

UNIVERSITI TUNKU ABDUL RAHMAN
ACADEMIC YEAR 2018/2019
UECS2083/UECS2413
PROBLEM SOLVING WITH DATA STRUCTURES AND ALGORITHMS
MID-TERM TEST MARKING SCHEME

FRIDAY, 20 JULY 2018

TIME: 2:30 PM – 3:30PM (1 hour)

Q1. (a)

```
public static int gcd(int x, int y) {  
    if(x < y)  
        return gcd(y, x);           //2 marks  
    else if(y == 0)  
        return x;                   //2 marks  
    else  
        return gcd(y, x % y);       //2 marks  
}
```

 (6 marks)

- b) (i) There are two method calls to the `gcd()` method within the body of the `gcd()` method. These self-calls allow us to identify the method as recursive. (2 marks)
- (ii) By convention, the base case(s) stops the recursive method from calling itself infinitely. In the recursive method constructed in part (a), the base case is when `y` is equal to 0. It provides a path through which control can flow without calling `gcd()` again. In the method above, the block simply returns an integer value `x`. (2 marks)

Q2. The program will work if the method header in lines 12 is as follows:

```
public static <T> void add(List<T> list1, List<? super T> list2)
```

OR

```
public static <T> void add(List<? extends T> list1, List<T> list2)
```

(4 marks)

Q3. (a) LinkedList (b) LinkedHashSet (b) Map
(2 marks × 3, total: 6 marks)

Q4. The Java Collections Framework supports three types of collections, named *sets*, *lists*, and *maps*.

Lists: A list can not only store duplicate elements, but can also allow the user to specify where the element is stored. The user can access the element by index. Java Collections Framework supports two types of list, named `ArrayList` and `LinkedList`. [3]

Sets: A set stores non-duplicate elements. No index number assigned for elements; the user cannot access element by index. Java Collections Framework supports three types of set, named `HashSet`, `LinkedHashSet` and `TreeSet`. [3]

Maps: The Map interface maps keys to the elements. The keys are like indexes. In List, the indexes are integer. In Map, the keys can be any objects. Java Collections Framework supports three types of set, named `HashMap`, `LinkedHashMap` and `TreeMap`. [4]

(total: 10 marks)

UECS2083/UECS2413 – Mid-Term TestQ5. `import java.util.*;`

```

public class TestLinkedList {
    public static void main(String[] args) {
        LinkedList<Integer> list =
            new LinkedList<Integer> ( Arrays.asList (
                2, 4, 7, 10, 11, 45, 50, 50, 59, 60, 66) );           //[2]

        System.out.println("The occurrence of 50 is: " +
            findOccurrence(list, 50) + "\n");                      //[1]
        print(list);                                                //[1]
    }

    public static int findOccurrence(List<Integer> list, int n) {
        int count = 0;                                             //[½]
        for(Iterator it = list.iterator(); it.hasNext(); )        //[2]
            if(it.next() == n)
                count++;                                           //[1]
        return count;                                              //[½]
    }

    public static void print(List<Integer> list) {
        for(int e:list)
            System.out.print(e + "\t");
        System.out.println("");
    }                                                                //[2]
}

```

(total: 10 marks)

Q6. (a) Throw an exception for unsupported operation:

```

public void add(int index, E e) {
    throw new UnsupportedOperationException("Method is not supported");
}

```

(4 marks)

(b) A new element is added *at the correct spot* in this list:

```

public void add(E e) {
    if(size() == 0)
        super.add(0, e);                                           //[2]
    else {
        int i = 0;                                                  //[1]

        while(get(i).compareTo(e) < 0)
            i++;                                                    //[2]

        super.add(i, e);                                           //[1]
    }
}

```

(6 marks)