Name

010  011  012
Section (circle one, (2 pts)):  
013  014  015
Circle one:
  Freshman  Sophomore  Junior  Senior  Other

General Instructions

• DO NOT WRITE YOUR NAME ON ANY PAGE EXCEPT THIS ONE!

• You have 50 minutes

• Pace Yourself!!!!!

  Pay attention to the point values. When there are 10 minutes left, skim through and be sure you have at least written something for the questions that are worth many points.

• Read all the directions carefully on each problem.

• Good luck.
1. (30 pts) Write a complete C++ program to solve the following problem, including

- an opening comment (don’t put your name in the comment! -2 pts if you do!)
- all necessary “stuff” that goes before the main program
- a full main program complete with comments

**Problem Statement:** Ask the user of the program to input three non-negative numbers. Determine which of the three numbers is largest. Then, scale the numbers down by dividing all three by the largest one. Then output all three numbers.

Examples:

- For input of 3 9 10, the output should be 0.3 0.9 1
- For input of 45 180 90, the output should be 0.25 1 0.5

Your program should provide appropriate prompts to the user, and should also label the output appropriately and neatly.

There are two error conditions you should check for. If either of these error conditions occurs, print an error message, and terminate the program immediately.

- If any of the numbers input is negative.
- If the largest of the three numbers is zero. (Note that this can only occur if all three are zero.)
Extra space in case you need it
Command Line arguments

**Instructions:** Suppose you are writing a program to convert Celsius to Fahrenheit. Rather than prompt the user for the celsius temperature, you want to accept the celsius temperature as a command line argument. For example, this might be a sample script (Assume that `strauss>` is the Unix command prompt.)

```
strauss> ./convert 0
32 degrees Fahrenheit
strauss>
```

If you pass in no command line arguments, you’ll give the user a message:

```
strauss> ./convert
Usage: ./convert celsiusTemp
strauss>
```

If you pass in too many command line arguments, you’ll give the user the same message:

```
strauss> ./convert 12 foo bar fum
Usage: ./convert celsiusTemp
strauss>
```

When the wrong number of command line arguments is passed, the following code could be used to print the error message. However, some parts of this code have been replaced with two nonsense symbols: `@@@@` and `ˆˆˆˆˆ`. (The questions which follow ask you to change these nonsense symbols to correct C++ code.)

```
if (@@@@)
{
    cerr << Usage: << ^^^^^ << " celsiusTemp" << endl;
    exit(-1);
}
```

Now, answer the following questions about this program (see next page).
2. (1 pts) What should be put in place of @@@? 

(a) if (argc!=1)  
(b) if (argc<=0 || argc>=2)  
(c) if (argc!=2)  
(d) if (argv[1]!=1)  
(e) if (argv[1]!=2)

3. (1 pts) What should be put in place of ^^^^^?  

(a) char argv[]  
(b) char *argv[]  
(c) char *argv  
(d) argv[0]  
(e) argv[1]

4. (1 pts) Which of the following could be the first line of the main function in this program? 

(a) int main(void)  
(b) int main(int argc, char argv[])  
(c) int main(int argv, char argc[])  
(d) int main(int argc, char *argv[])  
(e) int main(int argv, char *argc[])

5. (2 pts) Now assume that the correct number of command line arguments was passed. Suppose that you have a variable celsiusTemp that will store the temperature passed in on the command line.  

If celsiusTemp is declared of type int, which of the following correctly initializes this value from the command line argument? 

(a) int celsiusTemp;  
(b) double celsiusTemp;  
(c) celsiusTemp = argv[1];  
(d) celsiusTemp = atoi(argv[1]);  
(e) celsiusTemp = atof(argv[1]);
6. Number conversions:

(a) (3 pts) Convert 141 from decimal to binary

(b) (3 pts) Convert AD from hexadecimal to decimal

(c) (3 pts) Convert the following from binary to hexadecimal:
0001 0110 0111 1010 1011 1110 0101 1010

(d) (3 pts) Convert the same binary number (from the previous problem) into octal.
Extra space in case you need it
7. Consider the C++ program on the following page. The program does compile and run, but *beware*—it may have logic errors and style errors in it.

