Missouri University of Science & Technology — Department of Computer Science
**Spring 2023** — **CS 2500: Algorithms (Sec: 102)**

**Solutions to Homework 4**

**Instructor:** *Sid Nadendla* — **Due:** *April 24, 2023*

# Problem 1: Graph Traversal

1. Demonstrate both breadth-first search (BFS) and depth-first search (DFS) algorithms (with $v_1$ as the start node) on the unweighted, undirected graph shown in Figure 1. Clearly show how each node-attribute (including frontier) changes in each iteration in both the algorithms. (*20 points*)

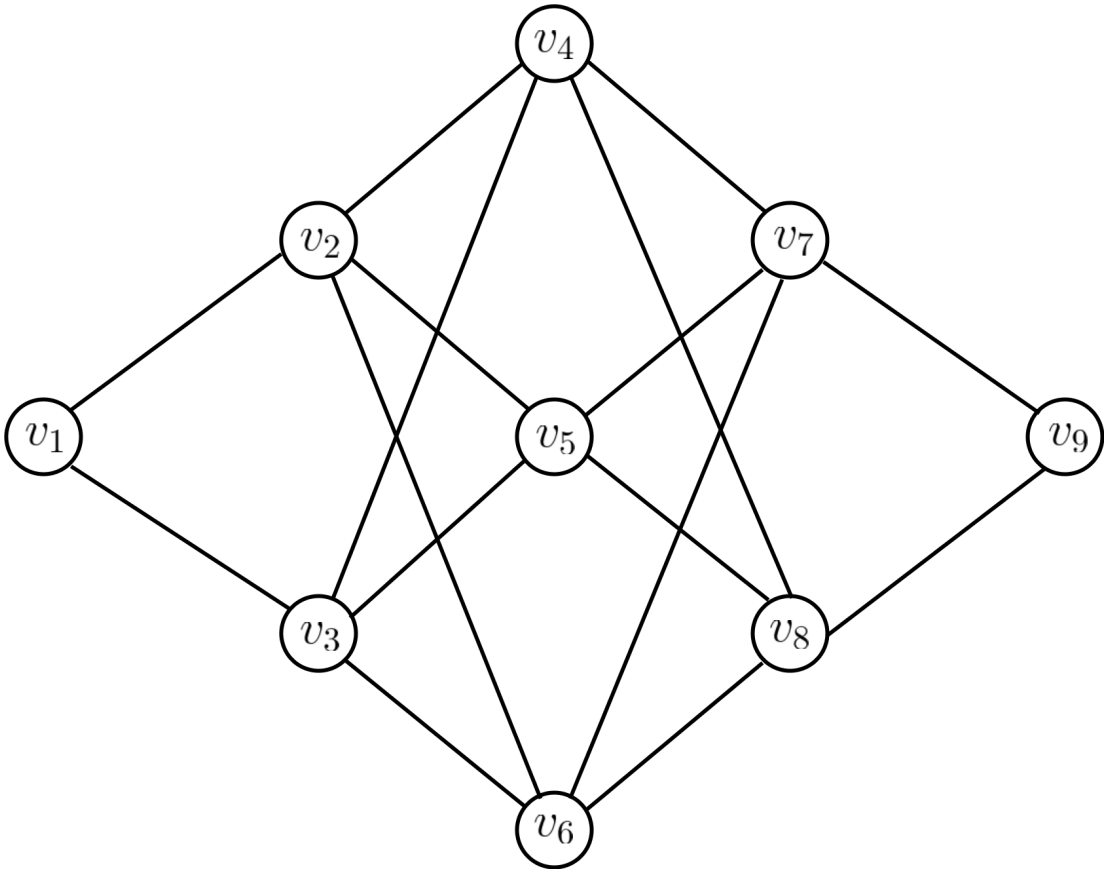
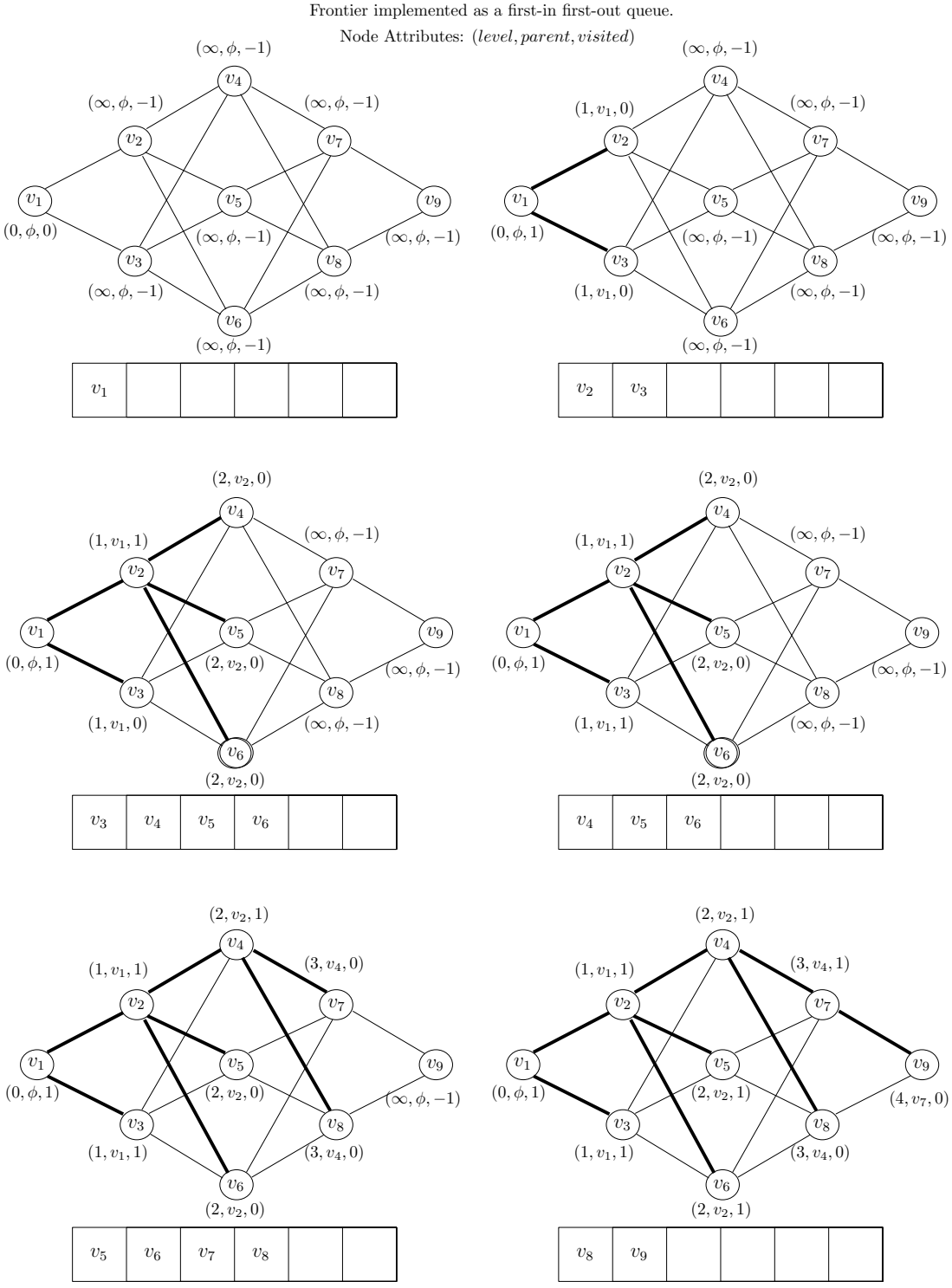


