

# Chapter 3: Selections and Conditionals

CS1: Java Programming  
Colorado State University

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# Exam Results

- 78% Average
- 2 Perfect scores
- Best results from the past two semesters on Midterm 1



# Motivation

- Raise your hand if you are wearing a red sweater.
- How do you get from the stadium to the CS Building?



# Conditionals

Conditionals allow you to Make Decisions using your programs.

```
if (condition)  
    statement;
```



# The `boolean` Type and Operators

- Often in a program you need to compare two values, such as whether `i` is greater than `j`.
- Java provides six comparison operators (also known as relational operators) that can be used to compare two values.
- The result of the comparison is a Boolean value: `true` or `false`.

```
boolean b = (1 > 2) ;
```



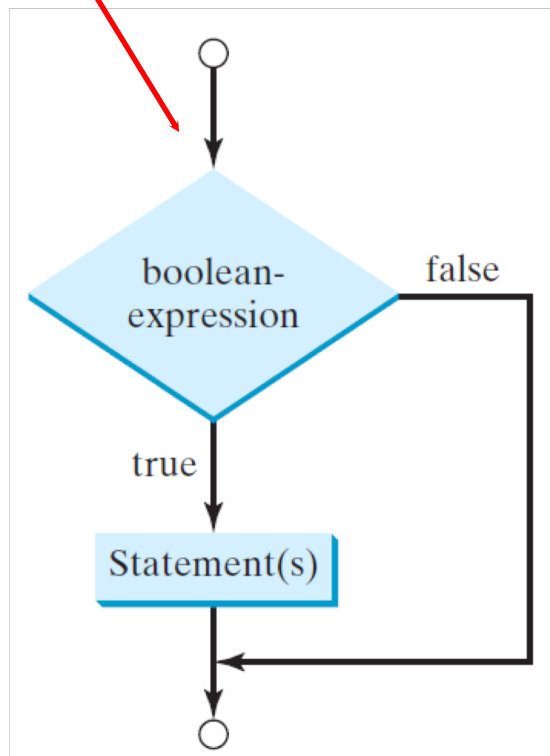
# Relational Operators

Java Operator	Mathematics Symbol	Name	Example (radius is 5)	Result
<	<	less than	<code>radius &lt; 0</code>	<code>false</code>
<=	≤	less than or equal to	<code>radius &lt;= 0</code>	<code>false</code>
>	>	greater than	<code>radius &gt; 0</code>	<code>true</code>
>=	≥	greater than or equal to	<code>radius &gt;= 0</code>	<code>true</code>
==	=	equal to	<code>radius == 0</code>	<code>false</code>
!=	≠	not equal to	<code>radius != 0</code>	<code>true</code>

