C.1 - CSC A48 – Quiz # 3

Please ***read each question very carefully***, and consider your answer before marking it down on the answer sheet. ***You should avoid erasing, making multiple answers, or scratching over answers*** as it will cause the marking software to make mistakes on your quiz.

1.- Which of the following statements about ***graphs*** is ***not true*****:**

a) Directed graphs can have links going from one node to the same node
b) Un-directed graphs have the shortest loops
c) An un-directed graph can not be used to represent a directed graph in general
d) Any graph problem can be represented using a directed graph
e) In the worst case, a directed graph will require more storage space than an un-directed graph with the same number of nodes when we store them as adjacency lists.

2.- Which of the following statements is not correct:

a) The ***out-degree*** *is the number of neighbors linked to a node by out-going edges*
b) In the worst case (largest possible number of edges), the sum of the ***degrees*** *of all the nodes in a graph is of order* ***O(N)***
c) ***DFS*** *has a complexity of* ***O(N)***
d) Copying an adjacency matrix is ***$O(N^2)$***
e) *A node with no edges is also a graph*

3.- Consider the following algorithm for working with a graph, and determine its worst-case complexity. ***N*** *is the number of nodes,* ***M*** *is the number of edges. We count how many linked list nodes are checked.*

```
AdjMatrix <-- AdjList
        * For every entry j in the adjacency list
        * Traverse the linked list at index j of the adjacency list, and for each node in it
                set AdjMat[i][j]=1,   set AdjMat[j][i]=1
```

a) O(M Log N) *b) $O(N^2)$* *c) $O(M^2)$* *d) O(N*M)* *e) O(M)*

4.- The following statement is ***true*** *regarding the algorithm above (in question 3)*

a) The average-case complexity is the same as the worst case complexity
*b) The average-case complexity is O(N*M)*
c) The average-case complexity is O(M Log N)
d) The best case complexity is O(N)
e) The average case complexity is $O(N^2)$

5.- You're writing an application for robotic cleanup company. They want to build a graph of the University so their robots can clean the floor overnight. Buildings appear as nodes connected by edges to each other, and each building is also connected to nodes representing floors, floors are linked to nodes representing rooms. What would be a suitable representation for this graph?

a*) An* ***adjacency list*** where nodes represent rooms, and un-directed edges connect them
b*) An* ***adjacency list*** with one entry for each building, floor, or room
c*) An* ***adjacency matrix*** with one row for each building, floor, or room
d*)* Either of a) or b)
e) Either of b) or c)

6.- You found a question on Stack Overflow: Someone implementing merge-sort for very large arrays found that their solution causes (what else!) a ***stack overflow!*** *But you know this shouldn't happen with merge-sort, and the programmer is careful not to pass arrays or subarrays in recursive calls. What could be causing this problem?*

a) The array has duplicate elements

b) The program is using the wrong splitting rule

c) The array is 10 million entries long

d) The array is a floating point array

e) The merging step is using too much memory

7.- What is the ***order of the maximum length*** *of a path in any graph with N nodes*?

*a) O(N*M)* *b) O(M)* *c) O(M Log N)* *d) $O(N^2)$* *e) O(N)*

8.- One of the statements below is ***true*** *regarding Tail Recursion*

a) It can involve multiple recursive calls ***in the same function*** *(e.g. tree traversal)*

b) It results in longer, more complex code

c) It requires more storage stack space

d) It reduces algorithm complexity

e) It allows us to handle much larger recursive problems

9.- A problem that is well suited for a recursive solution ***doesn't have*** *one of the properties below*

a) It can appear in many sizes, each of which is the same kind of problem

b) It can be broken into smaller chunks

c) It naturally leads to a recursive formulation

d) It always involves linked data structures

e) It can have multiple base cases

10.- Which of the problems below is ***not*** *well suited for a solution with* ***loops***

a) Drawing trees and plants

b) Copying a graph stored in an adj. matrix

c) Counting words in a linked list

d) Amino-acid sequence alignment

e) Matrix multiplication