Name______________________________

Please circle your section number:

010 013
011 014
012 015

Answer Questions 1–7 on a Brown Scantron Form

Bubble in ONLY your name and your answers

DO NOT bubble in your id number or section

Answer Questions 8–10 directly on the exam paper.

**General Instructions**

- **DO NOT WRITE YOUR NAME ON ANY PAGE EXCEPT THIS ONE!**
- You have 50 minutes. **Pace yourself,** and pay attention to the point values.
- The exam is 33% multiple choice, and 67% programming and short answer.
  - The programming/short answer questions start with number 8.
- Read **all** the directions **carefully** on each problem.
- You may assume that input will not produce errors for the procedures described, unless the questions say otherwise.
- Good luck.
Classes

1. (2 pts) If two functions have the same name, but differ in the number and/or type of their formal parameters, this is called:

   (a) binary scope resolution operator
   (b) function overloading
   (c) function prototypes
   (d) binary operators
   (e) none of the above

2. (2 pts) Suppose you have a class called Point. Which of the following results in a function call to the constructor for this class when it is written in a main program?

   (a) Point();
   (b) ~Point();
   (c) void Point(void);
   (d) Point p;
   (e) void destructor(Point p);

3. (2 pts) Data members typically appear in which part of a class?

   (a) private
   (b) public
   (c) constructor
   (d) attributes
   (e) data members

4. (2 pts) Attributes are also known as

   (a) private
   (b) binary scope resolution operators
   (c) constructor
   (d) member functions
   (e) data members

5. (2 pts) Information hiding refers to

   (a) keeping member functions and data members in the same syntactic construct (e.g. a C++ class)
   (b) keeping data attributes in a private section of the class so that can’t be tampered with
   (c) using inheritance to increase software reuse
   (d) dividing the specification of a class between a .h file and a .cc file
   (e) using Makefiles to summarize all the details of how to compile your software
Addresses and Pointers

6. (2 pts) If the variable a refers to an array of 10 elements, then the expression \( a[0] \) is equivalent to which of the following?

- (a) \( a \)
- (b) \( *a \)
- (c) \( a+0 \)
- (d) \( a++ \)
- (e) none of the above

7. (2 pts) If you want the variable a to contain the address of an integer, which of the following would be a correct declaration of a?

- (a) int a;
- (b) int &a;
- (c) int *a;
- (d) int %a;
- (e) none of the above
C++ Programming

8. (20 pts) Write a void function “findMidPoint” that takes six arguments:

(a) the first four are double's passed by value. These four arguments represent two pairs of
   x and y coordinates in the Cartesian Plane (for example, the x any y coordinates of two
   points \((x_1, y_1)\) and \((x_2, y_2)\) from one of the Gnuplot related labs).

(b) the last two are double's passed by reference. You should use these doubles to return
   to the calling function the “midpoint”, that is, the point \((x_m, y_m)\) that lies half way
   between \((x_1, y_1)\) and \((x_2, y_2)\). For passing by reference, you may use either pointers,
   or reference variables, your choice.

You should already know this, but so that we are testing C++ and not basic math knowledge,
here are the formulas you’ll need (in math notation): \(x_m = \frac{(x_1 + x_2)}{2}\) and \(y_m = \frac{(y_1 + y_2)}{2}\).
(Extra space in case you need it.)
9. (20 pts) A correctly written recursive function usually has two parts. Below is an incomplete
definition for a recursive function to compute two the power of n, given that n is a non-
negative integer. Finish the definition, clearly identifying (with comments) the two “parts”
that most recursive functions must have in order to be correct.

```cpp
#include <iostream>
using namespace std;

int twoToTheN(int n)
{
    // handle error case
    if (n<0)
    {
        cerr << "Fatal error: passed negative value to twoToTheN " << endl;
        exit(-1);
    }

    // Insert your code here for the two parts that a correct recursive
    // function typically needs:
}
```
(Extra space in case you need it.)
10. (10 pts) Draw a picture of the linked list that is constructed by this program, and is in memory at the time the `return(0);` statement is reached. In your picture, indicate where `head`, `tail`, and `p` are pointing. If you need more space, draw your picture next to the code on the following page.
```cpp
#include <iostream>
using namespace std;

struct Node
{
    int data;
    Node *next;
};

int main(int argc, char *argv[])
{
    int x;
    double y;
    int z;
    int *a;
    double *b;

    Node n;
    n.data = 12;
    n.next = NULL;

    x = 3;
    y = 7.3;
    z = 8;
    a = &z;
    b = &y;

    Node *head = NULL;
    Node *tail = NULL;
    Node *p = NULL;

    head = new Node;
    head->data = 3;
    head->next = NULL;
    tail = head;

    p = new Node;
    p->data = 6;
    p->next = NULL;
    tail -> next = p;
    tail = p;

    p = new Node;
    p->data = 10;
    p->next = NULL;
    tail -> next = p;
    tail = p;

    return 0;
} // end main
```
End of Exam. Total Points: 64