Object-Oriented Programming, Fall 2009

Final

1:10pm $\sim$ 2:50pm, Tuesday, January 12, 2010

INSTRUCTIONS

1. This is a *closed-book* exam.
2. Try to solve all of the problems.
3. Try to give short answers. (Hint: An answer need not always be longer than the question.)
4. No cheating.
5. Please hand in both the exam sheet and the answer sheet.
6. Please note that unless otherwise stated, all the line numbers for the program listings are for reference only.

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1. (10%) What are the names of the special member functions that would be implicitly defined by a C++ implementation if not given?
2. (10%) When overloading an operator, at least one of the operands to the operator must be of a class type. Why?
3. (10%) Use `typedef` to declare "`foo`" as an array of 3 pointers to functions taking as input an integer and returning as output an integer in a single declaration in C++.
4. (10%) Define an integer "`a`" in C++ that can only be seen in the file at which it is defined by not using `static`.
5. (10%) Define in a single declaration in C++ a pointer to integer "`p`" so that `p[1]` is an alias of `a[0]`, `p[2]` is an alias of `a[1]`, and so on, all the way up to `p[128]` is an alias of `a[127]` for the integer array "`int a[128];`" defined in C++.
6. (10%) What would be the output of the following program, assuming that the variable `a` is located at β?

```
1  #include <iostream>
2
3  using std::cout;
4  using std::endl;
5
6  int main()
7  {
8      int a = 10;
9      int& b = a;
10     int& c = b;
11
12     cout << "&a = " << &a << endl;
13     cout << "&b = " << &b << endl;
14     cout << "&c = " << &c << endl;
15
16     return 0;
17 }
```

7. (10%) What would be the output of the following C++ program? Why?

```
#include <iostream>

using std::cout;
using std::endl;

class A {
public:
    A(int i) : v(i) { cout << "A::A(" << i << ") called" << endl; }
    ~A() { cout << "A::~A(" << v << ") called" << endl; }
    operator bool() { return v != 0; }
private:
    int v;
};

int main()
{
    int i = 1;

    while (A a = i) {
        i = 0;
        cout << "avocado" << endl;
    }

    cout << "vineyard" << endl;

    return 0;
}
```

8. (10%) What would be the output of the following C++ program? Why?

```
#include <iostream>

using std::cout;
using std::endl;

class B {
public:
    virtual void f(int i)
    {
        cout << "B=" << i << endl;
    }
};

class D : public B {
public:
    void f(short s)
    {
        cout << "D=" << s << endl;
    }
};

int main()
{
    B* p = new D;

    p->f(16);

    delete p;

    return 0;
}
```

9. (10%) What would be the output of the following C++ program? Why?

```cpp
#include <iostream>

using std::cout;
using std::endl;

class B {
public:
    virtual B* f(int n)
    {
        cout << "B=" << n << endl;
    }
};

class D : public B {
public:
    D* f(int n)
    {
        cout << "D=" << n << endl;
    }
};

int main()
{
    B* p = new D;

    p->f(16);

    delete p;

    return 0;
}
```

10. (10%) What would be the output of the following C++ program? Why?

```cpp
#include <iostream>

using std::cout;
using std::endl;

class B {
public:
    B* f(int n)
    {
        cout << "B=" << n << endl;
    }
};

class D : public B {
public:
    D* f(int n)
    {
        cout << "D=" << n << endl;
    }
};

int main()
{
    B* p = new D;

    p->f(16);

    delete p;

    return 0;
}
```