Java Control: Repetition

CPSC 233: Introduction to Computer Science for Computer Science Majors II
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Loop types

Post-test loops

- Checking the looping condition *after* executing the body of the loop.
- The loop body executes at least *one* time.

Pre-test loops

- Checking the looping condition *before* executing the body of the loop.
- The loop body executes *zero or more* times.

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Post-Test Loop (do-while)

In Java! (not in Python)

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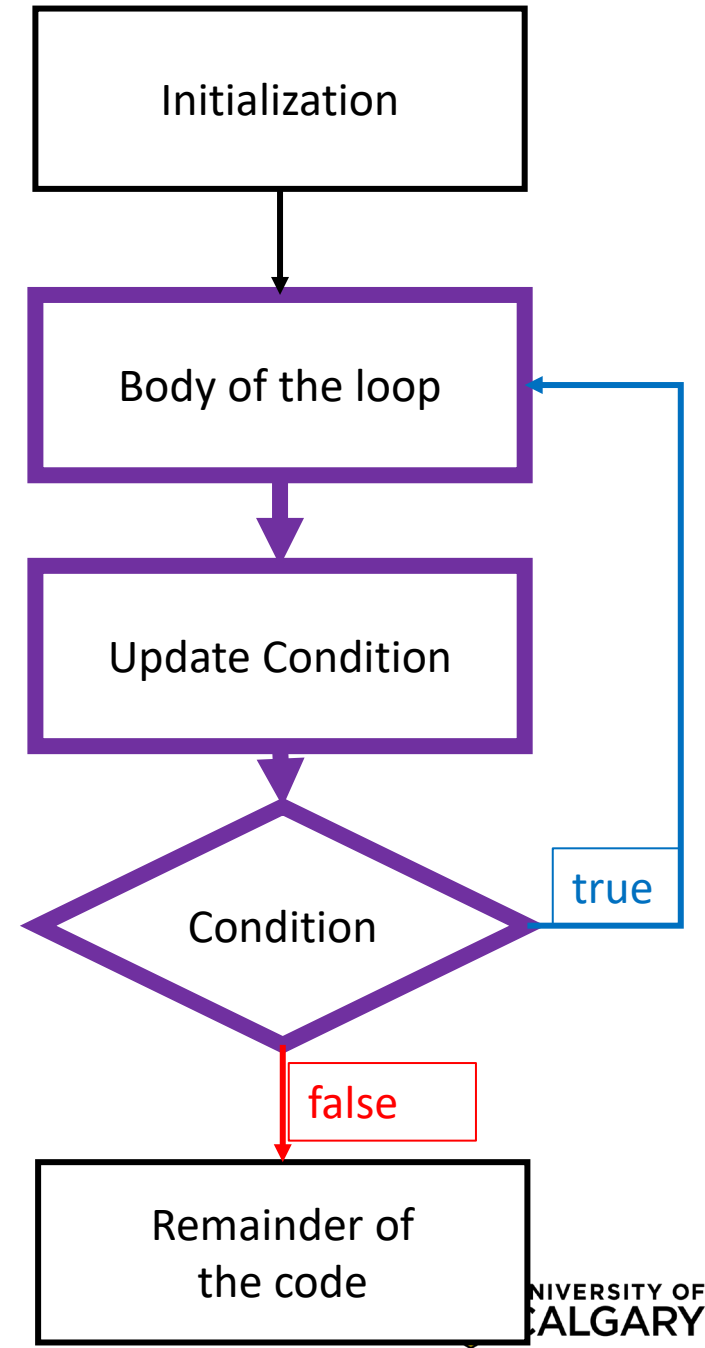
Post-test loops

