

# Version A

## Midterm I, CSE250

Date: Friday, March 4, 2011

Time: 2:00 - 2:50 pm

Total Points: 15

There are 4 questions (some with multiple parts). Answer all 4 questions.

Name (PRINT, Family-name first: ) \_\_\_\_\_

UB Person #: \_\_\_\_\_

**Note: Please read and observe the following rules:**

- This is a closes-book exam, closed notes exam.
- Please leave your UB ID card on the table.
- Print, in ink, your name, person number.
- This exam has 7 pages (including the cover). Make sure you have a complete exam booklet.
- All of your writing must be handed in. This booklet must not be torn or mutilated in any way, and must not be taken from the exam room.
- Show all your work, unless instructed otherwise. Partial credits may be awarded as appropriate.

**Q1** (2+2+2 = 6 Points)

(a) Trace the the following C++ program segment. What will be the output?

```
void Increase(int & x, int y)
{ x = x + 1;
  y = y + 2;
}
int main()
{ int a=1;
  int b=5;
  cout << "a= " << a << " b=" << b << endl;
  Increase(a,b);
  cout << "a= " << a << " b=" << b << endl;
}
```

**Solution:**

$a = 1, b = 5$  (1 point)

$a = 2, b = 5$  (1 point)

(b) What will be the output from the following C++ program segment. (If a statement causes error, or produces uncertain output, please explain why.)

```
int main()
{ int* p = new int(20);
  int* q = p;
  int a = -10;
  (*q) = 10;
  cout << "(*p)=" << *p << endl;
  q = &a;
  cout << "(*q)=" << *q << endl;
}
```

**Solution:**

$(*p) = 10$  (1 point)

$(*q) = -10$  (1 point)

c) What will be the output from the following C++ program segment.

```
string X= "Test String Class Code";
string Y= X[0] + X.substr(4,12);
cout << "Y = " << Y << endl;
int p1 = Y.find_first_of(" ,!",1);
int p2 = Y.find_first_of(" ,!",p1+1);
cout << " p1 = " << p1 << " p2 = " << p2 << endl;
string Z = Y.substr(p1+1,p2-p1-1);
cout << "Z = " << Z << endl;
```

**Solution:**

Y = T String Clas (0.5 point)

p1 = 1 p2 = 8 (1 point)

Z = String (0.5 point)

**Q2** (3 Points) Write a function `FindAve`, which takes an array (or a vector) `Score` of integers as the input parameter, and return the average of the numbers stored in `Score`. The value returned should be `double` type.

Your code should include the signature of the function (namely: the return type, the function name and the parameter list) and the function body.

If you use an array as the input, the function should have two parameters: the array itself, and the size of the array. If you use a vector as the input, one parameter is enough.

**Solution:**

```
double FindAve(int Score[], int size)  -- (1 point)
{
    int i = 0;
    double sum = 0.0;
    for (i = 0; i < size; i++) -- (1 point)
    {
        sum = sum + Score[i];  -- (1 point)
    }
    return sum/size;
}
```

**Q3** (1 + 1 + 2 = 4 Points) Consider the following class definition.

```
class MemoryBlock
{private:
  int size;    // the size of block
  int* p;     // the pointer to block
public:
  MemoryBlock(int n): size(n)
    { p = new int[n];}

  int get_size() const
    {return size;}
  int* get_address() const
    {return p;}
};
```

Note that the copy constructor and the assignment operator are not defined for this class. Consider the following main program:

```
int main() {                               /* line 1 */
MemoryBlock A(10);                          /* line 2 */

for (int i=0; i < A.get_size(); i++)       /* line 3 */
  *(A.get_address()+i) = 0;                /* line 4 */

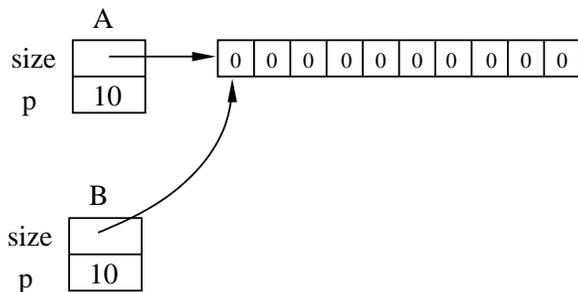
MemoryBlock B(A);                           /* line 5 */
for (int i=0; i < B.get_size(); i++)       /* line 6 */
  *(B.get_address()+i) = i;                /* line 7 */

cout << "A[5]= "
      << *(A.get_address()+5) << endl;    /* line 8 */
```

(a) In the main program, line 2 and line 5 define two objects A and B of MemoryBlock type. Draw a diagram that illustrates the memory space allocated to the data members of A and B.

**Solution:**

The pointers A.p and B.p point to the same address in the memory as shown in the figure below. – (1 point)



(b) What will be the output from line 8?

**Solution:**

5 (1 point)

(c) For the line 5, our intended purpose is to define an object B that is a fresh and complete copy of A. Does the code above achieve this goal? If not, explain what should you do to correct it. (You can either write necessary code segment, or explain how this should be done in details).

**Solution:**

No. Since A.p and B.p point to the same block in the memory, B is not a complete new copy of A. (1 point)

In order to achieve the intended goal, we need to define a *deep copy constructor*, as below:

```
MemoryBlock(const MemoryBlock& other): size(other.size)
{ p = new int[size];
  for (int i =0; i< size; i++)
    p[i]=other.p[i];
}
```

(1 point)

**Q4** (1 + 1 = 2 Points) Consider the `Computer` and the `Lap_Top` classes discussed in lectures. Here, `Computer` is the base class and `Lap_Top` is a derived class, which has two additional data members `screen_size` and `weight`.

Also suppose that a `go_string()` function is defined for `Computer` and `Lap_Top` classes (which prints out all data members in the corresponding objects).

(a) Consider the program segment:

```
Computer* my_computer = new Lap_Top("Dell", "Intel", 1024, 60, 13.3, 5.5);  
cout << my_computer -> go_string();
```

Which `go_string()` function (for the class `Computer` or the class `Lap_Top`) will be called? Briefly explain.

**Solution:**

The function for `Lap_Top` class will be called. A pointer to the base class type can point to an object of a derived class type. In addition, the method `go_string()` is overloaded in the derived class `Lap_Top`. At run time, the compiler checks that `my_computer` is actually pointing to a `Lap_Top` object. So the `go_string()` of the `Lap_Top` class will be called. (1 point)

(b) Consider the program segment:

```
Lap_Top* my_laptop = new Computer("HP", "AMD", 1024, 60);
```

Is this legal? Briefly explain.

**Solution:**

No. Because a pointer of a derived class type can NOT point to the base class object. (1 point)