`do`/`while` and Nested Loops

Section 5.5 & 5.11

`do/while` Repetition Structure

- So far, we have looked at
  - `while`
  - `for`
  - both of these are pretest loops
- `do/while` is another repetition structure
- Post-test: test happens at the end of the loop

do/while Loops

```
do
{
   cout << "Enter a year:" << endl;
   cin >> year;
} while (year < 0); // TEST!
// The body of the loops happens
// before the test
```

When to use do while?

- Will always execute at least once
- Perfect for data validation!
- Post-tested loop

```
do
{
   statements;
} while ( expression );
```

Example

- Write C++ statements that will read in integers from the user until the user inputs an integer greater than 10.

Practice

- Ask the user for an even integer greater than 100. Keep asking until valid input is given.

Practice

- Ask the user for a capital letter. Keep asking until you get valid input.

What is the Purpose?

```
char ch;
do
{
  cout << "Enter a valid code (h,c, i): ";
  cin >> ch;
} while ((ch != 'h') && (ch != 'c') && (ch != 'i'));

// how could we rewrite that test?
```

Loop Review

- We have three types of loops
  - while
  - for
  - do/while
- What is each good for?
- How are they different?

What is the Output?

```
for (int i = 0; i < 3; i++)
{
  // how many times will this run?
  cout << i << ": ";
  for (int j = 0; j < 2; j++)
  {
     // how many times will this run?
    cout << "*";
  }
  cout << endl;
}
```

What is the Output?

```
for (int i = 1; i < 4; i++)
{
   cout << i << ": ";
   for (int j = 0; j < i; j++)
   {
      cout << "*";
   }
   cout << endl;
}
```

Practice

- Write C++ statements that will read in an integer from the user (n) and produce:

```
1

22

333

4444

....

nnnnnnnnn
```

More Nested Loops

Problem: What is the output from the following program segment?

```
cout << setw(3) << "i" << setw(3) << "j" << endl;

for (int i = 0; i <= 3; i += 2)
   {
     for (int j = i; j <= 3; j++)
     {
       cout << setw(3) << i << setw(3) << j << endl;
     }
   }
```

Problem: Rewrite the above nested for loop example as a nested while loop.

Nested Loops

- Problem: Write a complete C++ program that allows the user the ability to input a number of students in a class and the number of exam scores for each student.
  - Output each student's average
  - Output the highest and lowest average in the class