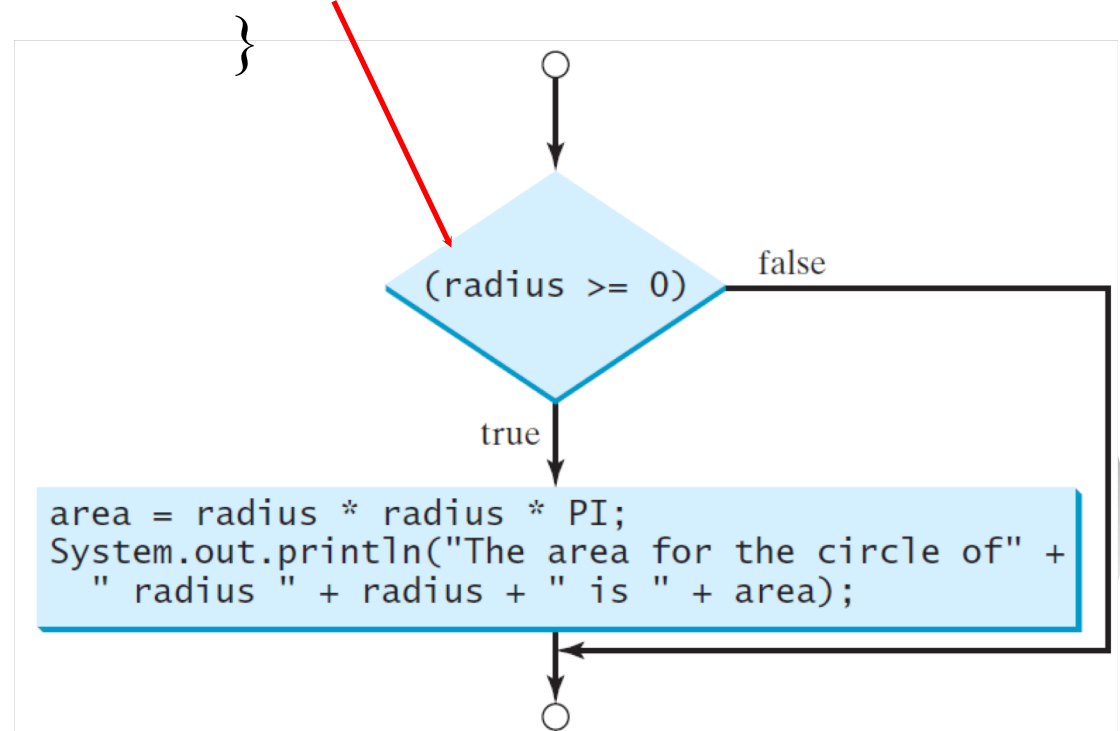


# One-way if Statements

```
if (boolean-expression) {  
    statement(s);  
}
```



```
if (radius >= 0) {  
    area = radius * radius * PI;  
    System.out.println("The area"  
        + " for the circle of radius "  
        + radius + " is " + area);  
}
```



# Note – Basic Syntax

```
if i > 0 {  
    System.out.println("i is positive");  
}
```

(a) Wrong

```
if (i > 0) {  
    System.out.println("i is positive");  
}
```

(b) Correct

```
if (i > 0) {  
    System.out.println("i is positive");  
}
```

(a)

Equivalent

```
if (i > 0)  
    System.out.println("i is positive");
```

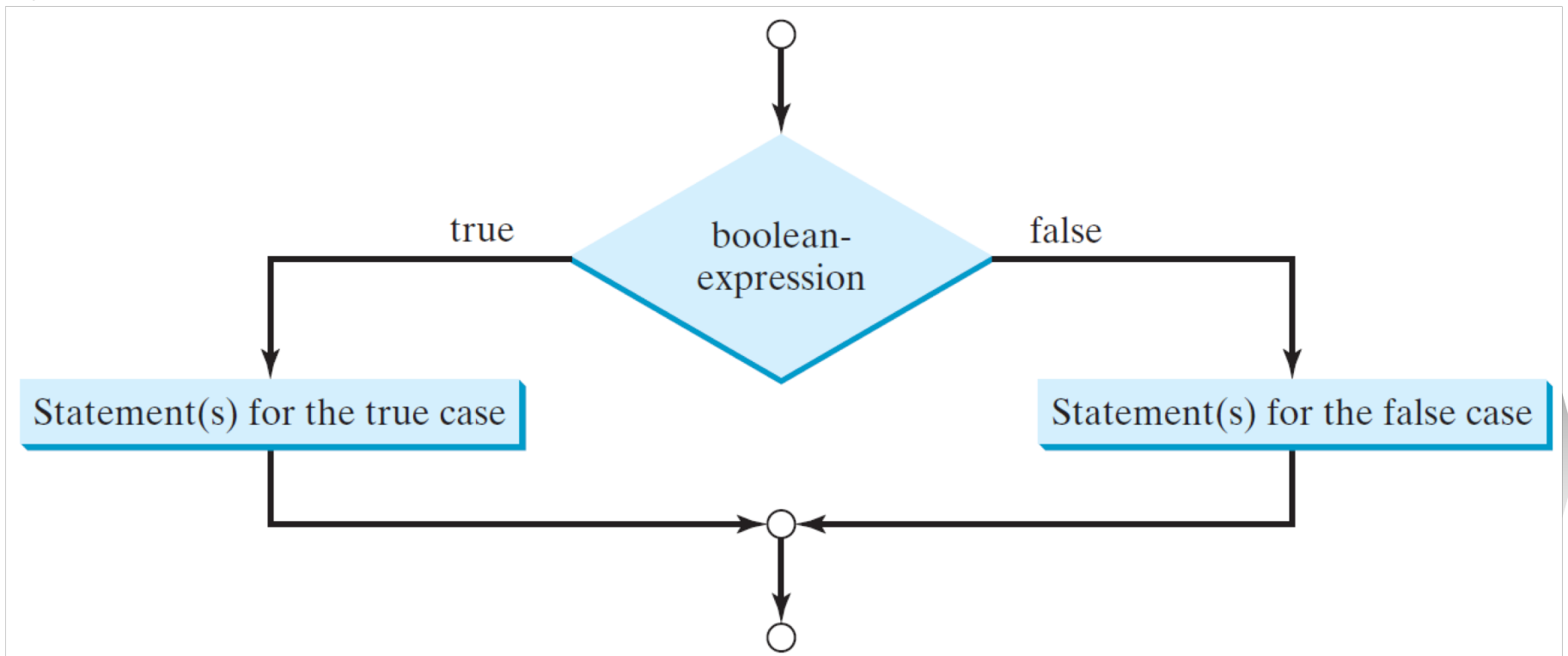
(b)





