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END OF SEMESTER EXAM | July 2023 Session | OBJECT ORIENTED PROGRAMMING
Level: I | Academic year: 2022/2023 | Branch: Software Engineering | Duration: 01h00

Question: (1 + 1 + 1 + 1 = 4 marks)

1. Why does an object require a class to exist?
2. Static member functions can be invoked without any reference to a particular instance. True or false? Justify your answer.
3. Why do you thing the use of friend functions or classes in C++ does not respect the concepts of Object oriented programming
4. What is the difference between a constructor and a copy constructor?

Problem: (1 + 2 + 6 + 2 + 4 + 1 = 16 marks)

The African Institute of Computer Sciences wishes to manage its employees. AS such, it creates a **class Employee** having the following characteristics : A data member **string name**, a data member **int age**, a data member **int longevity** (the number of years an employee has worked in the institution), a function **void display()** which displays the name of the employee with his/her profession, a function **double baseSalary()** which calculates the base salary of an employee, another function **double salary()** which calculates the salary of an employee (base salary + 10% of base salary * number of years of service), a constructor and a destructor. We wish to define the following derived classes of **Employee**:

- ✓ A **class Non_Teacher** having a data member **double turnover** and two static constant data member **double base** and **double share**. The base salary is calculated using the following formula: **base + turnover*share.**
- ✓ A **class Teacher** having a data member **int nbHoursTaught** and three static constant data member **double base, double unit_Gain** and **double share**. The base salary is calculated using the following formula: **base + nbHoursThaught*share*unit_Gain.**
- ✓ A **class Cleaner** having a data member **int nbHours** and a static constant data member **double base_Salary_Hour**. The base salary is calculated using the following formula: **base_Salary_Hour*nbHours.**

1. Which functions need to be declared as virtual functions in the **class Employee**?
2. Which functions need to be declared as pure virtual functions in the **class Employee**? Is the **class Employee** an abstract class?
3. Implement the different classes while defining the functions inside the classes.

We wish to create some new derived classes from **class Non_Teacher**:

- ✓ **Accountant** whose salary is calculated as a Non_Teacher
- ✓ **Security_Guard** whose salary is calculated as a Cleaner

4. What do we need to change inside the **class Non_Teacher** to implement these two classes?
5. Implement these two classes while defining the functions inside the classes.
6. Is there any code duplication between **Cleaner** and **Security_Guard**? If yes, how can we solve the problem?