

SOFTWARE DIAGNOSTIC CPC

MAX MARKS: 50

Note: For all output/error questions, assume the required header files are included and standard gcc compiler is used.

Section A Basics of programming (12 marks)

1. Predict the output for the following program.

(+1, -0.5)

```
#define sqr(x) x*x
int main()
{
    int a=2;
    cout<<sqr(2+3);
}
```

- A) 11
- B) 25
- C) 13
- D) None of these

2. Predict the output of the following program.

(+1, -0.5)

```
int main()
{
    int x = 1 , y = 1;
    cout << ( ++x || ++y ) << endl;
    cout << x << " " << y;
    return 0;
}
```

- A) 1
2 2
- B) 1
1 1
- C) 1
1 1
- D) 1
1 2

3. What is the worst case time complexity of mergesort?

(+1, -0.5)

- A) $O(n \log n)$ B) $O(n^2)$ C) $O(n)$ D) None of these

4. In its worst case QuickSort behaves like-

(+1, -0.5)

- A) Insertion sort B) Selection sort C) Bubble sort D) Merge sort

5. Union can store _____ number of values at a time (+1, -0.5)
A) all its members B) only 1 C) Only 2 D) cannot hold value

6. If storage class is missing in the array definition, by default it will be taken to be _____. (+1, -0.5)

- A) Automatic
- B) External
- C) Static
- D) Either automatic or external depending on the place of occurrence

7. Consider the following C function (+1, -0.5)

```
int f(int n)
{
    static int i = 1;
    if (n >= 5)
        return n;
    n = n+i;
    i++;
    return f(n);
}
```

The value returned by f(1) is

- A) 5 B) 6 C) 7 D) None of these

8. The result of evaluating the postfix expression 5, 4, 6, +, *, 4, 9, 3, /, +, * is? (+1, -0.5)
A) 600 B) 650 C) 350 D) 588

9. Predict the output/find the error. Assume appropriate header files. (2)

```
int main()
{
    int a=2;
    int *b = &a;
    *b = *b + 2;
    ++*b;
    cout<<(a+3)<<" "<<++*b<<" ";
    a = a+ 10;
    cout<<a<<', '<<++a<<', '<<a++<<"\n";
}
```

10. What will be the value of fn(71,60)? (2)

```
int fn(int a, int b)
{
    while (a != b)
    {
        if (a > b)
            return fn(a - b, b);
        else
            return fn(a, b - a);
    }
    return a;
}
```

Section B
Data structures and algorithms
(25 marks)

Note: Marks will be awarded for correct and efficient code. A well written code with a better time and space complexity will fetch you more marks.

- 1) Write a function to generate all the prime numbers between 1 and the given input n. Your function should take as input an integer **N** and print all prime numbers between 1 and N (both inclusive). Function prototype is as follows: (5)

```
void print_primes(int N)
{
    //Definition here
}
```

Example input: 11

Expected output: 2 3 5 7 11

- 2) Write a function to reverse a singly linked list. Your function takes as argument a pointer to the head of the list to be reversed and returns the pointer to the reversed node. Function prototype as follows: (5)

```
node * reverse_list(node *head)
{
    //Definition here
}
```

Where node is defined as follows

```
struct node
{
    int data;
    node *next;
}
```

Example input list: 1->2->3->4->NULL

Expected modified list: 4->3->2->1->NULL

- 3) Write a function to delete a node in a singly linked list. **The function takes as input a pointer to the node to be deleted (NOT A POINTER TO THE HEAD).** Prototype is as follows: (7)

```
void delete_node(node ** delete_me)
{
    //Definition here
}
```

Example list:

1->2->3->4->5->NULL

If input to the function is pointer to node 3, the modified list must be

1->2->4->5->NULL

- 4) Write a function that takes as argument the pointer to the root of the tree and returns the height of the tree. Function prototype is as follows: (3)

```
int find_height(treenode *root)
{
    //Definition here
}
```

Where treenode is defined as follows

```
struct treenode
{
    int data;
    treenode *left;
    Treenode *right;
}
```

- 5) Write a **program** that takes as input two strings and prints whether the strings are anagrams of each other or not. Two strings are called anagrams if the characters in one string can be rearranged to generate the other one.

Example: "dormitory" and "dirty room" are anagrams

"abba" and "bbaaa" are not (2 a's in first but 3 a's in second)

Print "YES" if they two strings are anagrams and "NO" if they are not. (5)

Section C

Object oriented programming

(13 marks)

- 1) Answer the following questions briefly (4 * 2 = 8)

- Define an abstract class.
- What is an inline function?
- What is the difference between overloading and overriding?
- Define a copy constructor.

- 2) Write any two differences between structures and classes in C++. (1)

- 3) What will be the output of the following code:

(+2, -1)

```
class Base
{
    public:
    virtual void show() = 0;
};

int main(void)
{
    Base b;
    Base *bp;
    return 0;
}
```

- There are compiler errors in lines "Base b;" and "Base bp;"
- There is compiler error in line "Base b;"
- There is compiler error in line "Base bp;"
- No compiler Error

4) Choose the correct output

(+2, -1)

```
class Base1
{
public:
    ~Base1() { cout << " Base1's destructor" << endl; }
};
class Base2
{
public:
    ~Base2() { cout << " Base2's destructor" << endl; }
};
class Derived: public Base1, public Base2
{
public:
    ~Derived() { cout << " Derived's destructor" << endl; }
};

int main()
{
    Derived d;
    return 0;
}
```

- A) Base1's destructor
Base2's destructor
Derived's destructor
- B) Derived's destructor
Base2's destructor
Base1's destructor
- C) Derived's destructor
- D) Compile error

ALL THE BEST :)