1. Initialize the loop control
2. Execute the body of the loop
   (the part to be repeated)
3. Update the loop control
4. Check the condition
   - **False** → stop the loop and go to the rest of program
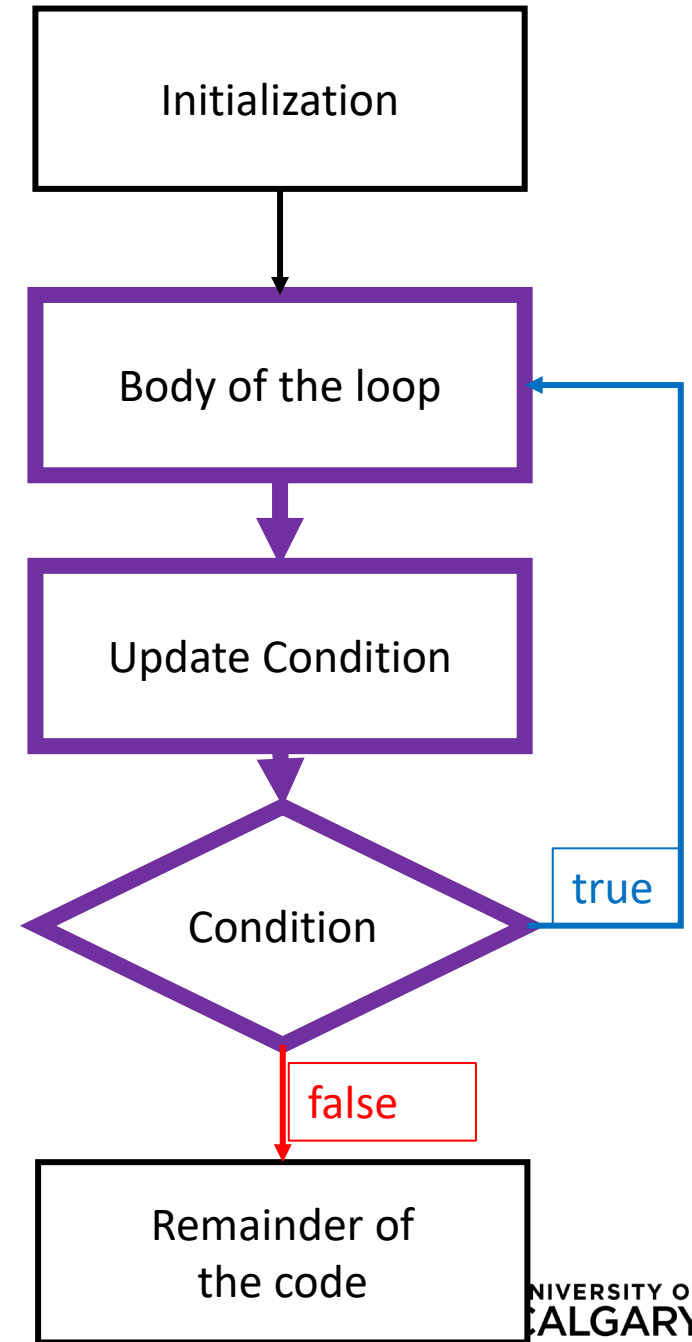   - **True** → repeat from step 2

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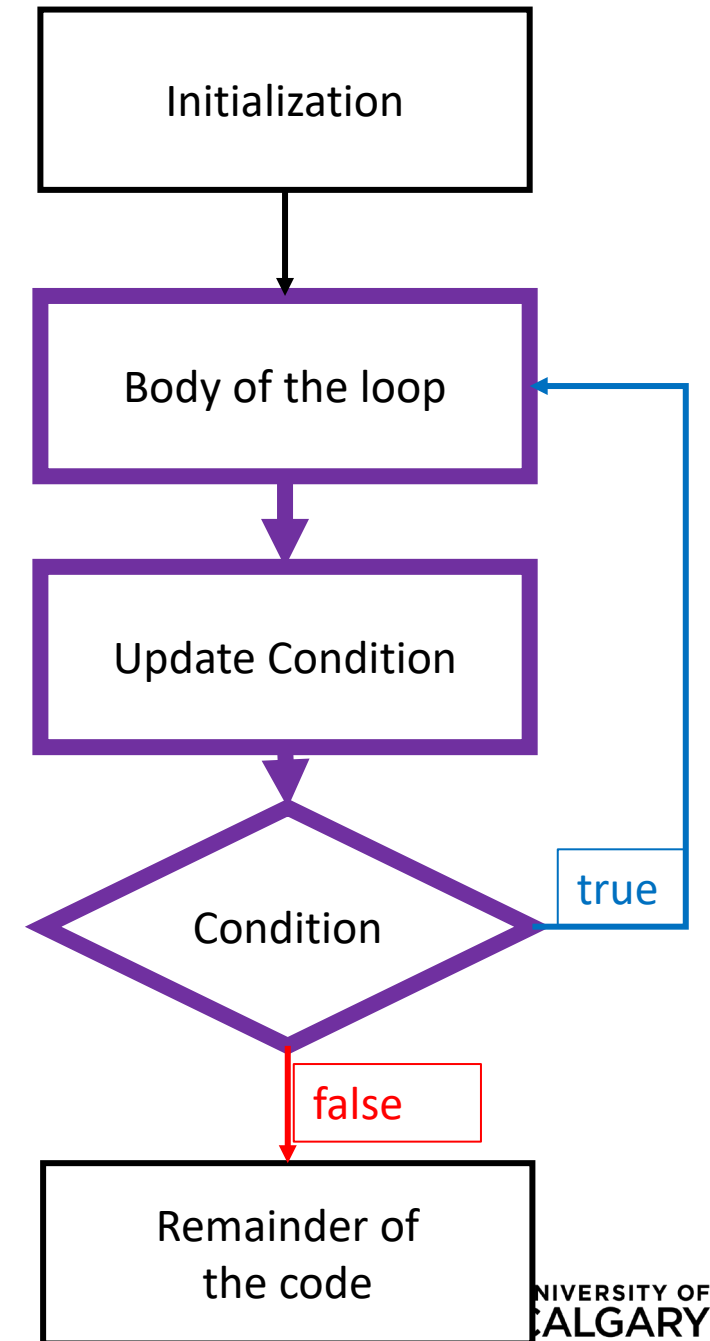
do-while loops – (simple)

```
int x = 1;
do {
        System.out.println("Hi");

        x = x + 1;
} while (x <= 5);
```

```
Hi
Hi
Hi
Hi
Hi
```

