`Boolean` and `if`

`Boolean`, `if`, and Comparison Operators

Lecture Contents

- The `boolean` type
- Comparison Operators
- Operator Precedence
- The `if` statement
- The `if..else` statement

The `boolean` Type

- The `boolean` type can take only two values, namely:
  - `true`
  - `false`
- Declaration of a boolean variable follows the same format as `int` and `double`:

```
boolean myBool = true;
```

Operator Types

✓ *Arithmetic*			+	–	*	/	%
✓ *Assignment*	=		+=	–=	*=	/=	%=
✓ *Increment*			++	– –			
Comparison	**!=**	**==**	**>**	**>=**	**<**	**<=**	
Logical	!		||		&&		
Bitwise	~ ~=		| |=		& &=		^ ^=

Comparison operators return either `true` or `false`.

As a general rule, only use ***comparison operators*** with ***primitive types*** (`int`, `double`, `boolean`)

Comparison Operators

Symbol	Name
==	equal to
!=	not equal to
>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to

Operator Precedence

Level	Description	Operators	Associativity
16	parentheses	( )	Left-to-right
15	post inc/dec	++, --	Left-to-right
13	cast	()	Right-to-Left
12	multiplicative	*, /, %	Left-to-right
11	additive	+, -	Left-to-right
9	**relational**	**>, >=, <, <=**	Left-to-right
8	**equality**	**==, !=**	Left-to-right
1	assignment	=, +=, -= *=, /=, %=	Right-to-Left

Comparison Operators

```
int myInt = 6;
boolean myBool = myInt >= 5;
System.out.println("myBool = " + myBool);
```

Comparison Operators

```
int myInt = 6;
boolean myBool = myInt >= 5;
System.out.println("myBool = " + myBool);
```

```
myBool = true
```

Comparison Operators

```
int myInt = 6;
boolean myBool = myInt <= 5;
System.out.println("myBool = " + myBool);
```

Comparison Operators

```
int myInt = 6;
boolean myBool = myInt <= 5;
System.out.println("myBool = " + myBool);
```

```
myBool = false
```

Comparison Operators

```
int myInt = 6;
boolean myBool = myInt == 6.0;
System.out.println("myBool = " + myBool);
```

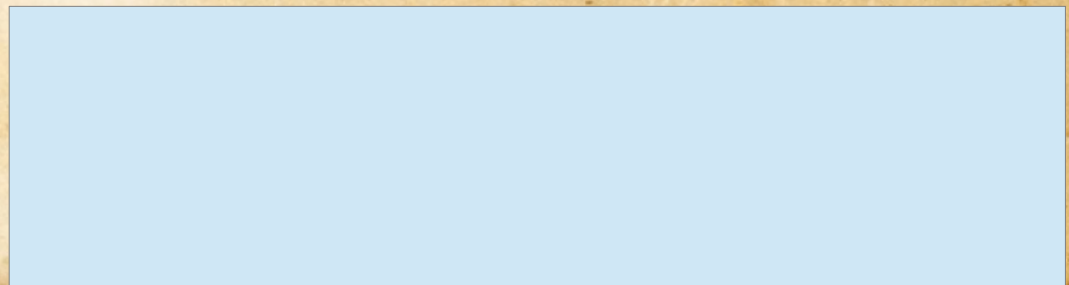
Comparison Operators

```
int myInt = 6;
boolean myBool = myInt == 6.0;
System.out.println("myBool = " + myBool);
```

```
myBool = true
```

The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x == 5) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```



The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x == 5) {  if(true) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```

