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# Loops

section 5.2, 5.4, 5.7

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## Loop!

- So far, we can
  - Get input
  - Produce output
  - Calculate
  - Conditionally execute statements
- Loops
  - Perform the same bit of code many times

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

- Why might we want to do this?

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## While Loop (5.2)

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

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

<sup>1</sup>Test the expression  
<sup>2</sup>Either  
    Perform the statements  
    in the loop  
**or**  
    Move past the loop  
<sup>3</sup>Repeat

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## Q.1. What happens?

```
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;
```

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## Q.2. 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?

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## Key Ingredients of **while** loops

- Initialize  
MUST initialize the counter
- Test  
The value of the counter is tested before each iteration
- Update (Increment/Decrement)  
The counter is changed during each loop iteration

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

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### Q.3. Counters

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```
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?

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### Q.4. Counters

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```
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?

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### Q.5. Counters

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```
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?

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### Q.6. Practice

- Write a snippet of code that will print all the numbers from 0 to 10000

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### Q.7. User controls 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
}
```

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### Q.8. 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.

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### Q.9. 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
}


```

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### Q.10. 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.

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### Q.11. 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.

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## Q.12. Exercise

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- 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;
```

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