كلية التقنية الإلكترونية /طرابلس

الإمتحان النهائى لمادة تراكيب بيانات/ الفصل الدراسى 2019

رقم القيد:..... الإسم:.....

1.(10 pts)

a) **Big-Oh and Run Time Analysis:** Describe the worst case running time of the following pseudo code functions in Big-Oh notation in terms of the variable n. ***Showing your work is not required*** (don't spend a lot of time showing your work.). You MUST choose your answer from the following (not given in any particular order), each of which could be re-used (could be the answer for more than one of I. – IV.):

$O(n^2)$, $O(n^3 \log^n)$, $O(n \log^n)$, $O(^n)$, $O(n^2 \log^n)$, $O(n^5)$, $O(2^n)$, $O(n^3)$, $O(\log^n)$, $O(1)$, $O(n^4)$, $O(n^n)$, $O(n^6)$, $O(n^8)$, $O(n^7)$

```
I. int happy (int n, int m) {
     if (n < 10) return n;
       else if (n < 100)
       return happy (n - 2, m);
     else
       return happy (n/2, m);
   }
```

```
II. void sunny (int n) {
    j = 0;
    while (j < n) {
      for (int i = 0; i < n; ++i) {
        System.out.println("i = " + i);
        for (int k = 0; k < i; ++k)
        System.out.println("k = " + k);
       }
      j = j + 1;
    }
  }
```

```
III. void smiley (int n) {
for (int i = 0; i < n * n; ++i) {
for (int k = 0; k < i; ++k)
System.out.println("k = " + k);
for (int j = n; j > 0; j--)
Syastem.out.println("j = " + j);
}
}
```

```
IV. void funny (int n, int x) {
for (int k = 0; k < 100; ++k)
if (x > 500) {
for (int i = 0; i < n * k; ++i)
for (int j = 0; j < n; ++j)
System.out.println("x = " + x);
}
}
```

b) Convert the infix expression " 2+1-(4-3*1)*3 " to its postfix expression. Your tracing showing in to the following table

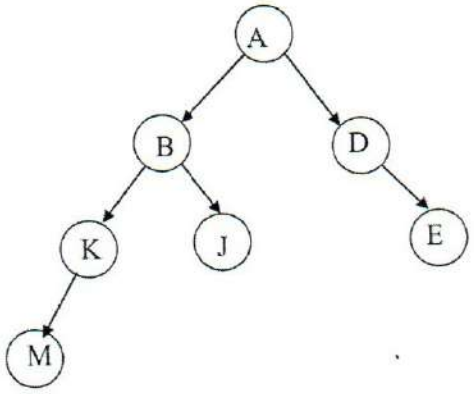
Input	Stack content(bottom to top	output

2. (14 pts total) **Trees**.

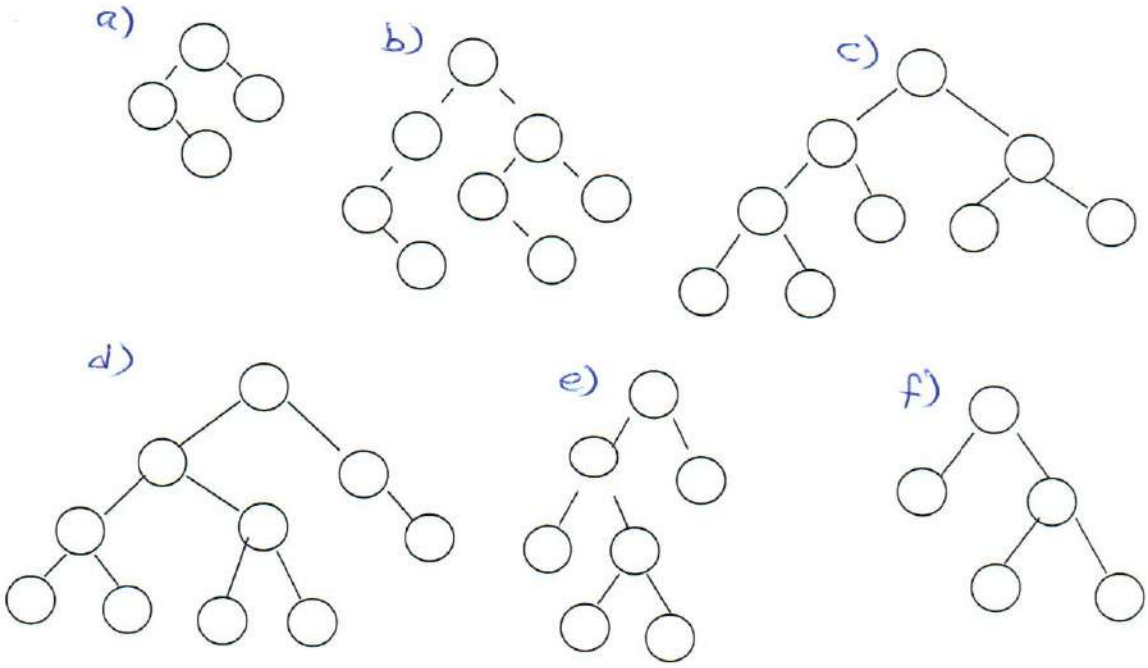
a) (4 pts) What is the minimum and maximum number of **leaf** nodes in a **complete tree of height ?** (Hint: the height of a tree consisting of a single node is 0) ***Give an exact number*** (with no exponents) for both of your answers – not a formula.

