FINAL EXAMINATION

Course: **OBJECT ORIENTED PROGRAMMING**
Time: **100** minutes Term: **3** – Academic year: **2019-2020**
Lecturer(s): **Bui Tien Len, Nguyen Van Vu, Dinh Ba Tien, Nguyen Minh Huy, Trương Toan Thinh, Tran Duy Quang**
Student name: Student ID:

(Notes: Closed book exam)

Question 1. a) What are class and object? Please give one example for each concept.

b) List and explain the usage of three access specifiers in C++?

c) Fill in the blanks:

(1)_____ lets us create a new class by reusing (2)_____ and (3)_____ from another class.

d) 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:

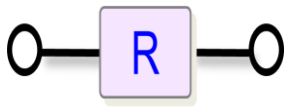
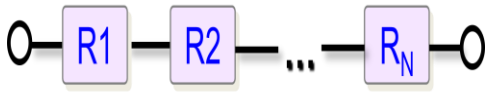
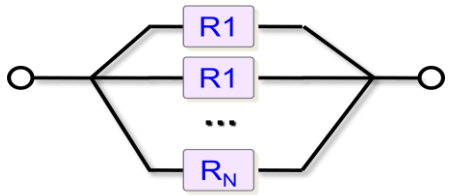
```
01 class Person {
02 protected:
03   string name;
04 public:
05   virtual void introduce() {
06     cout << "I'm "<< name <<endl;
07   }
08   virtual void work() = 0;
09   void doDailyTask() {
10     introduce();
11     work();
12   }
13 };
14 class Student: public Person {
15 private:
16   Person *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 }
```

a) Are there any lines in the `main()` function that cannot be compiled? If yes, why can't they be compiled?

b) Assume that all invalid lines of code are removed, can we change the key word `protected` in Line #2 to `private`? Explain.

c) 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 (Resistance) = U (Voltage) / I (Current).
	Series circuit is a circuit containing more than two sub-circuits which are connected in series. $R = R_1 + R_2 + ... + R_N$.
	Parallel circuit is a circuit containing more than two sub-circuits which are connected in parallel. $1/R = 1/R_1 + 1/R_2 + ... + 1/R_N$.

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.

***** GOOD LUCK *****