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do-while loops – (always loops once)

```java
int x = 1;
do {

        System.out.println("Hi");

        x = x + 1;

} while (x <= -999);
```

```
Hi
```
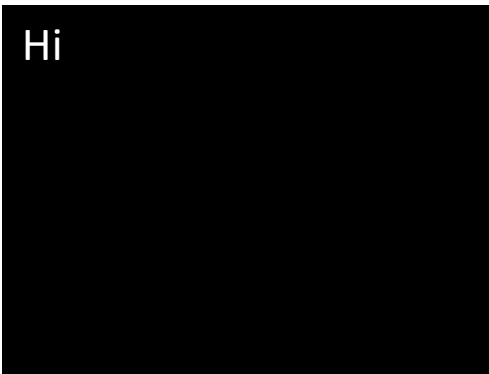
Pre-Test Loop (for/while)

In Java!

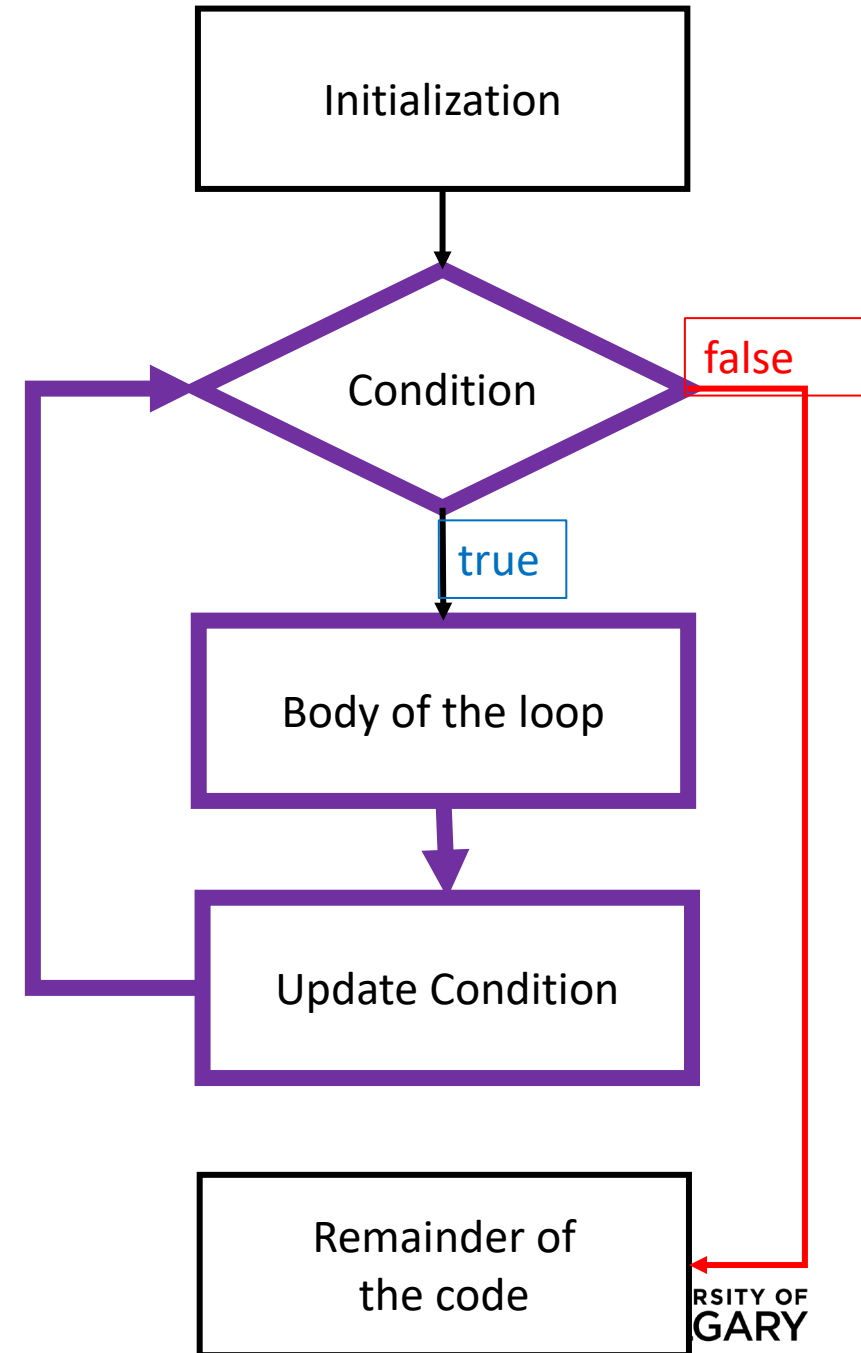UNIVERSITY OF
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Pre-test loops

