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| **National University of Computer and Emerging Sciences, Lahore Campus** | | | | |
| final design | **Course:** | **CP Lab** | **Code:** | **CL103** |
| **Program:** | **BS (Computer Science)** | **Semester:** | **Fall 2018** |
| **Duration:** | **150 minutes** | **T. Marks:** | **50** |
| **Date:** | **December 10-12-2018** | **Weight** | **40** |
| **Section:** | **A, B, C** | **Page(s):** | **2** |
| **Exam:** | **Lab Final** |  |  |

**Instructions/Notes:**

* Use of the internet, notes, codes, lab manuals, and flash drives is strictly prohibited.
* Plagiarism will result in **F** grade in lab.
* Code must be **indented properly**, failure to comply will incur a penalty.

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**Question # 1: (30 marks)**

You need to implement an amateur level system for an online mobile selling store. This store keeps various type of mobiles including android and iPhone.   
You should implement following classes to handle the scenario mentioned above:

1. Class OnlineStore

This OnlineStore has a name (char \*).

This class will offer following functionalities:

* + - It will keep a list of all the phones that are in the store.
    - It will allow user to add a new phone of two mentioned types below, by passing **features of the phones**. Shop has a limit of 10 phones. However, you have to keep track of how many phones are currently present in the shop. For example, addPhone (....) function should decide whether which phone should be added and allows user/admin to enter values.
    - It will allow user to see all the phones available and their specifications.

1. Class MobilePhone (abstract class)

With following functions:

* It will have protected dynamic variables for

**Battery (**Int**),** **Camera (**Bool**),** **OS** **Version (**char **\*)**

* It will be abstract class since it contains following functions

**Printinfo ()**

1. Class Android (Derived class from Mobile Phones)

With following functions

* It will have private dynamic variables

**Ram (**Int**)**

* It will override **printinfo**

To display all the features of the phone.

1. Class iPhone (Derived class from Mobile Phones)

With following functions

* It will have private dynamic variables.

**audioJack (**Boolean**)**

* It will override **printinfo**.

To display only Camera, OS Version and Audio jack

You have to write a main function to test all above functionalities. Since you have to test all functionalities through OnlineStore, so you need to make a variable of that class as well, which should be made dynamically.

Since you are to use only dynamic variables, **you need to manage memory effectively and make sure that proper destructors** are called.

**Question # 2: (20 marks)**

Your fellow machine learning developer spend most of his time working with statistical problems. This involves spending most of the time to deal with SETS. You are to help your fellow with the poor and repetitive code that your fellow developer has written to manage set operations. (^,+, -, ==)  
You have to implement following class.

template<class T>

Class **Set** {

private:

T\* **data**;

//can be other data members

Public:

//constructor. You need to make sure that SETS only contain unique values. You might have to implement additional function to extract unique values out of the array that user have passed into the constructor.

//Operator overloaded for ^,+,-,==)

//Other necessary functions

};

**Note:** All the functions of class SETS must be implemented outside the class. You need to take care of Shallow Copy & memory leakage, if it occurs somewhere, will cause deduction in marks.

**Examples:**

The difference (subtraction) is defined as follows. The set A−B consists of elements that are in A but not in B. For example, if A = {1,2,3} and B = {3,5}, then A−B = {1,2}

The union (Addition: to make it simple for you) is defined as follows. The set A+B consists of elements that are in A, B and their common elements. For example, if A = {1,2,3} and B = {3,5}, then A+B = {1,2,3,5}

The intersection operator is defined as follows. The set A^B consists of elements that are in A as well as in B. For example, if A = {1,2,3} and B = {3,5}, then A^B = {3}

The equal (==: to make it simple for you) is defined as follows. For example, if A = {1,2,3} and B = {1,2,3}, then A==B will return true.