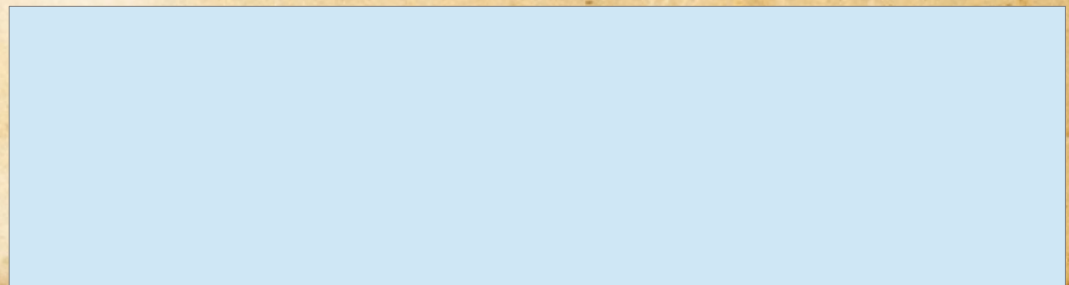
The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x == 5) {  if(true) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```

```
Starting Program...
Hello World!
Finished Program!
```

The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x > 5) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```



The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x > 5) {  if(false) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```

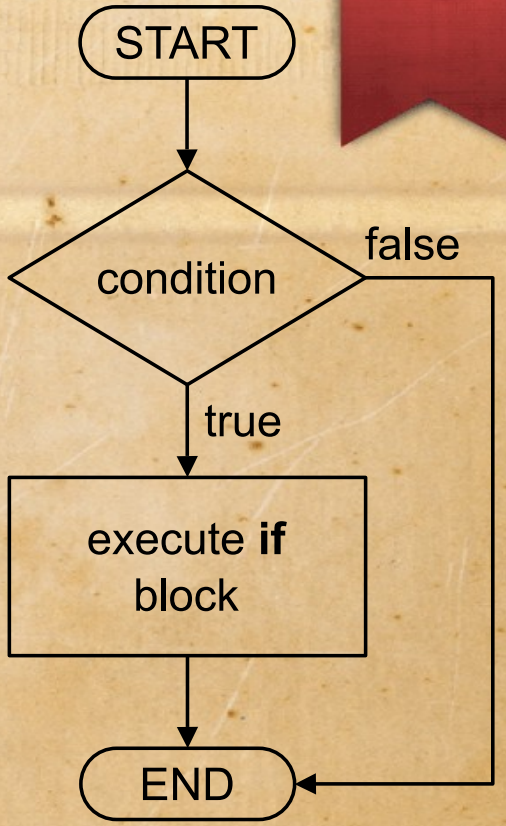
The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x > 5) {  if(false) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```

```
Starting Program...
Finished Program!
```

The `if` Statement

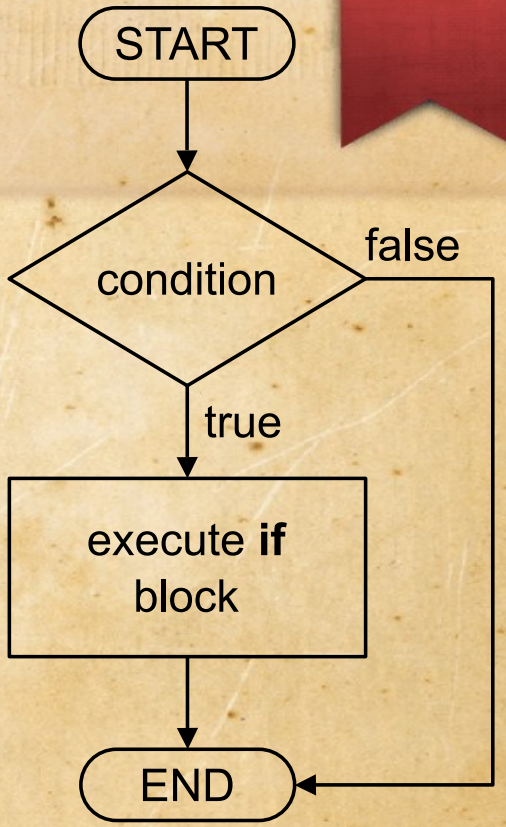
```
public static void main(String args[]) {
    int x = 5
    System.out.println("Starting Program...");
    if(x > 5) {  if(false) {
        System.out.println("Hello World!");
    }
    System.out.println("Finished Program!");
}
```




```
Starting Program...
Finished Program!
```

The `if` Statement

```
public static void main(String args[]) {
   int x = 5
   System.out.println("Starting Program...");
   if(x > 5) {  if(false) {
      System.out.println("Hello World!");
   }
   System.out.println("Finished Program!");
}
```