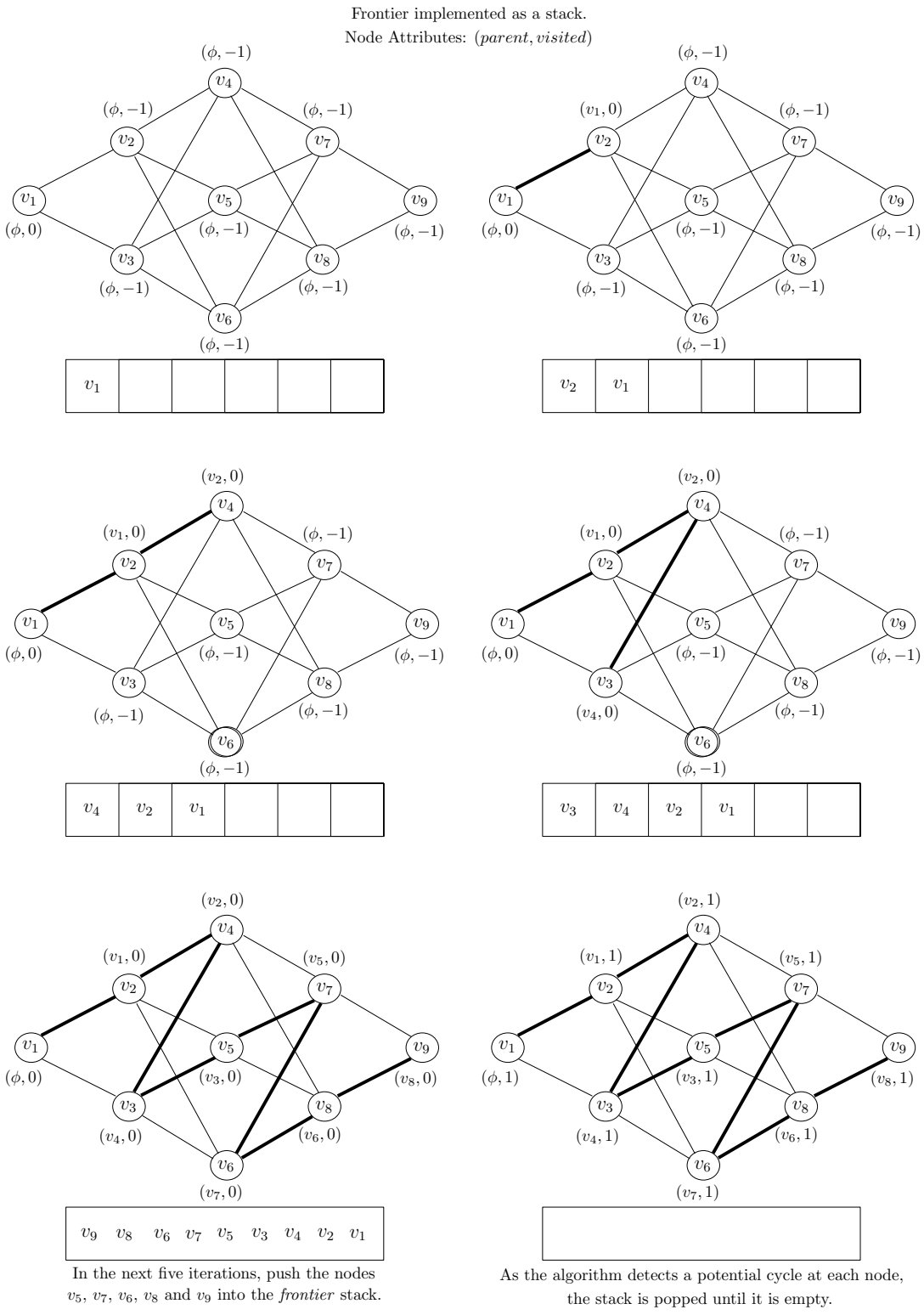

Figure 1: Example Graph for Search Algorithms

**Solution:** Please turn over to the next page.

(a) **Breadth-First Search (BFS):** Following is the step-by-step workflow of BFS in the context of the given example:

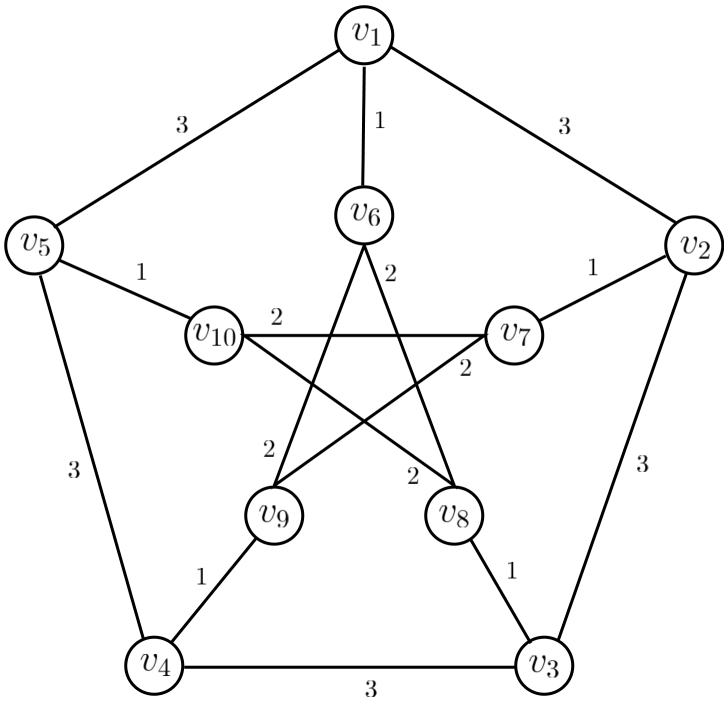


(b) **Depth-First Search (DFS):** Following is the step-by-step workflow of DFS in the context of the given example:



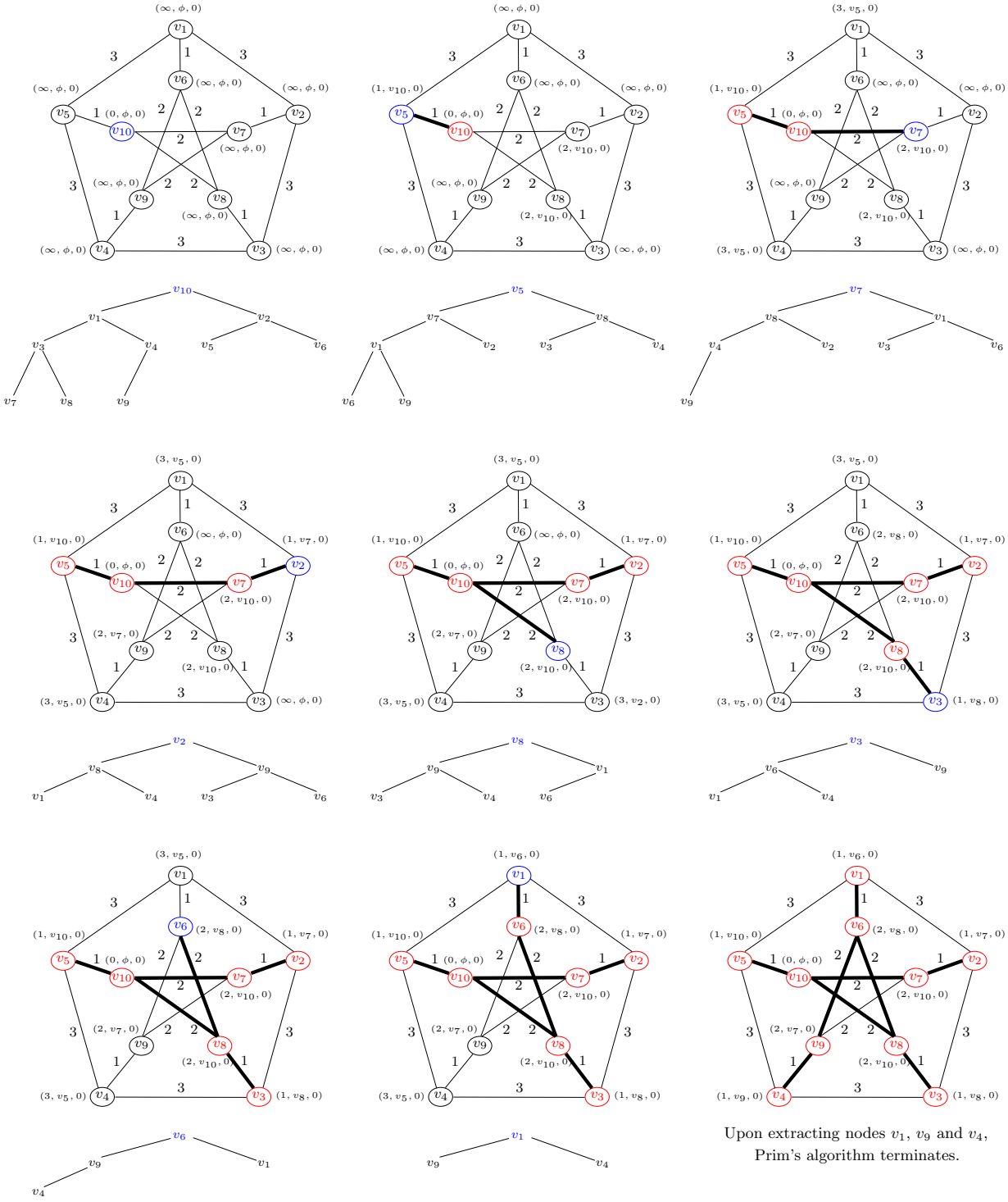
# Problem 2: Minimum Spanning Trees *50 points*

1. Demonstrate Prim's algorithm (with vertex $v_{10}$ as the start node) for the Petersen graph shown in Figure 2. (*20 points*)




**Solution:**

Min. priority queue implemented using min. heaps.
Node Attributes: $(key, parent, adj\_count)$



Upon extracting nodes $v_1$, $v_9$ and $v_4$, Prim's algorithm terminates.