1. Initialize loop control

2. Check the condition

   False→ stop the loop, skip the body,
   go to the rest of program

   True → Execute the body of the loop

4. Update the loop control

5. Repeat from step 2

while loop (simple)

int x = 1;

while (x <= 5){

  System.out.println("Hi");

  x = x + 1;

}

```
Hi
Hi
Hi
Hi
Hi
```

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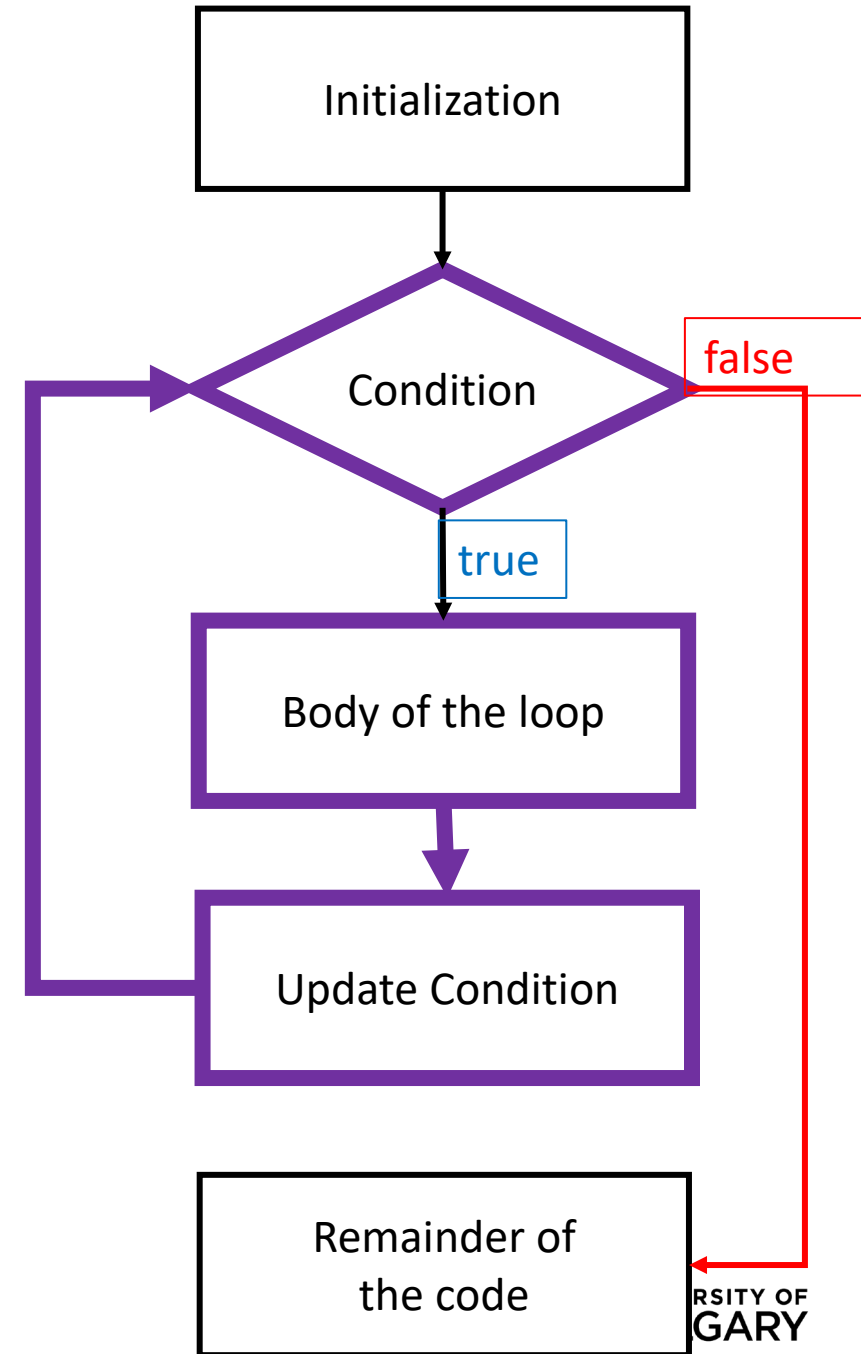
for loop (simple)

for (int x = 1; x <= 5; x = x +1){

       System.out.println("Hi");

