

# AP Computer Science A Study Guide Unit 4

From Simple Studies: <https://simplestudies.edublogs.org> &

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## Iteration

### while Loops and for Loops

- for loop vs. while loop
  - for loops repeat for a range of values
  - while loops repeat when a condition is true/met
  - for loops have a start value for the loop variables
  - for loop can be best when you know how many times to repeat the code
  - while loops can be best when you don't know how many times to repeat the code
- Similarities between for loops and while loops
  - Repeats code
  - Loop stops once the condition is false

- Example of a while loop

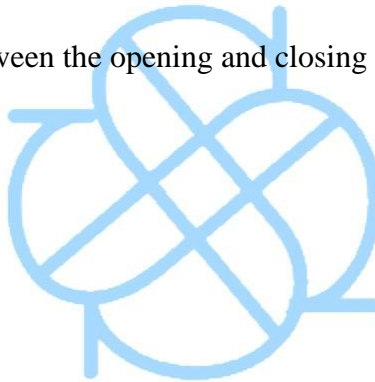
```
public class Test
{
    public static void main(String[] args)
    {
        int x = 10;
        while (x > 0)
        {
            System.out.println(x);
            x = x - 2;
        }
    }
}
```

### while Loops and for Loops (continued)

- Example of a for loop

```
public class Test
{
    public static void main(String[] args)
    {
        for (int x = 3; x > 0; x--)
        {
            System.out.println(x);
        }
    }
}
```

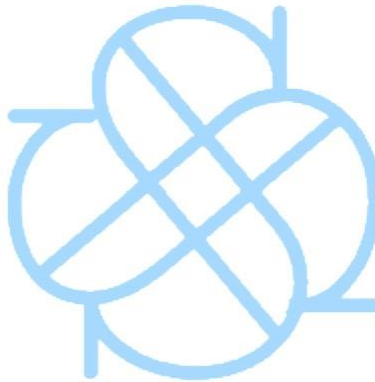
- Body of the loops
    - A single statement after “while” or “for”
- OR
- Block of code between the opening and closing curly braces.



### **Developing Algorithms Using Strings**

- Loops are usually incorporated in:
  - String traversals
  - String processing

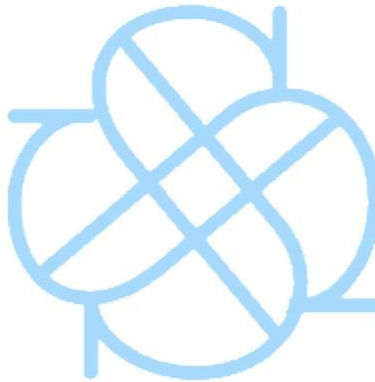
- The code processes a string by each character.
- First character in a Java String ALWAYS starts with the index 0
  - Last character: `length() - 1`
- String methods that are often used:
  - `int length()`
  - `int indexOf(String Str)`
  - `String substring (int from, int to)`
  - `String substring (int from)`
- Standard algorithms use String traversals to:
  - Find if the substrings have a certain property
  - Determine how many substrings meet the criteria
  - Create new strings with the characters of an existing string reversed.



## **Nested Iteration**

- Nested loops – a loop inside of another loop
- Used when working with two dimensions such as arrays and ArrayLists.
- The inner loop runs multiple times before the outer loop runs again.
- Inner loop must finish all iterations before the outer loop can go onto the next iteration.
- Example of a nested loop:

```
public class NestedLoops
{
    public static void main(String[] args)
    {
        for (int row = 1; row <= 3; row++)
        {
            for (int col = 1; col <= 5; col++)
            {
                System.out.print("*");
            }
            System.out.println();
        }
    }
}
```



### Informal Code Analysis

- Trace tables – used to keep track of the variables
  - Keeps track of any values assigned in each iteration of the loop
- Statement Execution Count – determines how many times a block of code runs
  - Known as run-time analysis
- $\text{largestValue} - \text{smallestValue} + 1$ 
  - Number of times a loop executes