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| **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)***

### 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).

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

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| 01  02  03  04  05  06  07  08  09  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25  26  27 | class Person {  protected:  string name;  public:  virtual void introduce() {  cout << "I'm "<< name <<endl;  }  virtual void work() = 0;  void doDailyTask() {  introduce();  work();  }  };  class Student: public Person {  private:  Person \*pAdvisor;  public:  Student(string name,  Person \*pAdvisor) {  this->name = name;  this->pAdvisor = pAdvisor;  }  void introduce() {  Person::introduce();  cout << "My advisor " <<endl;  pAdvisor->introduce();  } | 28  29  30  31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50  51  52  53  54 | void work() {  cout << "study" << endl;  }  };  class Professor: public Person {  public:  Professor(string name) {  this->name = name;  }  void work() {  cout << "teach" << endl;  }  };  void main() {  Professor p1("Hinton");  Student p2("Bengio", &p1);  Person \*p3= new Student("LeCun", &p2);  p1.introduce();  p1.work();  p2.introduce();  p3->introduce();  Person \*p4 = new Person();  } |

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?

1. There are three types of basic electrical circuits:

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|  | 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 = R1 + R2 + ... + RN. |
|  | Parallel circuit is a circuit containing more than two sub-circuits which are connected in parallel.  1/R = 1/R1 + 1/R2 + ... + 1/RN. |

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 \*\*\***