}

```
Hi
Hi
Hi
Hi
Hi
```

Initialization

Condition

false

true

Body of the loop

Update Condition

Remainder of the code

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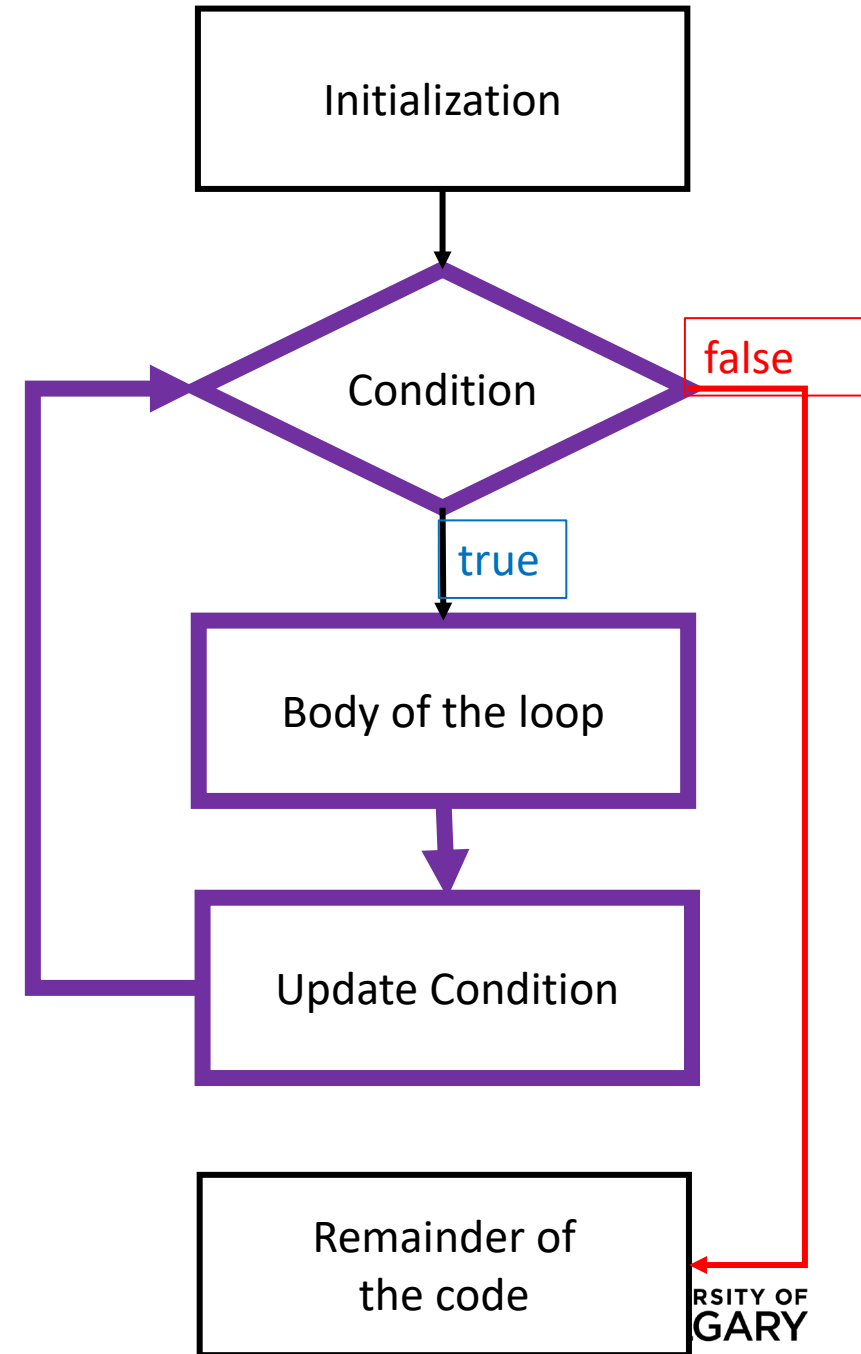
Compare

For vs While

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all for loops are while loops
all while loops are for loops*

```
int x = 1;
while (x <= 5){

        System.out.println("Hi");

        x = x + 1;

}



for (int x = 1; x <= 5; x = x +1){

        System.out.println("Hi");

}
```