In the questions below, give the output the program would *actually give* if it were compiled and run, not the output that the comments, variables names, and indentation imply the program *should* give if it were coded correctly.

(a)  (3 pts) Give the output when the input is 2

(b)  (3 pts) Give the output when the input is 3
// e03.cc  Exam question for CISC181
// P. Conrad, 03/07/05

#include <iostream>
using namespace std;

void drawStarSquare(int side);
void drawCharSquare(int side, char c);

int main(void)
{
    int x;
    cout << "Enter x: ";
    cin >> x;

    drawStarSquare(x);

    drawCharSquare(x, '+');

    cout << endl;
}

void drawStarSquare(int side)
{
    for (int i=0; i<side; i++)
        for (int j=0; j<side; j++)
            cout << "*";
    cout << endl;
}

void drawCharSquare(int side, char c)
{
    for (int i=1; i<side; i++)
    {
        for (int j=1; j<side; j++)
            cout << c;
        cout << endl;
    }
}
Recursion

8. (10 pts) Integer division and the modulus operator (%) can be used to strip apart a number digit by digit.

This question tests your knowledge of that concept, plus your understanding of recursion.

Write a C++ function (just the function, not a complete C++ program) with the following prototype:

```cpp
int sumOfDigits(int x);
```

The function must use recursion (not iteration) to return the sum of the digits in a number. Negative values are treated as if they were positive. Examples:

- If you pass in 345, the function returns 12, since $3 + 4 + 5 = 12$
- If you pass in 12, the function returns 3, since $1 + 2 = 3$
- If you pass in -12, the function still returns 3 (treat negative numbers as if they were positive).
- If you pass in 7, the function returns 7.

Clues:

- If the number passed in is negative, multiply it by -1 right away.
- For any number between 0 and 9, the function returns the same number you passed in. This is your base case.
- For the other case, consider the following:
  - get the final digit by a clever use of the % operator.
  - add that to the result of a recursive call on the number you get when you strip off the final digit (you can do that by dividing by 10).
- This should go without saying, but since you are asked only for a function, not a main program, neither cout nor cin should appear anywhere in your answer.
9. (2 pts) Rewrite the following piece of code using a ternary operator.

```java
if (x < 0 )
    absX = x * -1;
else
    absX = x;
```
Short Answer

10. (6 pts) Write 3-4 lines of C++ code that illustrate the correct usage of both the stream insertion operator and the stream extraction operator. Then, circle the stream extraction operator, and label it clearly as the “stream extraction operator”. Then, do the same for the “stream insertion operator”.

Declare any variables that you use.

(You should NOT write a complete program; assume that you already did any necessary #include’s and “using” statements, and that you are inside the main function.)

11. (10 pts) Write a line of code (or two) that illustrates the point that the * operator has higher precedence than the + operator.

That is, your code should produce some output that depends on * having higher precedence that +.

(You may assume that your code will appear inside a main function, and that all necessary #includes and using statements have been done.)

Give both the code, and the output the code produces, along with an explanation of your answer.

An accurate one-sentence explanation is enough. Don’t write a book.

12. The C++ language includes something called “pre-processor directives”.

- (2 pts) Write a complete line of C++ code demonstrating an example of using a pre-processor directive.
• (2 pts) Explain *what* that pre-processor directive “means”, or what it “does”.

• (2 pts) Explain *why* a programmer might write that line of code (that is, when would your example line of code be used?)
Unix Commands

13. (3 pts) What is the command (or sequence of commands) you must issue to make all the files under your public_html directory readable on the web? (Assume that your current working directory is NOT your home directory.)

14. (8 pts) Assume that the following directory contains a collection of C++ files and text files:

```
~pconrad/public_html/cisc181/lab05
```

Assume that you start at the shell prompt, and your current working directory is your home directory.

Type a command, or sequence of commands, so that when you are finished:

- there is a subdirectory of your home directory called cisc181,
- there is a subdirectory under cisc181 called lab05
- your newly created lab05 directory ends up containing a copy of every file from pconrad’s version of the lab05 directory.
- the newly created directory lab05 is your new working directory.
Total Points: 100