Homework 8: Classes++

CS16 - Winter 2021

Due:	Thursday, March 4, 2021 (11:59 PM PST)
Points:	40
Name:	_____
Homework buddy:	_____

- You may collaborate on this homework with **at most** one person, an optional "homework buddy."
- **Submission instructions:** All questions are to be written (either by hand or typed) *in the provided spaces* and turned in as a single PDF on Gradescope. If you submit handwritten solutions write legibly. We reserve the right to give 0 points to answers we cannot read. When you submit your answer on Gradescope, **be sure to select which portions of your answer correspond to which problem** and clearly mark on the page itself which problem you are answering. We reserve the right to give 0 points to submissions that fail to do this.

1. (4 points) According to lecture and the textbook, what are the rules of class definition in order to make a class an abstract data type (ADT)?

2. (2 points) What are derived classes and what mechanism do they use in order to fulfill what they need to do?

3. (2 points) Can a derived class directly access by name a private member variable of the parent class?

4. (2 points) Suppose the class `SportsCar` is a publicly derived class of a class `Automobile`. Suppose also that the class `Automobile` has public member functions named `accelerate` and `addGas`. Will an object of the class `SportsCar` have member functions named `accelerate` and `addGas`?

5. (14 points) Suppose your program contains the following class definition:

```cpp
class Automobile {
  public:
      void set_price(double new_price);
      void set_profit(double new_profit);
      double get_price();
  private:
      double price;
      double profit;
      double get_profit();
};
```

Suppose the main part of your program contains the following declaration and that the program somehow sets the values of all the member variables to some values:

```cpp
Automobile hyundai, jaguar;
```

Which of the following statements are then **not** allowed in the main part of your program and explain **why**.

(a) `hyundai.price = 4999.99;`
(b) `jaguar.set_price(30000.97);`
(c) `double a_price, a_profit;`
(d) `a_price = jaguar.get_price();`
(e) `a_profit = jaguar.get_profit();`
(f) `a_profit = hyundai.get_profit();`
(g) `if (hyundai == jaguar) {hyundai = jaguar;}`

6. (16 points) Suppose your program contains the following class definition:

```cpp
class TwoNumbers {
  public:
     TwoNumbers(int n1, int n2);
     TwoNumbers(); // initializes num1, num2 to 0
     double sum(); // returns sum of num1 & num2
     double difference(); // returns diff. of num1 from num2
     double max(); // returns larger of num1, num2
  private:
     double num1, num2;
};
```

a. (10 points) Given the comments shown, give definitions to all 5 of these member functions/constructors:

b. (2 points) Consider these instructions in `main()`:

```
TwoNumbers thisOne, thatOne(5,7);
thisOne.num1++;
thisOne.num2 -= 7;
thatOne.num2 = thatOne.sum() + thisOne.difference();
cout << thisOne.max() / thatOne.max();
```

Explain all the reasons **why** this code will not compile.

c. (2 points) What would you change to the class definition to make this code compile?

d. (2 points) When you fix it, what would these instructions do?