# UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, DEC 2014

COURSE NO : **CE 267**
COURSE NAME: **DATA STRUCTURES AND ALGORITHMS**
CLASS : **CE II** TIME: **3 HOURS**

Name**:** _____ Index Number: _____

INSTRUCTIONS: *Attempt **All** questions. Section A carries 15 marks, sections B carries 10 marks and section C carries 35 marks.*

***Section A*** ***(15 marks)***

1. In a queue, insertion takes place at one end called the …… while deletion takes place at the other end called the ……
2. Dequeuing means …… **……**
3. FIFO and LIFO principles are applied in the …… and …… data structures respectively
4. A queue data structure is empty if head[Q]=…….
5. Popping and pushing apply to the ……. Data structure(s) ……
6. If **Top[S]=0** for a stack, then …….?
7. A binary tree of height 5 has …… nodes
8. The difference between a binary tree and a binary heap is ……
   ……
9. The minimum heap property states that ……..**.....**
   ……..
10. Given the index *i* of a node of a binary heap, the index of its right child: RIGHT (*i*), is given by ……
11. The degree of a directed graph is given as the sum of …….. And ……
12. Self-loops are not allowed in …… graphs
13. The adjacency relationship in an undirected graph is ……..
14. Two common methods of creating hash functions are ……..... and ……
15. A problem must exhibit …….. and …….. for dynamic programming to be applicable.

***Section B (10 marks)***

1. Entries in a stack are "ordered". What is the meaning of this statement?
   A. A collection of Stacks can be sorted.
   B. Stack entries may be compared with the '<' operation.
   C. The entries must be stored in a linked list.
   D. There is a first entry, a second entry, and so on.

2. Which of the following stack operations could result in stack underflow?
   A. is_empty B. pop
   C. push D. Two or more of the above answers

3. Which of the following applications may use a stack?
   A. A parentheses balancing program.
   B. Keeping track of local variables at run time.
   C. Syntax analyzer for a compiler.
   D. All of the above.

4. If the characters 'D', 'C', 'B', 'A' are placed in a queue (in that order), and then removed one at a time, in what order will they be removed?
   A. ABCD B. ABDC
   C. DCAB D. DCBA

5. A . . . . . of order k has $2^k$ nodes.
   a) Binary tree b) graph
   c) binomial heap d) binomial tree

6. The binary representation of the number of nodes of a binomial heap is 1101. Which of the following statements is true about the binomial heap?
   a) The binomial heap has 3 trees with orders 0, 2, 3.
   b) The binomial heap has 2 trees with orders 1, 2, 5.
   c) The binomial heap has 1 trees with orders 0, 2, 5.
   d) The binomial heap has 2 trees with orders 0, 2, 3.

7. In Fibonacci heaps, what is the condition that a given node y is an only child?
   a) if left (y)=right(y)=0; b) if left(y)=right(y)=y;
   c) if left(y)=0; d) if right (y)=0;

8. During the operation of a DFS algorithm, if it finds out that the current vertex has been visited, then. ..
   a) it paints it gray b) it paints it black
   c) It ends the operation d) It backtracks.

In the figure below, DFS has visited nodes 1,2 and 3 in that order.

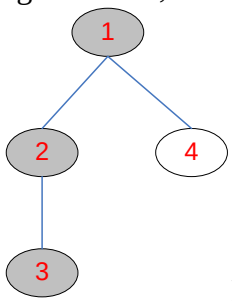


**Figure 1**

9. To which node will DFS move immediately after it visits node 3?
   a) to the node marked 1 b) to the node marked 4
   c) The algorithm will end its operation on node 3 d) The algorithm backtracks to node 2.

10. The minimum spanning tree idea may be applied for interconnecting nodes in electronic circuitry and computer networks to:

a) maximize cost; b) to minimize cost

c) To increase efficiency in performance d) To minimize faults;

***Section C (35 marks)***

1. Adjacency matrix of a graph is given below:

| | A | B | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|
| **A** | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **B** | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| **D** | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **E** | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| **F** | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **G** | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| **H** | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| **I** | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| **J** | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |

a) Draw the graph.

b) What is the corresponding incidence matrix of this graph?

c) A pre-order traversal of a binary tree produces the outcome:8,5,9,7,1,12,2,4,11,3. The in-order traversal of the same tree produces: 9, 5, 1, 7, 2, 12, 8, 4, 3, 11.

i. Draw the structure of this binary tree

ii. Write the order of nodes of this binary tree when visited in post-order traversal [8 marks]

**Question 3:**

```
int main()
{
vector<int>vect;
int i,n,size;
cout<<"Enter size of Array";
cin>>size;
for(i=0;i<size;i++)
{
        cout<<"Enter Element\n";
        cin>>n;
        vect.push_back(n);
        if(n%2==0)
        vect.pop_back();
}

for(i=0;i<vect.size();i++)
{
                cout<<vect[i]<<" ";
}
        system("pause");
        return 0;
}
```

***Listing 1.***

i. Explain precisely the work done within the first *for-loop*;

ii. Write the output of this program if the following integers are entered by a user at runtime:
11 22 33 44 55 66 77 88 99