

CSE399 Spring 2008 PRACTICE Exam

Name:

By signing below I swear or affirm that all answers I give on this exam represent my own individual knowledge and effort. I will neither receive nor give any improper help to other students during the administration of this exam.

Signature:

- There are 5 questions.
- This exam is 50 minutes long. Pace yourself accordingly.
- If you have any questions, please raise your hand.

Topic	Question	Points	Maxium
Pointers	1		20
Constructors/Operator Overloading	2		20
Templates	3		20
Object layout/inheritance	4		20
OO Designs/ STL	5		20
	Total		100

Question 1: Pointers

Part A (5 points): Given the following declarations:

```
char c = 'A'  
char * p = &c;  
char ** p2 = &p;  
void * v = &p2;
```

Examine each of the following expressions. If the expression is illegal, write **ILLEGAL**. If the expression is legal, write its type (i.e. `int`, `void *`, etc):

- `&p2`
- `*p2`
- `&v`
- `p2 + 1`
- `v[0]`

Part B (5 points): Briefly explain what the function `realloc` does in C:

Part C (10 points): Write the function `swap`, which takes two pointers to integers and swaps the values pointed to by them. Show the proper way to call your `swap` function such that the `printf` statements print what the comments indicate:

```
/* Fill in parameter list first */
void swap (                ) {

    /* your code goes here */

}

int main(void) {

    int a = 3;
    int b = 4;

    /* fill in arguments here */
    swap (                );

    printf("a is now %d\n", a); // should print a is now 4
    printf("b is now %d\n", b); // should print b is now 3
    return 0;
}
```

Question 2: Constructors/Operator Overloading

Part A (3 points): Copy constructors and the assignment operator (=) are similar. Copy constructors, however, are used only in specific circumstances: list the three situations in which copy constructors are used:

Part B (6 points): What is the appropriate signature for the copy constructor for a class called Foo?

Part C (6 points): What is the appropriate signature for the assignment operator in the class called Foo (to allow assignment of one Foo to another)?

Part D (5 points): There is an important difference between how dynamically dispatched functions behave during object construction in C++ and Java. Explain what this is and how it occurs.

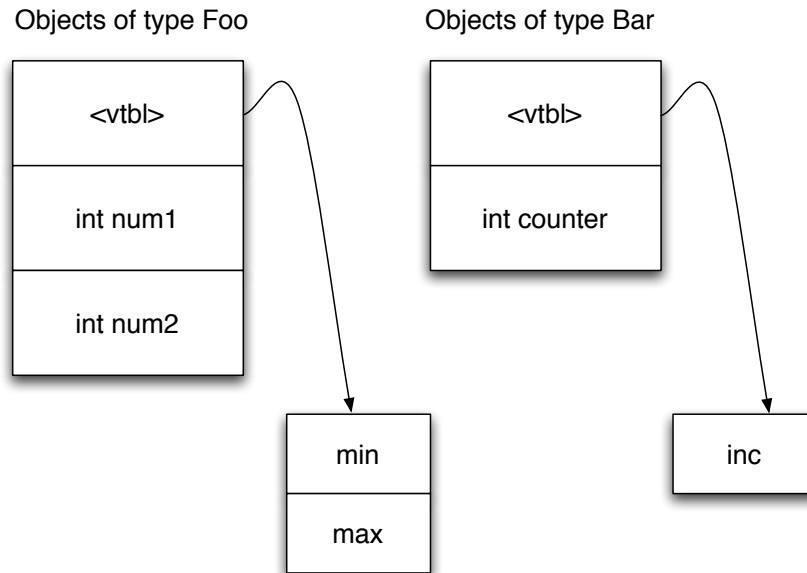
Question 3: Templates

Part A (10 points): Write the function `findMin` which is templated over the type of item it processes. The `findMin` function should take a vector (i.e. the STL vector) of the given type. It should return the smallest item in the vector by value. You may assume the vector passed in is non-empty. Hint: you should use an iterator.

Part B (10 points): The function you wrote in part A uses the `<` operator, which is not defined on all types. Explain how the C++ compiler handles this. When/where would an error occur if you tried to use this function on a type for which `<` was not defined?

Question 4: Object Layout

For this question, use the following object layouts for objects of type Foo and Bar:



Part A (10 points) Class Baz is declared as follows:

```
class Baz: public Foo, public Bar {  
    int xyz;  
};
```

Draw the layout of an object of type Baz in the space below:

Part B (5 points) Briefly explain what a vtable is and what is used for.

Part C (5 points) Given the following declarations:

```
class A {...}
class B: public A {...}
class C: public A {...}
class D: public B, public C {...}
```

How many A sub-objects does a D have? Suppose that this is not the behavior you desired, indicate what changes need to be made to the above declarations to get the other possible behavior.

Question 5: OO Design and STL

Part A (5 points): For each statement, indicate true or false.

----- Methods should be noun-like.

----- Changing a good design to accomodate different features should be a massive undertaking: new changes are best redesigned from the ground up.

----- The “monolithic” design pattern is useful for minimizing the cognitive load on a code maintainer.

----- Computer scientists should seek to special case as many things as possible.

----- Design patterns are only useful in C++.

Part B (8 points): The C++ STL vector class has no method to remove a particular element from the vector. The STL provides a different means of removing a specific element. Briefly explain how this is accomplished.

Part C (7 points): Name the design pattern shown below:

```
class A {
    virtual X* makeX() = 0;
    virtual Y* makeY() = 0;
};

class OneThing : public A {
    virtual X* makeX() {
        return new XOne();
    }
    virtual Y* makeY() {
        return new YOne();
    }
};
....

A* a = new OneThing();
.....

X * x = a->makeX();
...
```