Variables and Expressions

Increment and *Decrement* Operators

Lecture Contents

- Operator Types
- Java Arithmetic Operators
- Java Assignment Operators
- Operator Precedence

Operator Types

- *Arithmetic*
- *Assignment*
- ***Increment / Decrement***
- *Comparison*
- *Logical*
- *Bitwise*

Java Arithmetic Operators

- Java ***arithmetic operators***:
  - Add: `x + y`
  - Subtract: `x - y`
  - Multiply: `x * y`
  - Divide: `x / y`
  - Modulus: `x % y`

Java Assignment Operators

- In addition to the simple assignment operator, **=** , there are assignment operators that combine ***arithmetic*** operations:

	Arithmetic Operation and Assignment	Combined Operation
Addition	`x = x + 5`	`x += 5`
Subtraction	`x = x - 7`	`x -= 7`
Multiplication	`x = x * 3`	`x *= 3`
Division	`x = x / 6`	`x /= 6`
Modulus	`x = x % 4`	`x %= 4`

- Note: There are also ***bitwise assignment*** and ***shift assignment*** operators, which are not part of the *Java AP Subset*.

Operator Precedence

Level	Operators	Associativity
16	( )	Left-to-right
15	++, --	Left-to-right
12	*, /, %	Left-to-right
11	+, -	Left-to-right
1	=, +=, -= *=, /=, %=	Right-to-Left

Increment, `++`, and decrement, `--`, Operators

- The operator `++` is the increment operator. It increases the value of the variable by 1.
- Tye operator `--` is the decrement operator. It decreases the value of the variable by 1.
- In Java, these operators can be used with:
  - integers (`byte`, `short`, `int`, `long`)
  - real numbers (`float`, `double`)
  - and even characters (`char`)

(Can not use these operators with the `boolean` type or objects)

Increment, **++**, and decrement, **--**, Operators

- When placed in their own statement, the following three operations are equivalent:

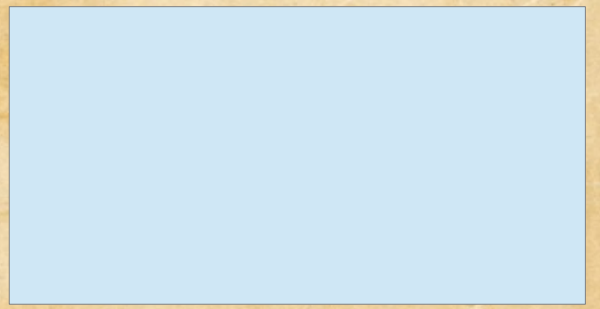
```
x = x + 1;
x += 1;
x++;
```

- Similarly for subtraction:

```
x = x – 1;
x –= 1;
x––;
```

Increment Operator, **++**

```
public static void main(String[] args) {
     int i = 5;
     i ++;
     System.out.println(i);
}
```



Increment Operator, **++**

```
public static void main(String[] args) {
     int i = 5;
     i ++;
     System.out.println(i);
}
```

```
6
```

Increment, **++**, and decrement, **--**, Operators

- When <u>not</u> in their own statement, there is some nuance...

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(i++);
     System.out.println(i);
}
```

Increment, **++**, and decrement, **--**, Operators

- When not in their own statement, there is some nuance...

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(i++);
     System.out.println(i);
}
```

```
5
6
```

- When the increment is placed after the variable, the variable is used in the calculation first, and the incremented after it is used.

Increment, **++**, and decrement, **--**, Operators

- When <u>not</u> in their own statement, there is some nuance...

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(++i);
     System.out.println(i);
}
```

Increment, **++**, and decrement, **--**, Operators

- When not in their own statement, there is some nuance...

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(++i);
     System.out.println(i);
}
```

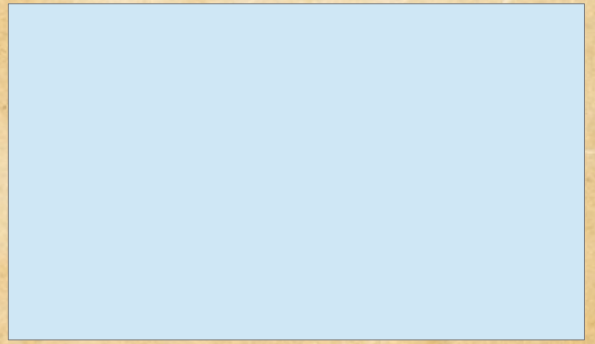
```
6
6
```

- When the increment is placed before the variable, the variable is incremented before it is used in the calcuation.

Increment, **++**, and decrement, **--**, Operators

- What is the output?

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(i);
     System.out.println(i++);
     System.out.println(i);
     System.out.println(++i);
}
```



Increment, **++**, and decrement, **--**, Operators

- What is the output?

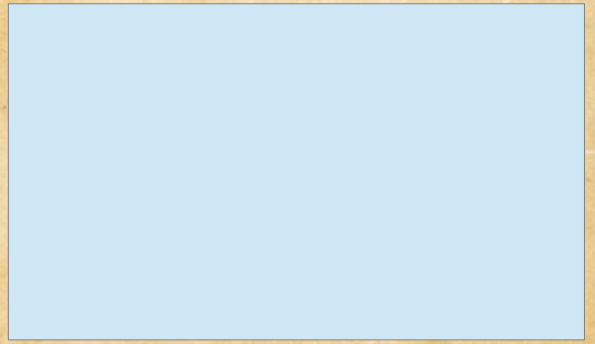
```
public static void main(String[] args) {
     int i = 5;
     System.out.println(i);
     System.out.println(i++);
     System.out.println(i);
     System.out.println(++i);
}
```

```
5
5
6
7
```

Increment, **++**, and decrement, **--**, Operators

- The functionality is the same for the decrement operator.

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(i);
     System.out.println(i--);
     System.out.println(i);
     System.out.println(--i);
}
```



Increment, **++**, and decrement, **--**, Operators

- The functionality is the same for the decrement operator.

```
public static void main(String[] args) {
     int i = 5;
     System.out.println(i);
     System.out.println(i--);
     System.out.println(i);
     System.out.println(--i);
}
```

```
5
5
4
3
```

Variables and Expressions

Operators: *Assignment* and *Arithmetic*