National University of Computer and Emerging Sciences

FAST School of Computing Spring 2020 Islamabad Campus

CS-217: Object Oriented Programming Lab

Remote Final Exam

Attempt Time: 3 Hours
Submission (on Classroom and through email) Time: 15 minutes

Wednesday, 15th July, 2020

Total Marks: 100

Lab Instructors

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Instructions:

1. Exam should be attempted on the recommended programming tools not on A4 pages.
2. If the program of a student does not compile (but the solution you provided is logical enough) you will be awarded 60% marks out of the total marks reserved for that section.
3. Segmentation faults and code crashes will lead to absolute ZERO so submit working code.
4. Name of the class should start with capital letter. In case of any ambiguity of naming convention, you can verify through the test case file.
5. You need to follow camel casing notation to name the attributes & getter setter for each data member and the first letter of member function should be lowercas. For example; getter and setter for the variable **age** should look like “int getAge ()” and “void setAge(int a)”.
6. You have to submit .h and .cpp files in a zip format on Classroom and **MUST e**mail your exam to the email address (of the concerned course/lab instructor) which will be provided. You will be given 15 minutes (after the 3 hours attempt time) for this purpose. All students must use the standard file name format (Full course code - Roll number e.g. CS-305-17i-0123). Submissions after 30 minutes may not be accepted. **Try to submit soon after 3 hours of attempt time and do not wait for 15 minutes to be elapsed.**
7. For proven cheating/ plagiarism, student will get an F grade even if the student had opted for S/U grade, and the case will be referred to DDC (Department’s Disciplinary Committee). Instructors will conduct vivas of randomly selected students or in case of doubt (significantly different attempt as compared to past performance in the course or matching attempt with other students). Plagiarism includes sharing an attempt to other students (copy providing). Students who are not able to satisfactorily answer instructor’s questions (based on the exam as well as slightly lateral but related concepts) during viva will also be considered as plagiarism cases.

	Q-1	Q-2	Q-3	Total
Marks	50	30	20	100

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Polymorphism

Question 1: [50Marks]

A cargo ship is a merchant ship that carries cargo, goods, and materials from one port to another. Thousands of cargo carriers ply the world's seas and oceans each year, handling the bulk of international trade. Ship cargo carries items of different types and weight. Each have a maximum limit of weight to carry and pass them from one port to another.

Consider a scenario of Ship cargo which can carry an unlimited number of items, as long as they don't exceed the maximum weight of the cargo bay, 25 Tons (1 ton=1000KG).

Implementation

Considering the above description of cargo shipment, you need to implement ship cargo service as below required:

- Items carries by the cargo should have attributes such as **Name**, **Weight**, **Value**, **Durability** and **ID**.

- As mentioned on the scenario, ship cargo can carry an unlimited number of items, as long as they don't exceed the maximum weight of the cargo bay, 25 Tons. Here you need to check the weight on an item and then add it to the inventory list.

- Now classify the items by separating them into 3 distinct categories **Equipable**, **Consumable** or **Weapon**. (You must implement these 3 classes that are subclasses of **Item** and they must have at least **3 unique attributes** in each subclass based on their categorization) e.g. in Weapon class it should have a license number associated with it, other don't required them, equitable may have some size and consumable may have some expiry date.

- In main you will create only one array of items of dynamic size considering unlimited number of items can be loaded to ship but you will keep track of total weight which can't exceed limit of 25 Ton.

- You need to provide the following methods for each class by creating a menu which provides the option to the user: **Add, Remove**, **Search**, **Sort**, **and Display**. Based on the user selection of item below functionality is required:

  - **Add:** Add function will be used to add an item in array based on the attribute/type entered by the user. First it will ask the user which type of item he/she wants to add and will require to input those specific attributes with general attributes of item.

  - **Remove:** Remove will delete the item from the array based on user input i.e will ask item type first and then will let user to select unique attribute from 3 unique attributes related to that type of item for deletion and then user will input that attribute. For example, your program may ask license number in case of weapon deletion. (there r lots of items how can we ask for unique attribute)

  - **Search:** Search will find the item from the array and display the result if found. It will take input same as remove i.e will ask specific attributes for search.

- **Sort:** It will sort all the items in array, it will place equipable first then consumables and then weapon. For example, if there are 10 equipable in array then from index 0 to 9 there will be equipable and from 10th index consumable will start.

- **Display:** Display will output all the items along with item details and their respective categories attributes.

