

CSCI2100C 2019-20: Assignment 4 Part 2*

This assignment is due at 11:59:59pm, 5th May 2020.

- **Q1. [38 marks]** Consider the directed graph G_1 as shown in Figure 1. Answer the following questions.

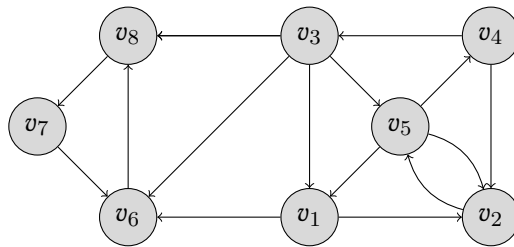


Figure 1. Directed graph for Q1

- (i). [4 marks] Calculate the out-degree of v_3 and the in-degree of v_8 . (Refer to CSCI2100C-Lecture22 Page 11)
- (ii). [8 marks] For G_1 , show both its adjacency list representation and its adjacency matrix representation. (Refer to CSCI2100C-Lecture22 Pages 17-20)
- (iii). [10 marks] Traverse G_1 using breadth-first search with v_1 as the source, assuming that the out-neighbors of a node are visited in ascending order of ID. Show the process and the content of the queue Q step by step. You may use 0 to denote the color to be white, 1 to denote the color to be gray, and 2 to denote the color to be black. (Refer to CSCI2100C-Lecture22 Pages 24-28)
- (iv). [8 marks] According to the results of Part (iii), show the contents of **minlength** array and **prev** array respectively. (Refer to CSCI2100C-Lecture22 Pages 34-35)
- (v). [4 marks] Show how to get the minimum length path from the source v_1 to v_4 using the **minlength** array and **prev** array. Justify your answer.
- (vi). [4 marks] Draw the BFS tree. (Refer to CSCI2100C-Lecture22 Page 36)

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- **Q2. [26 marks]** A directed graph G_2 is shown in Figure 2. Assume that we use depth-first search (DFS) to check if G_2 is a DAG and the permutation of nodes to do DFS on G_2 is $(v_2, v_3, v_4, v_5, v_6, v_1, v_7)$. During a DFS traversal, assume that the out-neighbors of a node are visited in ascending order of ID. Answer the following questions.

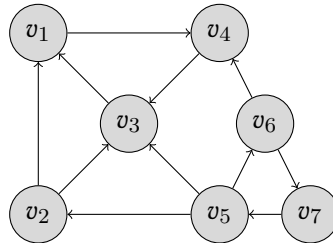


Figure 2. Directed Graph G_2 for Q2

- (i). [7 marks] Show the first discovery time and finish time of each node. (Refer to CSCI2100C-Lecture24 Pages 5-6)
- (ii). [4 marks] Draw the DFS trees. (Refer to CSCI2100C-Lecture24 Page 7)
- (iii). [11 marks] Classify edges according to the interval of each node derived from Part (i). You should explicitly output the type of each edge. Justify your answer. (Refer to CSCI2100C-Lecture24 Page 8)
- (iv). [4 marks] Show why G_2 is (or is not) a DAG using the results in Part (iii). Justify your answer. (Refer to CSCI2100C-Lecture24 Page 11)