Supplemental Lab: Inheritance

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Today's Schedule

1. What?
2. Why?
3. How?
4. Example
5. Assignment!

What is inheritance?

Create new classes from existing ones that are related.

Inherits from

Person

Student

1

Why inheritance?

We naturally think in categories and subcategories!

Why use inheritance?

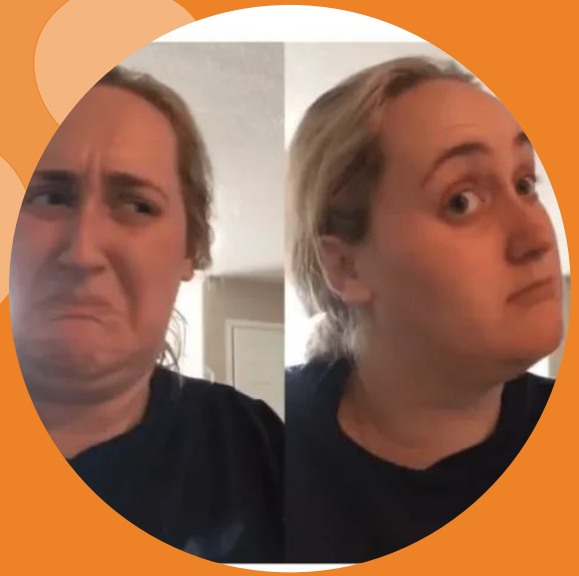
Reuse functions and data members

string name;
int age;

void thumbsUp();

Person

Student



How?

- Syntax
- Constructors
- Private/Protected/Public
- Virtual/Abstract
- Destructors

Syntax (header file)

```
class Person {
    public:
        Person(std::string name);
        std::string getName();
    private:
        std::string mName;
        int mAge;
};

class Professor : public Person {
    public:
        Professor(std::string name, std::string department);
        std::string getDepartment();
    private:
        int mSalary;
        std::string mDepartment;
};
```

Parent

Child

Constructors

```
Student::Student(string name) : Person(name) {
    // rest of student constructor
}
```

Gets called BEFORE the rest of the constructor!

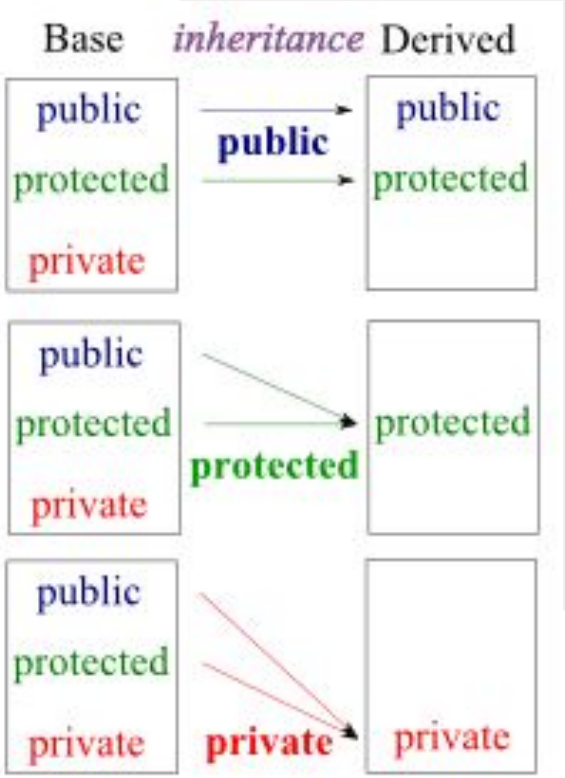
Private/Protected/Public Data Members

1. **Private**: child classes cannot access

2. **Protected**: child classes can, but not 3rd parties

3. **Public**: anyone can access

Private/Protected/Public Inheritance



Private/Protected/Public Example

- Which functions can class A access?
  - B?
  - C?
- Which functions can a user of A access?
  - User of B?
  - User of C?

```
class A {
    public:
        void funcA();
};

class B : private A {
    protected:
        void funcB();
};

class C : public B {
    public:
        void funcC();
};
```

Private/Protected/Public Example

- Which functions can class A access? funcA()
  - B? funcA() AND funcB()
  - C? funcB() AND funcC()
- Which functions can a user of A access? funcA()
  - User of B? Nothing!
  - User of C? funcC()

```
class A {
    public:
        void funcA();
};

class B : private A {
    protected:
        void funcB();
};

class C : public B {
    public:
        void funcC();
};
```

Virtual (good exam question alert!)

- Compile time vs. Runtime type

```
Person* p = new Professor();
p->printTitle();
```

```
class Person {
  public:
    virtual void printTitle(); // prints "Person"
};

class Professor : public Person {
  public:
    void printTitle(); // prints "Professor"
};
```

- Virtual functions go by runtime type!

Destructors should be virtual!

- Why?

  MEMORY LEAKS!

```
class Person {
    public:
        Person();
        ~Person();
    private:
        std::string name;
};

class Student : public Person {
    public:
        Student();
        ~Student();
    private:
        // Dynamically allocated array of courses.
        std::string* courses;
};

Person* p = new Student();
delete p; // <--- which deconstructor will get called here?
```

Example!

Let’s handle error messages together

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Assignment!

NOTE: for Inventory, the items in the list are supposed to be *unique*. They have associated amounts.

Yay Inheritance!

Any questions? Ask on Piazza in this thread!

Pause this video and complete the assignment.