Master Networks-IoT.
Operations Research.

Quiz
October 2022

In the following, we consider that the number of edges (resp. arcs) in an undirected (resp. directed) graph is m, and the number of vertices is n.

1. Consider an undirected graph with n vertices. Assume that the graph is connected. What are the minumum and maximum numbers of edges, respectively, that the graph could have?

   A) $n-1$ and $\frac{n(n-1)}{2}$
   B) $n-1$ and n^2
   C) n and 2^n
   D) n and n^n

   Solution: A

2. How many edges does a tree with n vertices contain?

   A) n
   B) $n-1$
   C) It depends on the trees
   D) $\frac{n(n-1)}{2}$

   Solution: B

3. We consider two algorithms A and B solving the same problem on a graph G. A is in $O(n+m)$ and B is in $O(n \log n)$. Which algorithm to use if G is a tree?

   A) Algorithm A
   B) Algorithm B

   Solution: A

4. We consider two algorithms A and B solving the same problem on a graph G. A is in $O(n+m)$ and B is in $O(n \log n)$. Which algorithm to use if G is a complete graph?

   A) Algorithm A

B) Algorithm B

Solution: B

5. How much space does the adjacency list representation of a graph require?

   A) $O(n)$
   B) $O(m)$
   C) $O(n+m)$
   D) $O(n^2)$

   Solution: C

6. How much space does the adjacency matrix of a graph require?

   A) $O(n)$
   B) $O(m)$
   C) $O(n+m)$
   D) $O(n^2)$

   Solution: D

7. What is the time complexity of a graph search algorithm (choose the most accurate possible answer)?

   A) $O(n^2)$
   B) $O(m)$
   C) $O(n+m)$

   Solution: C

8. In the graph G_1, what is $\{A, B\}$?

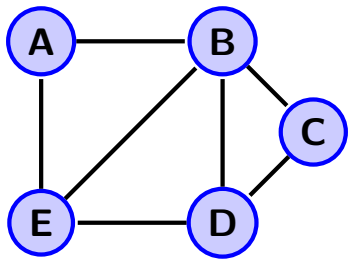

Figure 1: Graph G_1.

   A) an arc

B) an edge

C) a path

Solution: B

9. In the graph G_2, propose the list of explored nodes in BFS order starting from E?

   Solution: (E, A, B, C, D) **or** (E, B, A, C, D)

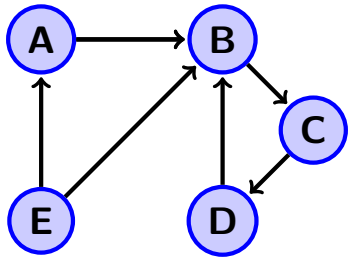

Figure 2: Graph G_2.

10. In the graph G_2, propose a list of explored nodes in DFS order starting from E.

    Solution: (E, A, B, C, D) **or** (E, B, C, D, A)

11. In the graph G_2, the number of strongly connected components is:

    A) 1

    B) 2

    C) 3

    D) 5

    Solution: C

12. In the graph G_2, the number of connected components is:

    A) 1

    B) 2

    C) 3

    D) 5

    Solution: A

13. Consider a undirected graph G represented by an adjacency matrix. Given a vertex v, how many operations are required to identify the edges incident to v?

A) $O(1)$

B) $O(k)$ where k is the degree of v

C) $O(n)$

D) $O(m)$

Solution: C

14. Consider a directed connected graph G represented by adjacency lists (each storing the outgoing arcs of a vertex). Given a vertex v, how many operations are required to identify the incoming arcs of v?

A) $O(1)$

B) $O(k)$ where k is the degree of v

C) $O(n)$

D) $O(m)$

Solution: D