Loops

section 5.2, 5.4, 5.7

Loop!

- So far, we can
  - Get input

  - Produce output

  - Calculate

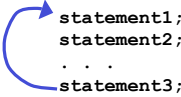 - Conditionally execute statements

---

Loops

- What do they do?
  - Perform the same bit of code many times

    ```
    statement1;
    statement2;
    . . .
    statement3;
    ```

  - Why might we want to do this?

1

While Loop (5.2)

- **while** the **expression** is **true**, loop!

```
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
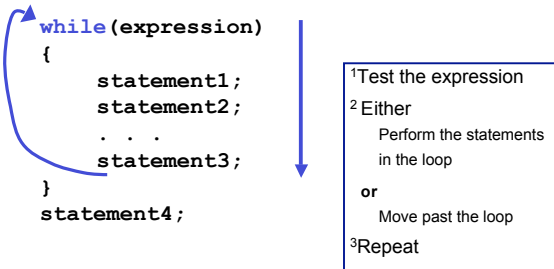
Example: What happens?

```
int number = 0;

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

```
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

```
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

```
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

```
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

```
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
}
```

4

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?

```
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

```
int examScore;
```

6