

 <b>UNIVERSITI SAINS MALAYSIA</b>	 <b>SCHOOL OF COMPUTER SCIENCES</b> <small>UNIVERSITI SAINS MALAYSIA</small>	<b>CPT212 - Design &amp; Analysis of Algorithms</b>
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## Assignment II: Graph Algorithm and Application

Semester II 2022/23

### Objectives

This assignment will enable you to acquire in-depth understanding of graph traversal namely depth-first search and its application in finding a path.

### Specifications

You are to implement the finding a path application program in Java using depth-first search algorithm. We can find a path from a source vertex  $v$  to a destination vertex  $d$  by starting a depth first search at vertex  $v$  and terminating the search as soon as we reach vertex  $d$ . To construct a path (a series of edges) we need to remember the edges used to move from one vertex to the next. For the path problem, the needed set of edges is implicitly stored in the depth-first recursion, so it is easier to develop a path-finding code by using the depth-first strategy. As the recursion unfolds following the labelling of vertex  $d$ , the path is constructed backward from  $d$  to  $s$ . The pseudocode for DepthFirstSearch (from lecture) is modified as follows:

```

FindPathDFS (v,d)
for all vertices v
num(v) = 0;
edges = null;
i=0;
while v!=d && there is a vertex v such that num(v) is 0
    DFS(v,d);
If v==d
    output edges; // there is a path from v to d
else
    No path from v to d

```

DFS is modified so that it discontinues the search for reachable vertices as soon as the destination is reached. Notice that DFS is invoked only when  $v!=d$ . Also notice that the algorithm does not necessarily find a shortest path (i.e., a path with the fewest number of edges to the destination).

```

DFS(v,d)
num(v) = i++;
for all vertices u adjacent to v
    if num(u) is 0 and v!=d
        attach edge(uv) to edges;
        DFS(u,d);

```

- (ii) You have to further enhance the program in (i) above by making your program more user-friendly and incorporating an application or more such as transportation systems, and road networks.

### **Report**

The report for this assignment must be properly typed and cover the discussion on the program i.e., the design of the program and the data structures used. You are to enclose the program source code and executable code, and the test data if the input is through the text file. Only one program is to be submitted.

### **Testing and test data**

Complete test data are required to show that your program works properly. The datasets and the corresponding outputs are to be provided in the report with justifications.

### **Evaluation**

The evaluation is based on a good report, test data and programming approach that attempts to cover the best aspects that are required in implementing the algorithm and the method, and the enhancement as stated in the specifications.

### **Assessment Contribution**

This assignment contributes 15% of the total assessment of this course.

### **Regulation on collaboration**

This assignment is to be carried out in a group of 1-4 students. Any part submitted by a group for the evaluation must not be the same or similar to others. Declaration must be done on the assignment cover sheet as appended. However, you may discuss with other groups the general strategy in implementing the algorithm. Any components that are submitted by a group must be different. If any of the components are similar, all involved (including group who is negligent that causes their work to be stolen) will be given 0 (zero) mark.

### **Assignment Schedule**

Weeks (Minggu) 11-12: Specification (i)

Weeks (Minggu) 12-13: Specification (ii)

Weeks (Minggu) 14-15: Testing/Report Preparation/discussion

### **Point of Submission:**

All submissions must be made through e-learning portal and to be submitted by the group leader.

Group formation and Declaration by **21/6/23 11.59 pm**: Please use the appended group formation and Declaration Form

Final Submission by **9/7/23 11.59 pm**:

Assignment Cover Sheet and Declaration: Please use the appended Assignment Cover Sheet

Final report inclusive of the source code and output/screenshots