1 to n, and edges by adjacency lists. You may choose your own input format, whereas the output format must be as shown in the examples below. Submit a print-out of your programs and their output; make sure that the code is well-commented.

Problem 1 (5 points)
Implement a BFS program, which inputs a graph and source vertex, and outputs all vertices reachable from the source, *in the order of painting them gray.* For example, if you input the graph of Figure 23.2(a) in the textbook, with vertex 3 as the source, then the program may produce the following output:

```
BFS order of painting gray:
3 5 6 4 2
```

Note that a correct output is *not* unique, since it depends on the order of vertices in the adjacency lists. Thus, your program may output a different order for the same graph.

Apply your program to the graph in the picture below, with vertex 1 as the source, and submit the resulting output, along with the print-out of your code.

Problem 2 (5 points)
Implement a DFS program, which inputs a graph and outputs all its vertices, *in the order of making them gray.* The main loop of your program must process the vertices in their numerical order, from 1 to n. For example, if you run this program with the graph in Figure 23.2(a), then its output may be as follows:

```
DFS order of painting gray:
1 2 5 4 3 6
```

Submit a print-out of your program and the results of its application to the graph below.