1. Which of the following are characteristics of object oriented programming?
   (a) reduction, extension, invocation
   (b) polyamory, interactability, process hiding
   (c) encapsulation, inheritance, polymorphism
   (d) syntical and semantical relations
   (e) None of the above

2. Which of the answers is the output from the following program?

   ```c
   int main()
   {
     stack<int> stackNums;
     int Item1, Item2, Item3;
     Item1 = 1;
     Item2 = 2;
     Item3 = 3;
     stackNums.push(Item2);
     stackNums.push(Item1);
     stackNums.push(Item1+Item2);
     Item2 = stackNums.top();
     stackNums.pop();
     stackNums.push(Item3*Item3);
     stackNums.push(Item2);
     stackNums.push(5);
     Item1 = stackNums.top();
     stackNums.pop();
     cout<<Item1<<" "<<Item2<<" "<<Item3<<endl;
     return 0;
   }
   ```

   (a) 1 2 3
   (b) 3 1 4
   (c) 5 3 3
   (d) 5 3 5
   (e) None of the above

3. In a binary search tree, when an internal node is deleted it is replaced with which node?
   (a) The right most node of the right subtree.
   (b) The root node.
   (c) The right most leaf of the left subtree.
   (d) The node directly below it.
   (e) The operation cannot be performed.
4. For the class definition,

```cpp
class stack
{
    public:
        stack();
        void push(int x);
        void pop(int& x);
        bool is_empty();
    private:
        node *TopOfStack;
}
```

which of the following is the body of the constructor code?

(a) initialize.stack();
(b) myqueue.stack() = NULL;
(c) TopOfStack = NULL;
(d) *TopOfStack = 0;
(e) not shown

5. For the following program,

```cpp
int samplefun(int& a, int b, int& c)
{
    b = 5 * a;
    a = -c + b;
    return c;
}

int main()
{
    int x, y, z;
    x = 2;
    y = 1;
    z = 0;
    x = samplefun(z, x, y);
    cout << "x = " << x << " y = " << y << " z = " << z << endl;
    return 0;
}
```

the output line printed is:

(a) x = 1; y = 1; z = 1
(b) x = 2; y = 0; z = 5
(c) x = 1; y = 1; z = -1
(d) x = -1; y = -1; z = -1
(e) x = 5; y = 2; z = 6
(f) none of the above
6. Which of the following is the postfix form that would be generated by the stack conversion algorithm of the infix expression: a * b - (c + d)?

(a) a b c d + - *
(b) a b * c d + -
(c) a b c - * d +
(d) a b c - d + *

7. Which of the following correctly relates a sort and its complexity

(a) Bubble – NlogN
(b) Insertion – N!
(c) Merge – NlogN
(d) Tempsort – NlogN
(e) Quicksort – N^2

8. The following program recursively finds the sum of an array.

```c
int sum(int IntArray[], int n)
{
    if (n == 0)
        return IntArray[0];
    else ___________________________________________;
}

int main()
{
    int IntArray[10] = {4, 3, 6, 7, 8, 3, 9, 1, 2, 4};
    cout << sum(IntArray, 9)<<endl;
    return 0;
}
```

Which of the following fills in the blank?

(a) IntArray[n] + sum(IntArray, n-1);
(b) return IntArray[1]
(c) return IntArray[n] + sum(IntArray, n-1);
(d) return IntArray[0] + sum(IntArray, n-1);
(e) none of the above

9. Which of the following is a program segment which implements an inorder traversal of a binary tree, printing the data as it visits each node?

(a) inorder(treePtr->left); inorder(treePtr->data); inorder(treePtr->right);
(b) for(i=0; i<treesize; i++)cout<< tree[i];
(c) inorder(treePtr->left); cout<<treePtr->data; inorder(treePtr->right);
(d) push(tree->left); cout<<pop(tree); push(tree->right);
(e) none of the above

10. Which of the following orders of complexity (big O) is in correct order of increasing complexity?

(a) N, logN, N^2, NlogN
(b) logN, N, NlogN, N^2
(c) N, logN, NlogN, N^2
(d) N, N^2, logN, NlogN
(e) none of the above
11. Which answer describes the use(s) of the following declaration?

```c
struct fooNode
{
    int fooData;
    fooNode* fooptr1;
    fooNode* fooptr2;
};
```

(a) linked list  
(b) doubly linked list  
(c) binary tree  
(d) b and c  
(e) none of the above

12. The following program computes the $n^{th}$ Fibonacci number where:

$$Fib(i) = Fib(n - 1) + Fib(n - 2)$$

and

$$Fib(1) = 1, Fib(2) = 1, Fib(3) = 2, Fib(4) = 3, Fib(5) = 5, Fib(6) = 8$$

```c
int Fib(int n)
{
    if (n <= 2)
        ______________;
    return (Fib(n-1)+ Fib(n-2));
}
```

Which of the following fills in the blank?

(a) return 0  
(b) return 1  
(c) return Fib(n-1)  
(d) return Fib(n+1)  
(e) none of the above