*For-each loops are different

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all for loops are while loops
all while loops are for loops*

```
int x = 1; int y = 2;

while (x <= 5){

        System.out.println("Hi");

        x = x + 1; y = y + 10;

}



for (int x = 1, int y = 2; x <= 5; x = x + 1, y = y + 10){

        System.out.println("Hi");

}
```

*For-each loops are different

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Loops in Java – Developing for/while

The following are equivalent loops:

```java
int sum = 0;

for (int i = 0; i < 10; i++){
    sum = sum  + i;
}
System.out.println(sum);
```

```java
int sum = 0;
int i = 0;
while ( i < 10 ){
    sum = sum + i;
    i++;}
System.out.println(sum);
```

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Loops in Java – Developing for/while

The following are equivalent loops:

```java
int sum = 0;

for (int i = 0; i < 10; i++){
    sum = sum  + i;
}
System.out.println(sum);
```

```java
int sum = 0;
int i = 0;
while ( i < 10 ){
    sum = sum + i;
    i++; }
System.out.println(sum);
```

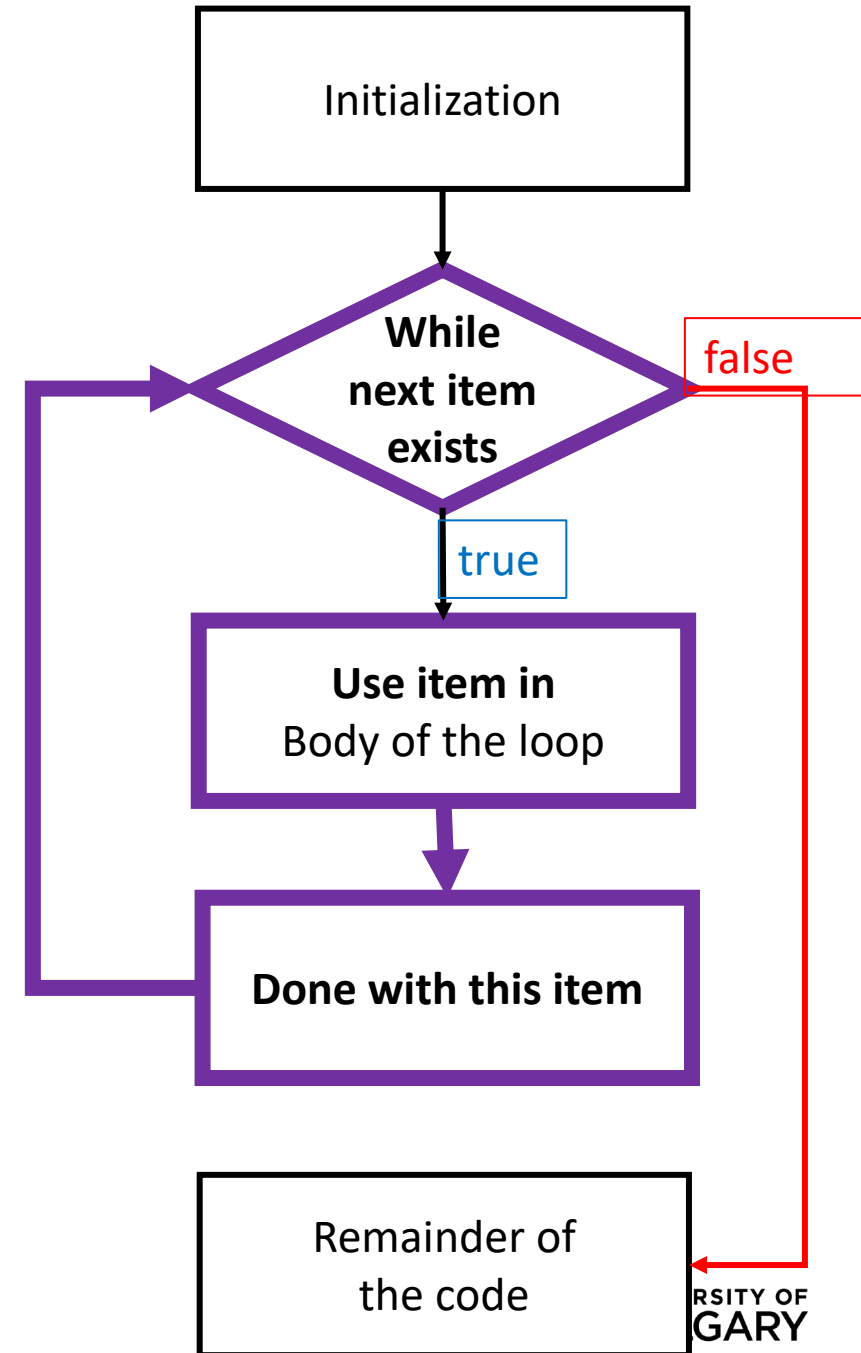UNIVERSITY OF CALGARY

For-each Loop

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for-each loops - invalid

String hello = "Hello, World!";
for (char x: hello){

   System.out.println(x);

}

Not always as simple as Python (this is invalid syntax!)

