HW #6: Iterations and Data Types

Due dates:

Part I: Monday Feb 22nd, at the beginning of the class. Make sure to write your name and msunetid on your paper.
Part II: Sunday Feb 21st, 11:59 pm through Handin (https://secure.cse.msu.edu/handin)

Part I: Comprehension Questions

1. Specify for each of the following C constants if it is represented in decimal, octal or hexadecimal form (2pts)

101011	Decimal
0234	Octal because it starts with 0
34	Decimal
0x34	Hexadecimal because it starts with 0x

2. For each constant, state if it is a legal constant or not (2pts)

0x899	Legal
899	Legal
0899	Illegal: octal notation does not include digits 8 and 9
0xGFF	Illegal: hexadecimal notation does not include G

3. What is the output? (3pts)

```
char ch = 'A';
int a2 = ch*2;
int a3 = 3;
a3 *= ch + 5;
char ch2 = ch + 5;
int x = sizeof(ch);
printf("%d %c %c %d %d %d\n", ch, ch, ch2, a2, a3, x);
```

   65 A F 130 210 1

4. What is the largest signed integer that can be stored when 2 bytes are used to represent int variables? What is the largest unsigned integer? Show your work (3 pts)

   2 bytes consist of 16 bits. Since the int is unsigned, all bits are used to compute the value. The largest is reached when all bits are 1. The binary representation is as follows:

   1111111111111111

   In decimal, this is equal to: $2^0 + 2^1 + 2^2 + \ldots + 2^{15} = 65535$

Part II: Lab Assignment

Getting started

Change into the cse220 directory. Create a new directory called lab06
Change into the new directory. Implement the program below in your lab06 directory

Pyramids

Write a program PyramidUp.c that reads an integer from the user and outputs the following pattern where the number of stars at the bottom is equal to the number read.

```
    *
   ***
  *****
 *******
```

```c
#include <stdio.h>
int main(void) {
	int n;
	//Collect number of stars from user
	printf("Enter an odd number:");
	scanf("%d", &n);

	//Verify it is odd, exit if not
	if (n % 2 == 0) {
		printf("You entered an even number. Please try again\n");
		return 0;
	}

	/*Draw the pyramid
	Draw rows containing x stars
	Repeat for x from 1 to n, incrementing by 2
	If row has x stars, then it has n-x spaces:
		Half of them before the start, half after
	So number of spaces before is (n-x)/2   */
	int x, staridx, spaceidx;
	for (x=1; x <=n; x += 2) {
		//Draw (n-x)/2 spaces
		for (spaceidx=0; spaceidx<(n-x)/2; spaceidx++)
			printf(" ");

		//Draw x stars
		for (staridx=0; staridx<x; staridx++)
			printf("*");

		//Draw new line
		printf("\n");
	}
	return 0;
}
```

Write a program PyramidDown.c that reads an integer from the user and outputs the following pattern alternating stars and equal signs where the number of stars at the top is equal to the number read

```
*******
 =====
  ***
   =
```

```c
#include <stdio.h>
int main(void) {
	int n;
	//Collect number of stars from user
	printf("Enter an odd number:");
	scanf("%d", &n);

	//Verify it is odd, exit if not
	if (n % 2 == 0) {
		printf("You entered an even number. Please try again\n");
		return 0;
	}

	/*Draw the pyramid
	Draw rows containing x symbols from n to 1, decrementing by 2
	If row has x symbols, then it has n-x spaces: Half of them
	before the start, half after
	So number of spaces before is (n-x)/2
	Alternate the symbol between * and = */
	int x, staridx, spaceidx;
	char symbol = '*';
	for (x=n; x >= 1; x -= 2) {
		//Draw (n-x)/2 spaces
		for (spaceidx=0; spaceidx<(n-x)/2; spaceidx++) {
			printf(" ");
		}

		//Draw x symbols
		for (staridx=0; staridx<x; staridx++) {
			printf("%c", symbol);
		}

		//Draw new line
		printf("\n");

		//Flip the symbol
		if (symbol == '*')
			symbol = '=';
		else
			symbol = '*';

	}
```

```
	return 0;}
```

Cubic Equation

Write a program CubicRoot.c that reads four decimals from the user: a, b, c, d and tries to find if the equation $ax^3 + bx^2 + cx + d = 0$ has any roots in the range -100..100. Your program should try decimals in the given range in small steps (eg. 0.01) and evaluate the equation at every step. If the equation evaluates to 0, the program should output the corresponding value of x.

```
#include<stdio.h>
int main(void) {
	double a, b, c, d, x, eq;

	printf("Enter the 4 coefficients of a cubic polynomial\n");
	scanf("%f %f %f %f", &a, &b, &c, &d);

	double x, eq;
	for (x = -100.0; x <= 100.0; x = x + 0.001) {
		eq = a*x*x*x + b*x*x + c*x + d;
		if (eq <= 0.001 && eq >= -0.001) {
			printf("eq(%f) = %f\n", x, eq);
		}
	}

	return 0;

}
```

Compile all programs and produce and executable with the same name as the program.

Handin

Submit through the handin system your C code and the executables generated.

The ''handin'' system has options to allow you to review your files online and to download them. You Should always verify that you submitted the correct files and they were received by the handin system. You can submit files as many times as you like for a particular assignment. Handin will only keep the last version of each file. Remember to submit your files prior to the deadline as you won't be able to use handin if the deadline has passed.