Grading Rubric

Sr no.	**Functionality**	**Points**
1.	Item class and attributes are correctly implemented	5 pts.
2.	Inheritance and Polymorphism used correctly	15 pts.
3.	Add feature correctly implemented	5 pts.
4.	Remove feature correctly implemented	5 pts.
5.	Search feature correctly implemented	5 pts.
6.	Sort feature correctly implemented	10 pts.
7.	Display feature correctly implemented	5 pts.
	Total:	**50 pts.**

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Templates

Question 2: [30Marks]

Suppose you are working in Software Company, and the company want to do analysis on the skill set of their employees from different departments. For instance, initially they take two departments in consideration that are: Development and Quality_Assurance.

Following are the skills set of Department Development & Quality_Assurance.
Development= {"Programming", "Debugging"," Requirement Verification"}
Quality_Assurance= {"Debugging"," Requirement Verification"," Testing"}

You are required to do the following analysis:
First of all create a template based class of **Company**. And add private member in Class Company

- T *Dept_A; //where T can be string/integer/char
- T *Dept_B; //where T can be string/integer/char
- Int size1; //size of array 1
- Int size2; //size of array 2

Create overloaded constructor to initialize the arrays.
Write the following methods for Company Class:

1. **Void Insert (element)** — adds item to the Dept_A, Dept_B arrays.
2. **Print ()** — Prints all the elements of both arrays.
3. **T Union ()** function of type Template that find the union of skill for Dept_A and Dept_B. There should be no repeating elements

Note: (The union of Dept_A and Dept_B is the set that contains those elements that are either in A or in B, or in both.)

Input	Output/result
{"Programming", "Debugging"," Requirement Verification"}	{"Programming", "Debugging"," Requirement Verification", "Testing "}
{"Debugging"," Requirement Verification"," Testing"}	

4. **T Intersection ()** function of type Template that find the intersection of skill for Dept_A and Dept_B. There should be no repeating elements.

Note: (The intersection of Dept_A and Dept_B is the set that contains those elements that are in both A and B.)

Input	Output/result
{"Programming", "Debugging"," Requirement Verification"}	{ "Debugging"," Requirement Verification"}
{"Debugging"," Requirement Verification"," Testing"}	

5. **Bool disjoint ()** function to check whether Dept_A and Dept_B are disjoint sets. Function returns 1 if disjoint else 0. (Two sets are called disjoint if their intersection is empty.)

Your code will be tested on following conditions:

1. Check last element of Union Set. (So return the last index value from your function)
2. Check start element of Intersection Set. (So return the start index value from your function)
3. Check if Dept_A and Dept_B are disjoint.

Grading Rubric

Sr no.	**Functionality**	**Points**
1.	Template based class and attributes are correctly implemented	2 pts.
2.	Insert element correctly implemented using template type variable	1 pts.
3.	Union feature using Template function correctly implemented	5 pts.
4.	Intersection feature using Template function correctly implemented	5 pts.
5.	Disjoint feature correctly implemented	1 pts.
6.	Print element correctly implemented	1 pts.
7.	Running of all test cases	5+5+5
	Total:	**30 pts.**

Filing

Question 3: [Marks 20]

Write a program to implement Employee Directory. The main purpose of the class is to get the data, store it into a file, perform some operations and display data.

For the purpose mentioned above, you should write a template class **Directory** for storing the data empID(**template**), empFirstName(**string**), empLastName(**string**), empContactNumber(**string**) and empAddress(**string**) of each Employee in a file **EmployeeDirectory.txt**.

1. Write a function **Add** to write the above mentioned contact details of the employee into EmployeeDirectory.txt. The record of each employee should be written in one line having tab '\t' character among the attributes. Consider the file below as example for EmployeeDirectory.txt

```
9743 Ali Ahmad 03005543287 H#34, sector H11, Islamabad
1234 Ayesha Ahmad 03215573987 H#45, sector G11, Islamabad
```

2. Write a template function **SearchByID** - **SearchByID** receives **empID** of type template and 4 references (firstname, lastname, contactno, address) of type string. The return type of the function should be bool, which should return either true or false. If the record is found, return true and copy the details of the record into the passed references for the caller to use.
3. Also write a void function **printDetails** which must read the file completely and print the record stored in EmployeeDirectory.txt.

Grading Rubric

Sr no.	**Functionality**	**Points**
1.	Template class and attributes correctly implemented	2 pts.
2.	Add function correctly implemented	6 pts.
3.	SearchByID correctly implemented	6 pts.
4.	PrintDetails correctly implemented	6 pts.
	Total:	**20 pts.**