Note: a ***condition*** is an expression that evaluates to either **`true`** or **`false`**.

```
Starting Program...
Finished Program!
```

The `if..else..` Statement

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if(false) {
      System.out.println("Hello World!");
   } else {
      System.out.println(“Goodbye cruel world…”);
   }
   System.out.println("Finished Program!");
}
```

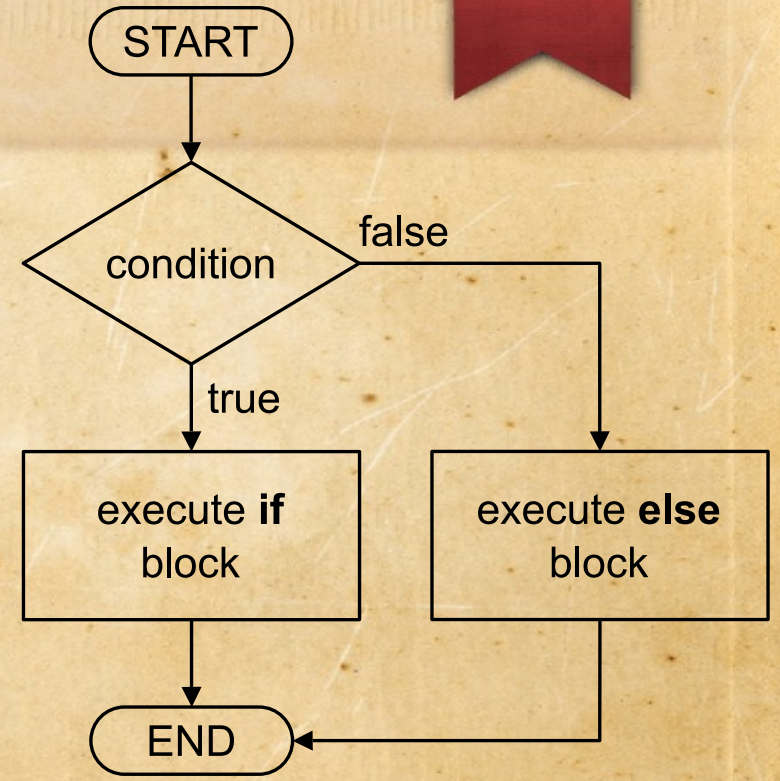
The `if..else..` Statement

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if(false) {
      System.out.println("Hello World!");
   } else {
      System.out.println(“Goodbye cruel world…”);
   }
   System.out.println("Finished Program!");
}
```

```
Starting Program…
Goodbye cruel world...
Finished Program!
```

The `if..else..` Statement

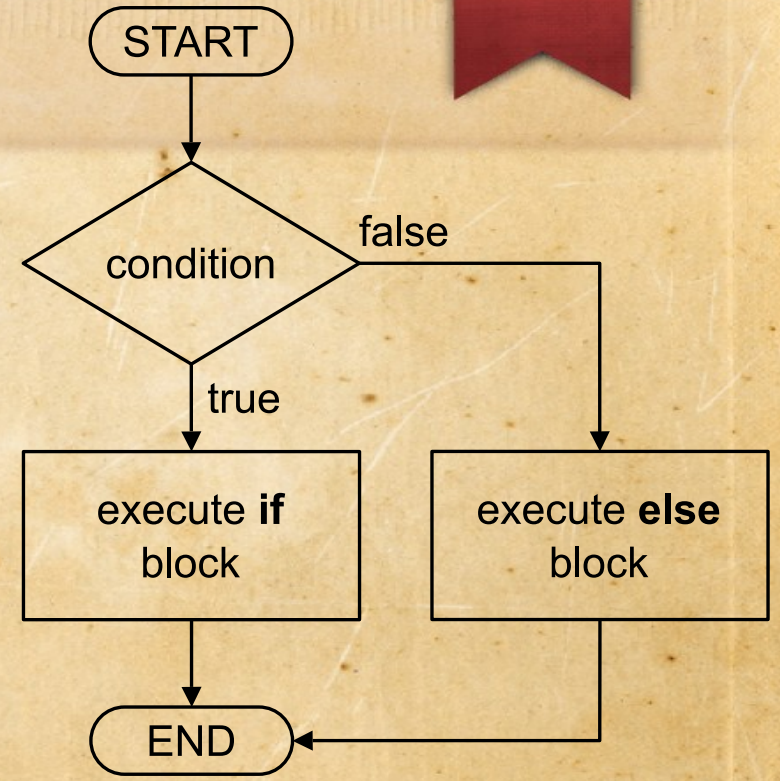
```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if(false) {
      System.out.println("Hello World!");
   } else {
      System.out.println(“Goodbye cruel world…”);
   }
   System.out.println("Finished Program!");
}
```




```
Starting Program…
Goodbye cruel world...
Finished Program!
```

