

OOP TEST 1

Question 1

- What are class and object? Please give one example for each concept.
- List and explain the usage of three access specifiers in C++?
- Fill in the blanks: (1)_____ lets us create a new class by reusing (2)_____ and (3)_____ from another class.
- Give one purpose of Encapsulation (Data Hiding).

Question 2

Assume that all necessary libraries are included, read the C++ code below and answer the following questions:

```
1  class Person {
2  protected:
3      string name;
4  public:
5      virtual void introduce() {
6          cout << "I'm " << name << endl;
7      }
8      virtual void work() = 0;
9      void doDailyTask() {
10         introduce();
11         work();
12     }
13 };
14 class Student: public Person {
15 private:
16     Person * pAdvisor;
17 public:
18     Student(string name,
19             Person * pAdvisor) {
20         this -> name = name;
21         this -> pAdvisor = pAdvisor;
22     }
23     void introduce() {
24         Person::introduce();
25         cout << "My advisor " << endl;
26         pAdvisor -> introduce();
27     }
28     void work() {
29         cout << "study" << endl;
30     }
31 };
32 class Professor: public Person {
33 public:
```



```

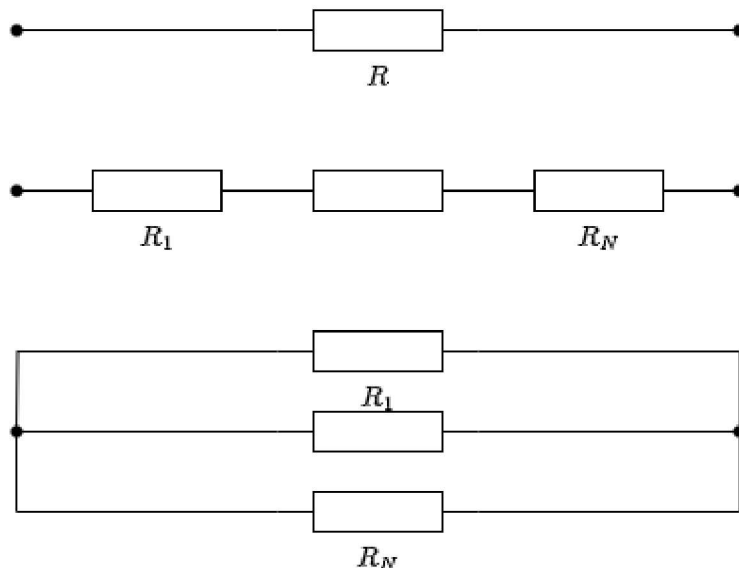
34     Professor(string name) {
35         this->name = name;
36     }
37     void work() {
38         cout << "teach" << endl;
39     }
40 };
41 void main() {
42     Professor p1("Hinton");
43     Student p2("Bengio", &p1);
44     Person *p3= new Student("LeCun",
45                             &p2);
46
47     p1.introduce();
48     p1.work();
49
50     p2.introduce();
51     p3->introduce();
52
53     Person *p4 = new Person();
54 }

```

- Draw UML class diagram
- Are there any lines in the `main()` function that cannot be compiled? If yes, why can't they be compiled?
- Assume that all invalid lines of code are removed, can we change the key word `protected` in Line #2 to `private`? Explain.
- What is the output of this code if the invalid lines of code are removed?

Question 3

There are three types of basic electrical circuits:



- Single circuit is a circuit containing only one resistor.

$$R(\textit{Resistance})$$

- Series circuit is a circuit containing more than two sub-circuits which are connected in series.

$$R = R_1 + R_2 + \dots + R_N$$

- Parallel circuit is a circuit containing more than two sub-circuits which are connected in parallel.

$$1/R = 1/R_1 + 1/R_2 + \dots + 1/R_N$$

The sub-circuit in series or parallel circuit can be either a single circuit, another series circuit, or another parallel circuit.

You are asked to do the followings by applying encapsulation, inheritance, and polymorphism:

- a. Draw a class diagram for a program to calculate circuit resistance. The design should include necessary variables and functions to:
 - Construct a circuit of one type.
 - Add a sub-circuit to a Series or Parallel circuit.
 - Calculate resistance of a circuit.
- b. Write C++ code to implement the design.