- For-each on String requires more syntax
- For-each on other types will exist (like ArrayLists)

for-each loops - valid

String hello = "Hello, World!";

//Change String into for-each loop-able type

for (char x: hello.toCharArray()){

    System.out.println(x);

}

// By index

for (int i =0; i < hello.length(); i++){

    System.out.println(hello.charAt(i));

}

```
Initialization
        |
        v
  While next item exists --- false --->
        |
       true
        |
        v
  Use item in
  Body of the loop
        |
        v
  Done with this item
        |
        (loop back to While)

  Remainder of
  the code
```

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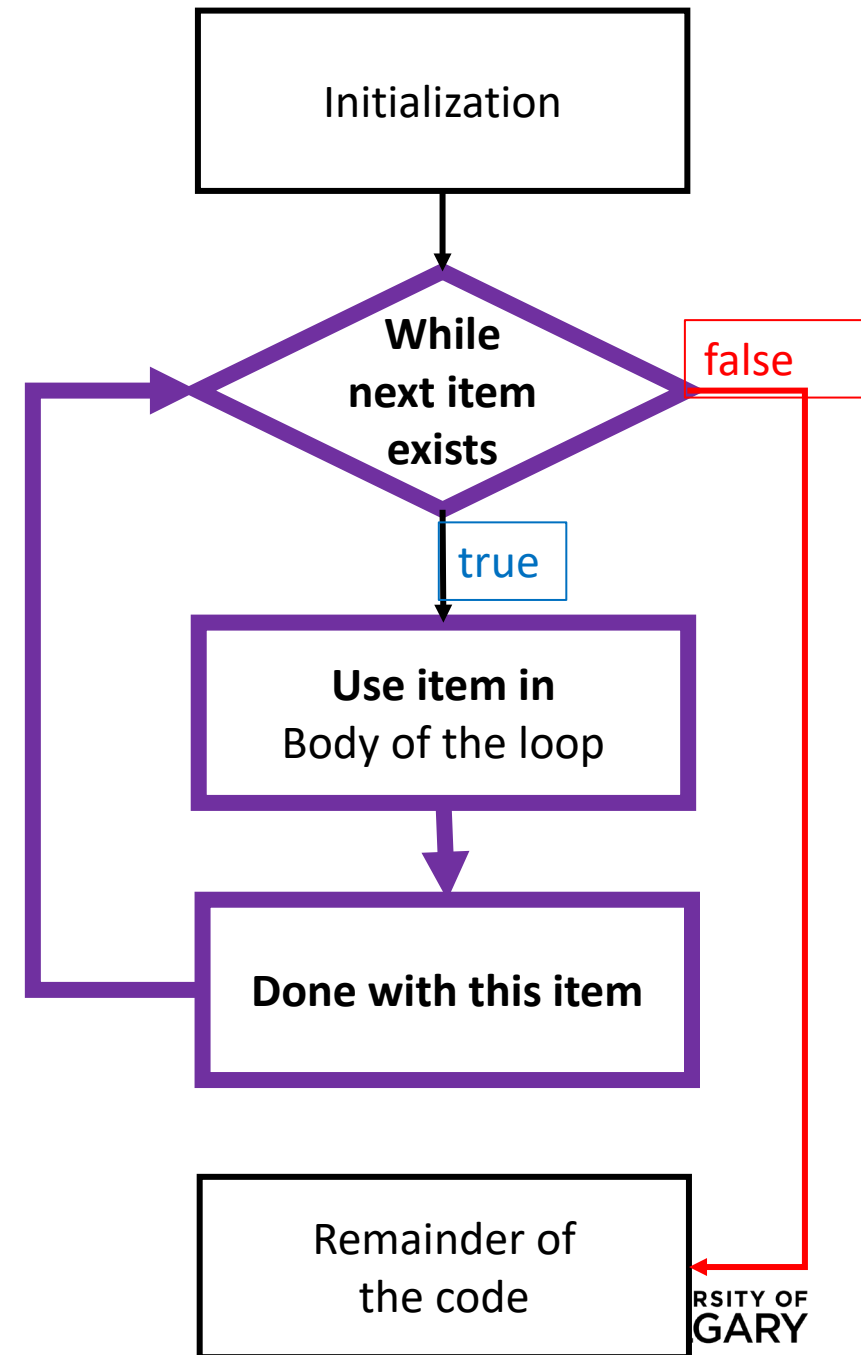
Break/Continue

Break and Continue

- Allow a loop iteration to end prematurely

- `break`
  - Entire loop ends immediately
  - Execution continues at the first statement after the loop body

