Object-Oriented Programming, Fall 2009

Midterm

1:10pm ∼ 2:50pm, Tuesday, November 17, 2009

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.

---

1. (10%) What are the three main characteristics of Object-Oriented Programming, *in English*?

2. (10%) Given the following C++ program, which of the declarations on lines 3 and 4 is an initialization and which is an assignment?

```
1  int main()
2  {
3      int a = 1;
4      int b = a;
5  }
```

3. (10%) What would be the output of the following C++ program? What are the mechanisms used by C++ to call each of the three functions f, g, and h?

```
1  #include <iostream>
2  using std::cout;
3  using std::endl;
4
5  void f(int x, int y)
6  {
7      int t = x; x = y; y = t;
8  }
9
10 void g(int *x, int *y)
11 {
12     int t = *x; *x = *y; *y = t;
13 }
14
15 void h(int& x, int& y)
16 {
17     int t = x; x = y; y = t;
18 }
19
20 int main()
21 {
22     int a = 1, b = 2;
23     f(a, b);
24     cout << a << ", " << b << endl;
25     g(&a, &b);
26     cout << a << ", " << b << endl;
27     h(a, b);
28     cout << a << ", " << b << endl;
29     return 0;
30 }
```

4. (10%) What would be the output of the following C++ program?

```c
#include <stdio.h>

int f(int i)
{
    static int v = 1;
    int t = v;
    v += i;
    return t;
}

int main()
{
    int i;
    for (i = 1; i <= 8; i <<= 1)
        printf("%d\n", f(i));

    return 0;
}
```

5. (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++.

6. (10%) Define an integer variable "a" in C++ so that it can only be seen in the file at which it is defined.

7. (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++.

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

```c
#include <stdio.h>

#define SQUARE(x) x*x

int main()
{
    printf("%d\n", SQUARE(1+2*3)*SQUARE(3+4*5));

    return 0;
}
```

9. (10%) What is (most) wrong with the C++ function `f` below?

```c
static int i = -1;
int *f()
{
    int a[10];
    for (i = 0; i < 10; i++) {
        a[i] = i;
    }
    return a;
}
```

10. (10%) What is (most) wrong with the C++ function g below?

```c
#include <stdlib.h>
#include <string.h>

char *g()
{
    char *d = (char *) malloc(128);
    char *s = "Now is the time...";
    strcpy(d, s);
    free(s);
    return d;
}
```