The `if..else..` Statement

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if(false) {
      System.out.println("Hello World!");
   } else {
      System.out.println(“Goodbye cruel world…”);
   }
   System.out.println("Finished Program!");
}
```



Note: a ***condition*** is an expression that evaluates to either **`true`** or **`false`**.

```
Starting Program…
Goodbye cruel world...
Finished Program!
```

Operator Types

✓ *Arithmetic*			+	–	*	/	%
✓ *Assignment*	=		+=	–=	*=	/=	%=
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Comparison	**!=**	**==**	**>**	**>=**	**<**	**<=**	
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Comparison operators return either `true` or `false`.

Comparison Operators

Symbol	Name
==	equal to
!=	not equal to
>	greater than
>=	greater than or equal to
<	less than
<=	less than or equal to

Comparison Operators

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if (5 == 5.0) {
      System.out.println("Hello World!");
   }else {
      System.out.println("Goodbye cruel world...");
   }
   System.out.println("Finished Program!");
}
```

Comparison Operators

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if (5 == 5.0) {
      System.out.println("Hello World!");
   }else {
      System.out.println("Goodbye cruel world...");
   }
   System.out.println("Finished Program!");
}
```

```
Starting Program...
Hello World!
Finished Program!
```

Comparison Operators

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if (5 == "5") {
      System.out.println("Hello World!");
   }else {
      System.out.println("Goodbye cruel world...");
   }
   System.out.println("Finished Program!");
}
```

Comparison Operators

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if (5 == "5") {
      System.out.println("Hello World!");
   }else {
      System.out.println("Goodbye cruel world...");
   }
   System.out.println("Finished Program!");
}
```

```
ERROR:
Incompatible operand types int and
String
```

Comparison Operators

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if (65 == 'A') {
      System.out.println("Hello World!");
   }else {
      System.out.println("Goodbye cruel world...");
   }
   System.out.println("Finished Program!");
}
```

Comparison Operators

```
public static void main(String args[]) {
   System.out.println("Starting Program...");
   if (65 == 'A') {
      System.out.println("Hello World!");
   }else {
      System.out.println("Goodbye cruel world...");
   }
   System.out.println("Finished Program!");
}
```

```
Starting Program...
Hello World!
Finished Program!
```

Comparison Operators – Strings

```
public static void main(String args[]) {
   if ("Hello" == "Hello") {
      System.out.println("Hello == Hello");
   }
}
```

Comparison Operators – Strings

```
public static void main(String args[]) {
   if ("Hello" == "Hello") {
      System.out.println("Hello == Hello");
   }
}
```

```
Hello == Hello
```

Comparison Operators – Strings

```
public static void main(String args[]) {
   String s = "Hell";
   s += "o";
   System.out.println("s == " + s);
   if (s == "Hello") {
      System.out.println("Confirmed. s == Hello");
   } else {
      System.out.println("What?! s != Hello");
   }
}
```

Comparison Operators – Strings

```
public static void main(String args[]) {
   String s = "Hell";
   s += "o";
   System.out.println("s == " + s);
   if (s == "Hello") {
      System.out.println("Confirmed. s == Hello");
   } else {
      System.out.println("What?! s != Hello");
   }
}
```

```
s == Hello
What?! s != Hello
```

