

# Object Oriented Programming & Design - Monsoon 2023 Final Practice Questions

## Student's Details

**Name of the Student:**

**Roll Number:**

**Stream:**

## 1 Short Conceptual Questions (3x15=45 points)

There are 20 questions in this section each worth 3 points. You may write the answers to these questions succinctly.

- A1 Consider a function where mergesort is being applied not on a single array, but on two distinct arrays. The output of the mergesort is a single merged sorted array. The two arrays would give a single array as output. How would you create and use a template-based mergesort in this case?
- A2 Assume that we are using the STL's algorithm library to perform a linear search. Assume that we have a total of 1000 objects of the same class. One developer utilizes a vector to store them, whereas another developer utilizes a heap. Which of them would be faster and why?
- A3 Compare both the execution speed AND compilation speed of the following two programs:

Program p1.cpp

```
int main(void) {  
    vector<int> v(100, 5);  
    for (int i = 0; i < 100; i++) {  
        v[i] = i;  
    }  
    return 0;  
}
```

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Program p2.cpp

```
int main(void) {
    vector<int> v();
    for (int i = 0; i < 100; i++) {
        v.push_back(i);
    }
    return 0;
}
```

A4 Consider the following C++ program and a bash script used together:

Program p1.cpp

```
int main(void) {
    vector<int> v(100, 5);
    for (int i = 0; i < 100; i++) {
        v[i] = i;
        cout << rand() << endl;
    }
    return 0;
}
```

Program script.sh  
./a.out > out.txt  
grep "1" out.txt

Is there a way to speed up the execution of the above programs?

- A5 Consider a command you are designing which needs to accept a (> 30) large number of behaviors depending on the argument. How would you go about designing it? Name the function that you would use, along with the reason behind it.
- A6 Consider a case where you need to mass rename files, for example, all files named as “abc1.txt”, “abc2.txt”, ..., would be renamed as “def1.txt”, “def2.txt”,... Which command(s) in bash would you use to do it?
- A7 Consider a filesystem that has empty space, but is still not letting you add content to a specific file, even though you have sufficient permissions. What is the problem here, and can you suggest a possible solution?
- A8 Suppose user U1 has created a file, but wants to allow user U2 and U3 to modify it, but not other people. What can user U1 do to facilitate this?
- A9 Consider a situation where you want to enter into a directory, but by mistake open it using a text editor. Will this file open? If so, what will you see in this file?
- A10 Assume that there are a sequence of rectangles that need to be sorted. You utilize a class of rectangles to model them. The sorting has to be done based on their bottom-left coordinates, followed by bottom-right coordinates in case of a tie. Is it possible to use an STL sort algorithm to do this, and if so, how?

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- A11 Suppose you want to use a reverse iterator instead of a standard iterator on a vector. Is it possible to use it by defining the iterator's type as auto?
- A12 Suppose you need to speed up the execution of a specific process, when it is slowed down by the functioning of other processes. How can you do it, and is there anything specific you need to ensure in order to do it?
- A13 Consider two functions A() and B() that works on a global variable x with different threads. What is the output of the following program?

```
int x = 0;
A() {
    x++;
}
B() {
    x--;
};
int main(void) {
    Thread t = new Thread(A());
    Thread s = new Thread(B());
    cout << x;
}
```