# The Two-way `if` Statement

```
if (boolean-expression) {  
    statement(s) -for-the-true-case;  
}  
else {  
    statement(s) -for-the-false-case;  
}
```



# if-else Example

```
if (radius >= 0) {  
    area = radius * radius * PI;  
  
    System.out.println("The area for the "  
        + "circle of radius " + radius +  
        " is " + area);  
}  
else {  
    System.out.println("Negative input");  
}
```



# In use...

- How could we use conditionals to create a program to calculate the letter grade from a number?



# Multiple Alternative if Statements

```
if (score >= 90.0)
    System.out.print("A");
else
    if (score >= 80.0)
        System.out.print("B");
    else
        if (score >= 70.0)
            System.out.print("C");
        else
            if (score >= 60.0)
                System.out.print("D");
            else
                System.out.print("F");
```

(a)

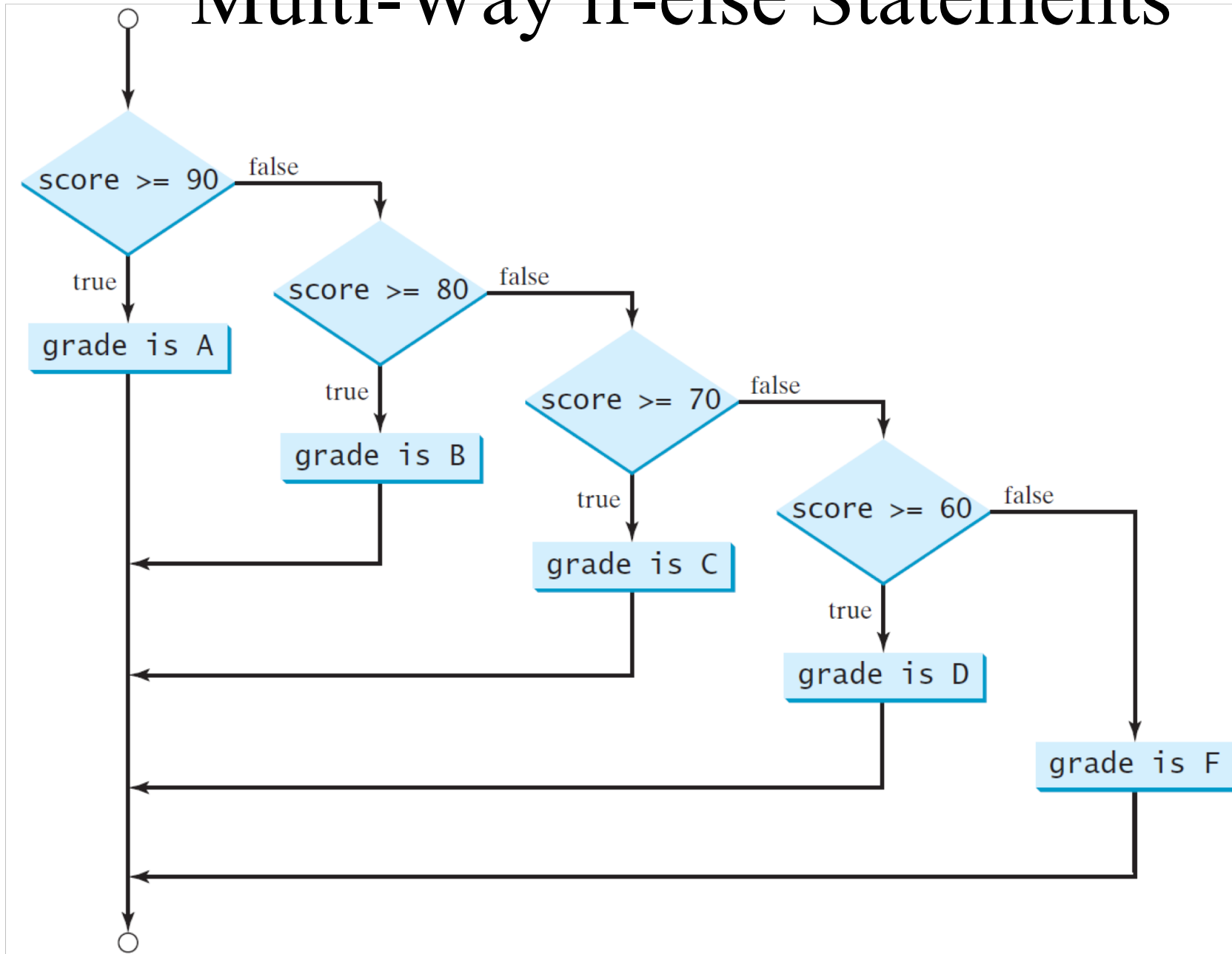
Equivalent

```
if (score >= 90.0)
    System.out.print("A");
else if (score >= 80.0)
    System.out.print("B");
else if (score >= 70.0)
    System.out.print("C");
else if (score >= 60.0)
    System.out.print("D");
else
    System.out.print("F");
```

