✅ Congratulations! You passed!

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Go to next item

1. Which one of these is the only true statement about a class constructor.   **1 / 1 point**

   ⦿ When declaring a constructor for a class, the name of the constructor must be the name of the class.

   ○ A class can only have one constructor.

   ○ When declaring a constructor for a class, the return type of the constructor must be the type of the class.

   ○ A class must have at least one constructor declared for it.

   ⊘ **Correct**
   A constructor cannot be assigned a name other than that of the class itself.

2. Which of the following examples does NOT call a copy constructor at least once?   **1 / 1 point**

   (If you already have advanced knowledge of C++ that makes this seem like a trick question, then we'll also specify this: Assume that compiler optimizations are mostly disabled.)

   ○
   ```
   1   Cube b(10);
   2   Cube a = b;
   ```

   ○
   ```
   1   // Function prototype for "contains":
   2   int contains(Cube outer, Cube inner);
   3   // ...
   4   Cube a(10),b(5);
   5   int a_bounds_b = contains(a,b);
   6
   ```

   ⦿
   ```
   1   Cube a,b(10);
   2   a = b;
   ```

   ○
   ```
   1   // Function prototype for "intersect":
   2   Cube intersect(Cube &left, Cube &right);
   3   // ...
   4   Cube a(10),b(5);
   5   Cube c;
   6   c = intersect(a,b);
   7
   ```

   ⊘ **Correct**

Correct: The copy constructor will not be called.

In this case, the assignment operator is called (either the default assignment operator or one that has been explicitly declared). Since the operand of the assignment operator is passed by reference and not by value, the copy constructor is not called because no new object needs to be constructed.

3. Recall that a custom assignment operator can be declared such that line 2 of the code below executes a user-defined function to perform the assignment.

1 / 1 point

```
1    Cube a,b(10);
2    a = b(10);
```

Which one of the following statements regarding the declaration of such a custom assignment operator allowing is true?

○ The custom assignment operator function is declared with two arguments: the source and target objects of the assignment.

○ The type of the custom assignment operator function should be void.

○ The custom assignment operator is a function declared with the name "operator::assignment".

◉ The custom assignment operator is a public member function of the class.

⊘ **Correct**
Indeed, the assignment operator is a member function of the class of the target object, and this member function must be public in order for the assignment operator to be used in contexts outside of the class's own implementation as shown in the example in this question.

4. Consider the following class:

1 / 1 point

```
1
2    class Orange {
3      public:
4        Orange(double weight);
5        ~Orange();
6        double getWeight();
7
8      private:
9        double weight_;
10   };
11
```

Select **all** functions that are present in this class (including any automatic/implicit functions added by the compiler):

☐ Default constructor

☑ At least one custom, non-default constructor

⊘ **Correct**

☑ Copy constructor

⊘ **Correct**

☑ Assignment operator

⊘ **Correct**

☑ Destructor

⊘ **Correct**

5. Consider the following class: **1 / 1 point**

```
1
2    class Blue {
3      public:
4        double getValue();
5        void setValue(double value);
6
7      private:
8        double value_;
9    };
10
```

Select **all** functions that are present in this class (including any automatic/implicit functions added by the compiler):

☑ Default constructor

⊘ **Correct**

☐ At least one custom, non-default constructor

☑ Copy constructor

⊘ **Correct**

☑ Assignment operator

⊘ **Correct**

☑ Destructor

⊘ **Correct**

6. Consider the following class: **1 / 1 point**

```
1
2    class Animal {
3      public:
4        Animal();
5        Animal(std::string name);
6        Animal(std::string name, int age);
7        Animal(std::string name, int age, double weight);
8
9        Animal(const Animal & other);
10
11        void setName(std::string name);
12        std::string getName();
13
14      private:
15        // ...
16    };
17
```

How many **explicit** (non-automatic) **constructors** are present in the class?

○ 2

○ 3

○ 4

⦿ 5

○ 6

○ 7

⊘ **Correct**

7. When you use the **new** operator to create a class object instance in heap memory, the **new** operator makes sure that memory is allocated in   **1 / 1 point**
    the heap for the object, and then it initializes the object instance by automatically calling the class constructor.

    After a class object instance has been created in heap memory with **new**, when is the *destructor* usually called?

    ○ The destructor is called automatically when the variable goes out of scope.

    ⦿ The destructor is called automatically when the **delete** operator is used with a pointer to the instance of the class.

    ○ The destructor is called automatically when the program returns from the function where the **new** operator was used to create the
    class object instance.

    ○ The programmer always needs to call the destructor manually in order to free up memory.

    ⊘ **Correct**

8. Consider the following program: **1 / 1 point**

```
 1    double magic(uiuc::Cube cube) {
 2       cube.setLength(1);
 3       return cube.getVolume();
 4    }
 5
 6    int main() {
 7       uiuc::Cube c(10);
 8       magic(c);
 9       return 0;
10    }
11
```

    How many times is the **uiuc::Cube** 's copy constructor invoked?

    ○ Never

    ⦿ Once

    ○ Twice

    ○ Three times

    ⊘ **Correct**

9. We have looked at examples where the assignment operator returned the value "*this". The variable "this" is available by default in most   **1 / 1 point**
    class member functions. What is the value of this built-in class variable "this"?

    ○ An alias of the current object.

    ○ A pointer to a heap-memory copy of the current object.

    ⦿ A pointer to the current object instance.

    ○ A reference to the current object.

    ⊘ **Correct**

This is correct. In fact, members of the current object can be accessed as "this->*membername*" . For example, if you define a member function whose argument is the same name as a member variable, any use of that name in the local scope of the function refers to the argument and not the member variable, but you can still access the member variable as "this->*membername*" . Hence the following example works.

```
1    class Just_a_double {
2        double val;
3    public:
4        void setValue(double val) {
5            this->val = val;
6        }
7    }
```

10. Consider the code below that includes a class that has a custom constructor and destructor and both utilize a global variable (which has global scope and can be accessed anywhere and initialized before the function main is executed).

1 / 1 point

```
1    int reference_count = 0;
2
3    class Track {
4    public:
5        Track() { reference_count++; }
6        ~Track() { reference_count--; }
7    };
```

Which one of the following procedures (void functions) properly ensures the deallocation of all the memory allocated for objects of type Track so the memory can be re-used for something else after the procedure returns?

For the correct answer, the variable reference_count should be zero after all calls to track_stuff() **and** all of the memory should be deallocated properly. This will dependably occur after only one of the following procedures.

○
```
1    void track_stuff() {
2        Track *t = new Track;
3        // ...
4        t->~Track();
5        return;
6    }
```

○
```
1    void track_stuff() {
2        Track t;
3        // ...
4        delete t;
5        return;
6    }
```

○
```
1    void track_stuff() {
2        Track t;
3        Track *p = &t;
4        // ...
5        delete p;
6        return;
7    }
```

```
1    void track_stuff() {
2        Track t;
3        Track *p = new Track;
4        // ...
5        delete p;
6        return;
7    }
```

✓ **Correct**

This procedure declares t as an object of class Track with its memory allocated on the stack at local scope. The object t will automatically be destroyed and the memory will be deallocated when the function returns. This example also allocates memory for another Track on the heap using **new** and stores that address in the pointer to Track, p. The object p is destroyed and its memory is deallocated when the **delete** operator is used.

```
1    void track_stuff() {
2        Track *p = new Track;
3        // ...
```