Graded Assignment 4

Q1) For a directed acyclic graph G with n nodes and m edges, what is the asymptotic complexity of efficient algorithms for topological sorting of G , using adjacency matrix and adjacency list representations, respectively?
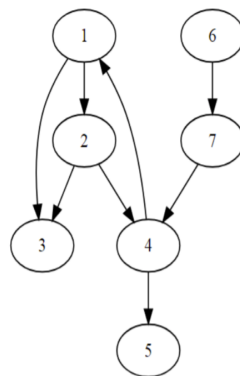
A1) $O(n^2)$, $O(n+m)$

Q2) The total number of edges that a complete undirected graph with n vertices can have is _____

[A complete graph is a simple undirected graph in which every pair of vertices is connected by a unique edge.]

A2) n(n-1)/2

Q3) In the given directed graph, removing one edge e makes it a directed acyclic graph. Which of the following can be the possible values of e ?


A3)

- ☑ 2 -> 4
- ☑ 4 -> 1
- ☑ 1 -> 2

Q4) Given below is a function for traversing the graph using BFS(breadth-first search). For which of the following graphs will the function BFS_adjList(vertices, AList) always traverse the complete graph?

```
# _ list of vertices of graph 'G', and  .
#  .st represetation of graph 'G'.
#  .ue is a data structure, that has two methods 'enQueue(x)' .
#  .queue()' to add and remove(respectively)
#  elements from Queue in 'First in First out' manner.
# 'isEmpty()' method return True if Queue is empty, False otherwise.

def BFS_adjList(vertices, AList):
    BFSList = []
    q = myQueue()
    visited = {v:0 for v in vertices}
    q.enQueue(vertices[0])

    while not q.isEmpty():
        v = q.deQueue()
        if not visited[v]:
            BFSList.append(v)
            for i in AList[v]:
                if(not visited[i]):
                    q.enQueue(i)
            visited[v]=1
```

A4) Connected undirected graphs.

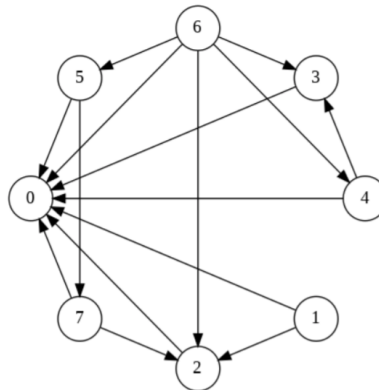Q5) Select all the possible topological sorted sequence(s) for the graph given below.
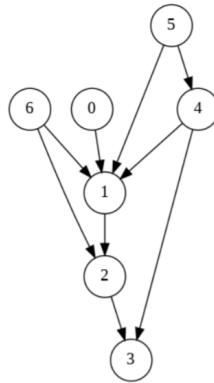
A5)

- ☑ 0, 5, 4, 6, 1, 2, 3
- ☑ 5, 6, 4, 0, 1, 2, 3
- ☑ 6, 0, 5, 4, 1, 2, 3
- ☑ 6, 5, 4, 0, 1, 2, 3

Q6) Which of the following graph can be sorted using topological sort?

A6)

Q7) Consider a directed graph G with 90 edges with the least number of vertices possible. What will be the number of vertices in graph G

A7) 10

Q8) We want to represent the graph G mentioned in previous question, in memory either as an Adjacency matrix or Adjacency list. Assume that each cell in the adjacency matrix takes 4 bytes of memory and each edge representation in the adjacency list occupies 8 bytes of memory(you can ignore all other factors that occupy memory). What will be the amount of memory required to represent graph G using Adjacency matrix and Adjacency List respectively? (This is follow

up question for question 7)

A8) 400 bytes, 720 bytes

Q9)

I: BFS can be used to find the shortest path between two vertices in an unweighted graph.

II: DFS can be used to find the shortest path between two vertices in an unweighted graph.

Which of the following options is correct?

A9) I is true, II is false.

Q10) An undirected graph G has 17 vertices. The sum of the degrees of all the vertices in G is D. The number of vertices of even degree in G is K, Which of these values are possible for D and K?

A10) D = 42, K = 9