

Java Expressions

Arithmetic Operators

Lecture Contents

- Operator Types
- Java Arithmetic Operators
- Operator Precedence

Operator Types

- Java uses the following types of operators
 - **arithmetic** (this lecture)
 - **assignment**
 - **comparison**
 - **logical**
 - **bitwise**

Note: **bitwise** operators are not part of the AP Java Subset.

Java Arithmetic Operators

- We should know the word “***operator***” from mathematics
- These are all the Java ***arithmetic operators***:
 - Add: $x + y$
 - Subtract: $x - y$
 - Multiply: $x * y$
 - Divide: x / y
 - Modulus: $x \% y$
 - Modulus is the remainder after integer division
- There is no exponential operator; exponentiation is implemented as a method in Java.

Java Arithmetic Operators

- We used arithmetic operators when we examined primitive types

```
System.out.println(3 + 5);
```

8

```
System.out.println(3.0 / 5.0);
```

0.6

```
System.out.println(3.0 + 5);
```

8.0

```
System.out.println(3 / 5);
```

0

```
System.out.println(5 % 3);
```

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Operator Precedence

- The order of operations is the same as in mathematics:
 - multiplication, division and modulus are higher precedence than addition or subtraction.
 - Operation at the same level are performed left-to right.

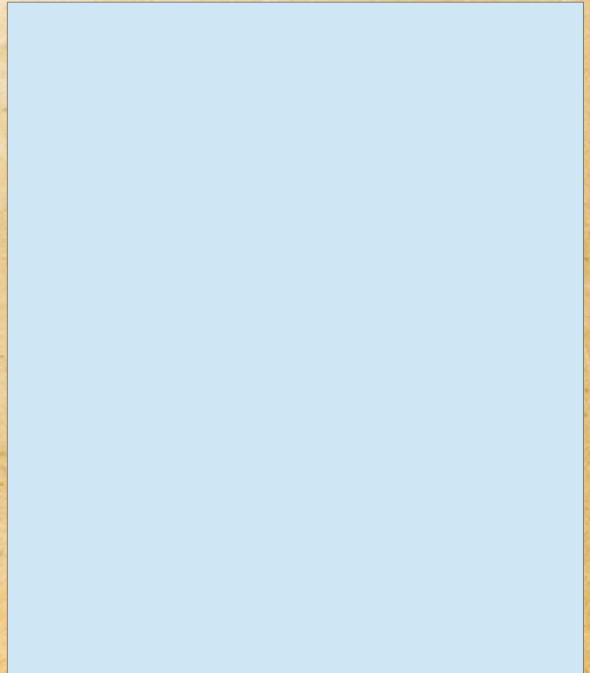
Level	Operators	Associativity
16	()	Left-to-right
12	* / %	Left-to-right
11	+ -	Left-to-right

- *Note:* we will fill the missing **Levels** as we add more operators.

Operator Precedence

- Predict the output:

```
public static void main(String[] args) {  
    int v = 10;  
    int w = 20;  
    System.out.println(w + v / w);  
}
```



Operator Precedence

- Predict the output:

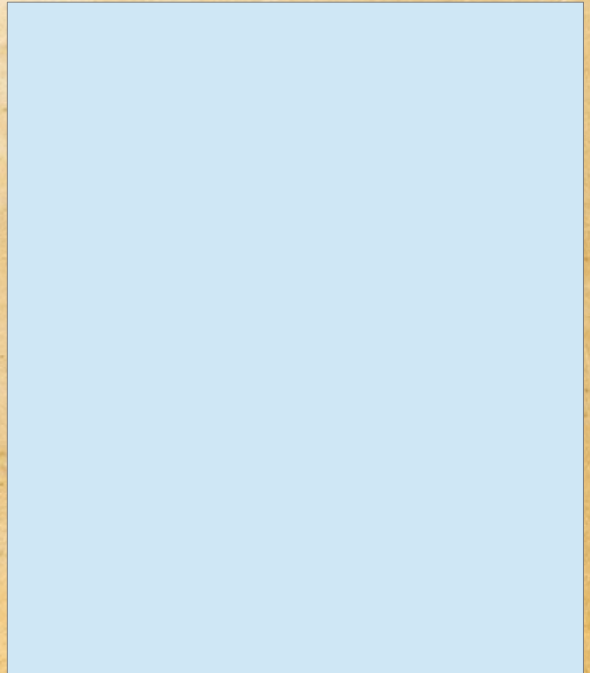
```
public static void main(String[] args) {  
    int v = 10;  
    int w = 20;  
    System.out.println(w + v / w);  
}
```

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Operator Precedence

- Predict the output:

```
public static void main(String[] args) {  
    int a = 1;  
    int b = 2;  
    int c = 3;  
    int d = 4;  
    int x = a + b * c % d;  
    System.out.println(x);  
}
```



Operator Precedence

- Predict the output:

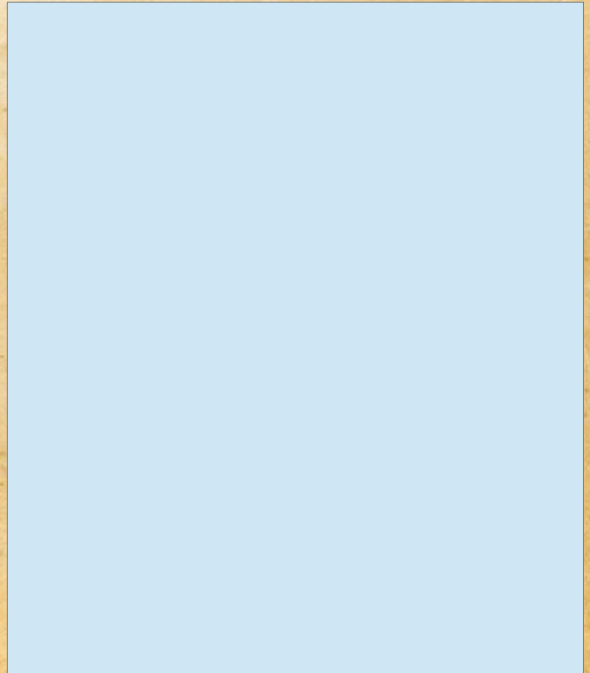
```
public static void main(String[] args) {  
    int a = 1;  
    int b = 2;  
    int c = 3;  
    int d = 4;  
    int x = a + b * c % d;  
    System.out.println(x);  
}
```

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Operator Precedence

- Predict the output:

```
public static void main(String[] args) {  
    System.out.println(2 / 5 % 3);  
    System.out.println(2 / (5 % 3));  
    System.out.println(2 / 5 + 1);  
}
```



Operator Precedence

- Predict the output:

```
public static void main(String[] args) {  
    System.out.println(2 / 5 % 3);  
    System.out.println(2 / (5 % 3));  
    System.out.println(2 / 5 + 1);  
}
```

0
1
1

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