b) (2 pts) What is the maximum number of **leaf** nodes in a **full tree of height ?** ***Give an exact number*** (with no exponents) for your answer – not a formula.

I) (1 pt) What is the **depth** of node K in the tree shown below:
II) (1 pt) Give a Pre-Order traversal of the tree shown below:



c) (6 pts) Given the following six trees a through f:



List the letters of all of the trees that have the following properties: (Note: It is possible that none
of the trees above have the given property, it is also possible that some trees have more than one
of the following properties.)

Complete: _____

Full: _____

d)(2 pts) Given a binary search tree, print all of the odd values from largest to smallest. Be specific about how you would get values in order from largest to smallest.

Explanation:

3. (8 pts) **Binary Min Heaps**

(a) (6 pt) Draw the binary min heap that results from inserting the integers: 7, 5, 6, 3, 8, 1 in that order into an initially empty binary min heap.. *You do not need to show the array representation of the heap*. You are only required to show the final tree, although drawing intermediate trees may result in partial credit. If you draw intermediate trees, please **circle your final result** for any credit.

(b) (2 pts) Draw the result of one delete min call on your heap drawn at the end of part (a).

4. (12 pts)

1. On which principle does stack work?
A. FILO B. FIFO
C. LILO D. Both a and c above

2. Can linked list be implemented using arrays?
A. Yes
B. No

3. Two dimensional arrays are also called
A. tables arrays B. matrix arrays
C. both of above D. none of above

4. Which of the following statements hold true for binary trees?
A. The left subtree of a node contains only nodes with keys less than the node's key .
B. The right subtree of a node contains only nodes with keys greater than the node's key.
C. Both a and b above
D. Both left and right subtree nodes contains only nodes with keys less than the node's key

5. Which of the following linked list below have last node of the list pointing to the first node?
A. circular doubly linked list B. circular linked list C. circular singly linked list
D. doubly linked list

6. Items in a priority queue are entered in a _____
A. random B. order of priority C. as and when they cc
D. none of the above

7. An empty list is the one which has no
A. nodes
B. data
C. both a and b above
D. address

8. Which data structure allows deleting data elements from front and inserting at rear?
a. Stacks b. Queues c. Deques d. Binary search tree

9. The post order traversal of a binary tree is DEBFCA. Find out the pre order traversal
a. ABFCDE b. ADBFEC c. ABDECF d. ABDCEF

10. Which of the following sorting algorithm is of divide-and-conquer type?
a. Bubble sort b. Insertion sort c. Quick sort d. All of above

11. An algorithm that calls itself directly or indirectly is known as
a. Sub algorithm b. Recursion c. Polish notation d. Traversal algorithm

12. Linked lists are best suited
a. for relatively permanent collections of data
b. for the size of the structure and the data in the structure are constantly changing
c. for both of above situation d. for none of above situation

5.(6 pts) In the following questions, consider the list of numbers:
62, 31, 70, 91, 25, 11, 9, 61, 73, 6. (20 points)
1. Show the result of inserting the numbers in the list in the same order specified above into an initially empty minimum heap. Note that you need to show how the heap looks like after each number is inserted. (3 points)

2. Show the result of inserting the numbers in the list in the same order specified above into an initially empty binary search tree. Note that you need to show how the binary search tree looks like after each number is inserted. (3 points)

6. (a Show the result of quick sort algorithm in the list in the same order specified below. Note that you need to show how the algorithm looks like after each step:

27	38	12	39	27	16

b)Show the result of merge sort algorithm in the list in the same order specified below. Note that you need to show how the algorithm looks like after each step:

38	16	27	39	12	27