Loops

section 5.2, 5.4, 5.7
Loop!

- So far, we can
  - Get input
  - Produce output
  - Calculate
  - Conditionally execute statements
• Loops
  o Perform the same bit of code many times
    \[\text{statement1;}\]
    \[\text{statement2;}\]
    \[...\]
    \[\text{statement3;}\]
  o Why might we want to do this?
While Loop (5.2)

• While the expression is true, loop!

```java
while (expression)
{
    statement1;
    statement2;
    ...
    statement3;
}
statement4;
```

1. Test the expression
2. Either
   - Perform the statements in the loop
   or
   - Move past the loop
3. Repeat
Example: What happens?

```cpp
int number = 0;

while ( number < 5 ) {
    cout << "Number : ";
    cout << number << endl;
    cout << "Please enter a number : ";
    cin >> number;
}

cout << "The final number is: ";
cout << number << endl;
```
Counters (5.4)

- Counter: A variable that is incremented or decremented each time a loop runs

```cpp
int theCounter = 0; // initialize the counter
while( theCounter < 2 ) // test the counter
{
    cout << "theCounter : " ;
    cout << theCounter << endl;
    theCounter += 1; // increment the counter
}
```

- What will happen?
Key Ingredients of **while** loops

- Initialize
- Test
- Update (Increment/Decrement)

*If any one of these is missing or incorrect, your loop won’t run properly--not at all, too many/few times or infinitely.*
Counters

```cpp
int theCounter = 1; // initialize the counter

while ( theCounter < 2 ) // test the counter
{
    cout << "theCounter : " ;
    cout << theCounter << endl;
    theCounter += 1; // increment the counter
}

• What will happen?
```
Counters

```cpp
int theCounter = 0; // initialize the counter

while( theCounter < 2 ) // test the counter
{
    theCounter += 1; // increment the counter
    cout << "theCounter : " ;
    cout << theCounter << endl;
}
```

- What will happen?
Counters

```cpp
int theCounter = 0; // initialize the counter
while( theCounter > 2 ) // test the counter
{
    cout << "theCounter : ";
    cout << theCounter << endl;
    theCounter += 1; // increment the counter
}
```

- What will happen?
Practice

- Write a snippet of code that will print all the numbers from 0 to 10000 using a while loop!
Let the user control the Loop

- Let the user determine how many times to run the loop

```cpp
int theCounter = 0; // initialize the counter
int maxValue;

cout << "How many times should we run the loop? ";
cin >> maxValue;

while ( ) // test the counter
{
    cout << "theCounter : ";
    cout << theCounter << endl; // increment the counter
}
```
Practice

Write a snippet of code that will ask the user for a number. Print the numbers from 0 to the square of the number the user supplied.
Running totals (5.7)

- How many hours did you work on assignment 1?

```cpp
int theCounter = 0; // initialize the counter
int days;

// let the user tell us how many times to loop
cout << "How many days did you work on assignment 1? ";
cin >> days;

while() // test the counter
{
    // increment the counter
}
```
Practice

- Write a snippet of code that will ask the user for a number. Print the sum of all the numbers from 0 to the number the user supplied.
Practice

- Write a snippet of code that will ask the user for a number. Print the sum of all the even numbers from 0 to the square of the number the user supplied.
Exercise

- Write a snippet of code that will ask for a student’s exam score and then print the appropriate letter grade (A,B,C,D,F).

- Continue asking for exam scores and printing letter grades until the user enters a negative exam score

```cpp
int examScore;
```