- `continue`
  - Current iteration ends immediately
  - Execution returns to the top of the loop
    - In a for loop, the next item in the list is used

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Break and Continue

```java
int i = 0;
while (i <= 10) {
    i++;
    if (i == 5){
        break;
    }
    System.out.println(i);
}
```

```java
int i = 0;
while (i <= 10) {
    i++;
    if (i == 5){
        continue;
    }
    System.out.println(i);
}
```

1, 2, 3, 4

ends loop at 5 before print

1, 2, 3, 4, 6, 7, 8, 9, 10, 11

skips rest of body before print at 5

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Loop Examples

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Multiplication Table (Python)

Produce a multiplication table from **1** to some **value** inputted by user:

```python
max_multiplier = int(input("Enter the maximum multiplier: "))

for i in range(1, max_multiplier+1):
    row = ""
    for j in range(1, max_multiplier+1):
        row += str(i*j) + "\t"
    print(row)
```

1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

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Multiplication Table (Java)

Produce a multiplication table from **1** to some **value** inputted by user:

```java
Scanner scanner = new Scanner(System.in);
System.out.println("Enter the maximum multiplier: ");
int max_multiplier = scanner.nextInt();
for (int row = 1; row < max_multiplier + 1; row++) {
    String line = "";
    for (int col = 1; col < max_multiplier + 1; col++) {
        line += row * col + "\t";
    }
    System.out.println(line);
}
```

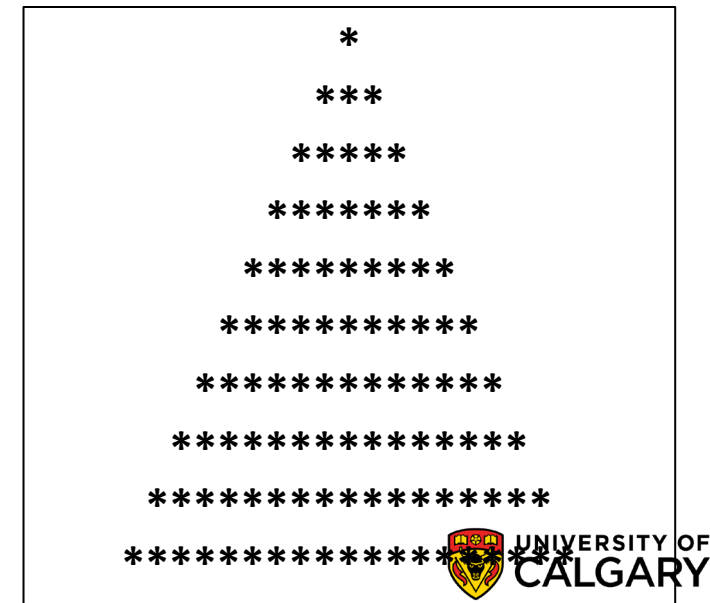| 1	2	3	4	5	6	7	8	9
2	4	6	8	10	12	14	16	18
3	6	9	12	15	18	21	24	27
4	8	12	16	20	24	28	32	36
5	10	15	20	25	30	35	40	45
6	12	18	24	30	36	42	48	54
7	14	21	28	35	42	49	56	63
8	16	24	32	40	48	56	64	72
9	18	27	36	45	54	63	72	81

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Christmas tree

- Write a program that will print a triangle of a height provided by the user. For example:
  - If the height is 3, the triangle will look like:

```
  *
 ***
*****
```
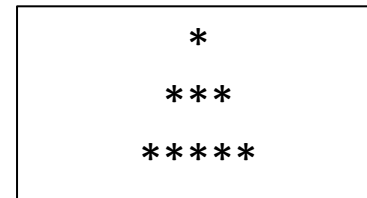
  - If the height is 10, the triangle will look like:

```
         *
        ***
       *****
      *******
     *********
    ***********
   *************
  ***************
 *****************
*******************
```

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Christmas Tree Solution (Python)

```python
iHeight = int(input("Please enter the height of the triangle: "))

for i in range(iHeight):
    row = ""
    for j in range(iHeight-i-1):
        row += " "
    for j in range(i*2 +1):
        row += "*"

    print(row)
```

Christmas Tree Solution (Java)

```java
Scanner scanner = new Scanner(System.in);
System.out.println("Enter height of tree: ");
int height = scanner.nextInt();
for (int h = 0; h < height; h++) {
    int spaces = height - h - 1;
    int stars = 2 * h + 1;
    String line = "";
    for (int i = 0; i < spaces; i++) {
        line += " ";
    }
    for (int i = 0; i < stars; i++) {
        line += "*";
    }
    System.out.println(line);
}
```

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Onward to ... Functions.

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