Comparison Operators – Strings

```
public static void main(String args[]) {
   String s = "Hell";
   s += "o";
   System.out.println("s == " + s);
   if (s == "Hello") {
      System.out.println("Confirmed. s == Hello");
   } else {
      System.out.println("What?! s != Hello");
   }
}
```

Note: to be safe simply do ***NOT*** compare the values stored in objects using the equality operator! (==)

```
s == Hello
What?! s != Hello
```

Operator Precedence

Level	Description	Operators	Associativity
16	parentheses	( )	Left-to-right
15	post inc/dec	++, --	Left-to-right
13	cast	()	Right-to-Left
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11	additive	+, -	Left-to-right
9	**relational**	**>, >=, <, <=**	Left-to-right
8	**equality**	**==, !=**	Left-to-right
1	assignment	=, +=, -= *=, /=, %=	Right-to-Left

Exercise

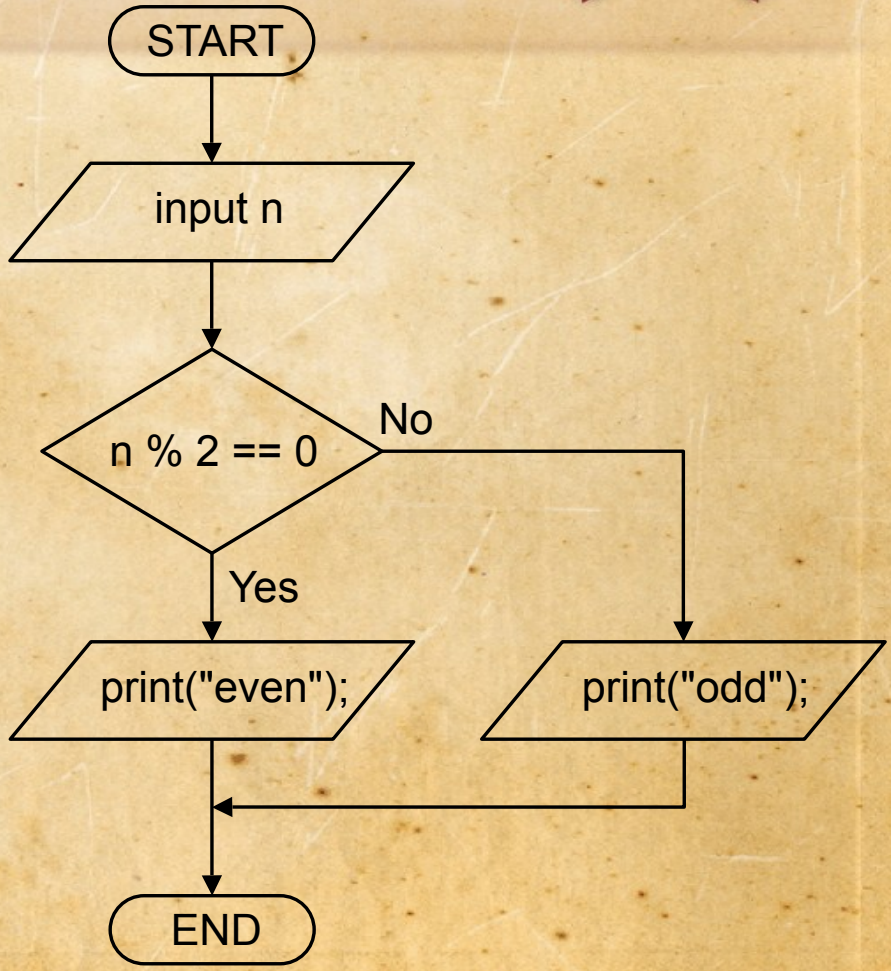
```
public static void main(String[] args) {
   evenOrOdd(5);
   evenOrOdd(26);
}

public static void evenOrOdd(int n) {

   /* WRITE YOUR CODE HERE */

}
```

```
5 is odd.
26 is even.
```



- `boolean` expressions and `if` statements
  - AP Exam Weighting: **15% - 17.5%**

`Boolean` and `if`

`Boolean`, `if`, and Comparison Operators