Exam	Semester 2
Module: Advanced algo & complexity	**Class L2**
Professor : T. Abdellatif	**Date:** 15/05/2024
NOT authorized Documents	**Duration:** 1h30

Exercise 1 : Multiple-choice quiz (10 pts)

1. What is the purpose of Java collections?
   a. A) To provide a way to store and manipulate groups of objects.
   b. B) To provide a way to perform mathematical operations.
   c. C) To provide a way to perform file I/O operations.
   d. D) To provide a way to manage database connections.
2. Which of the following interfaces does not extend the Collection interface in Java?
   a. A) List
   b. B) Set
   c. C) Map
   d. D) Queue
3. Which collection class in Java does not allow duplicate elements?
   a. A) ArrayList
   b. B) HashSet
   c. C) LinkedList
   d. D) TreeMap
4. What is the purpose of the Iterator interface in Java collections?
   a. A) It allows bidirectional traversal of elements in a collection.
   b. B) It allows sequential access to elements in a collection.
   c. C) It allows random access to elements in a collection.
   d. D) It allows parallel processing of elements in a collection.
5. Which of the following statements about ArrayList and LinkedList is true?
   a. A) ArrayList is implemented as a linked list.
   b. B) LinkedList is more memory-efficient than ArrayList.
   c. C) ArrayList supports constant-time random access to elements.
   d. D) LinkedList supports dynamic resizing of the underlying array.
6. Which collection class in Java maintains the elements in sorted order?
   a. A) HashSet
   b. B) LinkedHashMap
   c. C) PriorityQueue
   d. D) TreeSet
7. What is the time complexity of the contains() method in HashSet and TreeSet?
   a. A) O(1) for HashSet, O(log n) for TreeSet
   b. B) O(log n) for HashSet, O(1) for TreeSet
   c. C) O(n) for both HashSet and TreeSet
   d. D) O(n log n) for both HashSet and TreeSet
8. What is the purpose of the toArray() method in Java collections?
   a. A) It converts an array to a collection.
   b. B) It converts a collection to an array.
   c. C) It sorts the elements of a collection.
   d. D) It removes all elements from a collection.
9. What does the add() method return in the List interface?
   a. A) The index at which the element was added.
   b. B) The element that was added.
   c. C) True if the element was added successfully, false otherwise.
   d. D) The size of the list after adding the element.
10. Which collection class is best suited for implementing a stack in Java?
    a. A) ArrayList
    b. B) LinkedList
    c. C) HashSet
    d. D) TreeMap

Exercise 2 : Graphs (10 pts)

1. Consider the following graph. Which kind of graph is it ? directed/undirected/weighted ? cyclic/acyclic?

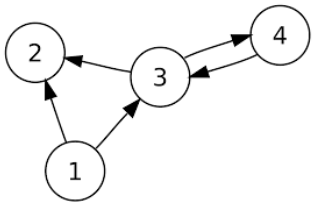

Figure 1. A Graph example

2. Complete the code where '**TODO**' is indicated inside the following methods: the constructor, addEdge and BFS in the following Graph class code :

```
import java.util.*;
// This class represents a directed graph using adjacency list representation
class Graph<T> {
   // No. of vertices
   private int V;
   // Adjacency Lists
   private LinkedList<T>[] adj;
   // Constructor
   public Graph(int v) {
//TODO   }
   // Function to add an edge into the graph
  public void addEdge(int v, T w) {
   //TODO }
   // prints BFS traversal from a given source s
  public void BFS(int s) {
  // TODO        }  }}}}
```

3. Test the code in a Java Main program using the Graph of Figure1 as example and indicate the displayed data.