This is better

(b)

# Multi-Way if-else Statements



# Trace if-else statement

Suppose score is 70.0

The condition is false

```
if (score >= 90.0)
```

```
    System.out.print("A");
```

```
else if (score >= 80.0)
```

```
    System.out.print("B");
```

```
else if (score >= 70.0)
```

```
    System.out.print("C");
```

```
else if (score >= 60.0)
```

```
    System.out.print("D");
```

```
else
```

```
    System.out.print("F");
```



# Trace if-else statement

Suppose score is 70.0

The condition is false

```
if (score >= 90.0)
    System.out.print("A");
else if (score >= 80.0)
    System.out.print("B");
else if (score >= 70.0)
    System.out.print("C");
else if (score >= 60.0)
    System.out.print("D");
else
    System.out.print("F");
```



# Trace if-else statement

Suppose score is 70.0

The condition is true

```
if (score >= 90.0)
    System.out.print("A");
else if (score >= 80.0)
    System.out.print("B");
else if (score >= 70.0)
    System.out.print("C");
else if (score >= 60.0)
    System.out.print("D");
else
    System.out.print("F");
```





# Trace if-else statement

Suppose score is 70.0

grade is C

```
if (score >= 90.0)
    System.out.print("A");
else if (score >= 80.0)
    System.out.print("B");
else if (score >= 70.0)
    System.out.print("C");
else if (score >= 60.0)
    System.out.print("D");
else
    System.out.print("F");
```



# Trace if-else statement

Suppose score is 70.0

```
if (score >= 90.0)
    System.out.print("A");
else if (score >= 80.0)
    System.out.print("B");
else if (score >= 70.0)
    System.out.print("C");
else if (score >= 60.0)
    System.out.print("D");
else
    System.out.print("F");
```

Exit the if statement



# Dangling else

The else clause matches the most recent if clause in the same block.

```
int i = 1, j = 2, k = 3;

if (i > j)
    if (i > k)
        System.out.println("A");
else
    System.out.println("B");
```

(a)

Equivalent

This is better  
with correct  
indentation

```
int i = 1, j = 2, k = 3;

if (i > j)
    if (i > k)
        System.out.println("A");
else
    System.out.println("B");
```

(b)



# Dangling else example

```
int i = 1;
int j = 2;
int k = 3;
if (i > j)
    if (i > k)
        System.out.println("A");
    else
        System.out.println("B");
```

The else matches the closest unmatched if, even if the indentation is bad.

**So what is printed here?**



# Dangling else cont'd

To force the else clause to match the first if clause, you must add a pair of braces (to finish the deepest if statement):

```
int i = 1;
int j = 2;
int k = 3;
if (i > j) {
    if (i > k)
        System.out.println("A");
}
else
    System.out.println("B");
```

So what does this statement print?



# Common Errors

Adding a semicolon at the end of an if clause is a common mistake.

```
if (radius >= 0) ; ← Wrong
{
    area = radius*radius*PI;
    System.out.println(
        "The area for the circle of radius " +
        radius + " is " + area);
}
```

This mistake is hard to find, because it is not a compilation error or a runtime error, it is a logic error.



# TIP

```
if (number % 2 == 0)
    even = true;
else
    even = false;
```

(a)

Equivalent

```
boolean even
    = number % 2 == 0;
```

(b)

There's always a couple of ways  
To do things in programming



# Problem: Computing Taxes

The US federal personal income tax is calculated based on the filing status and taxable income.

There are four filing statuses: single filers, married filing jointly, married filing separately, and head of household. The tax rates for 2009 are shown below.

<i>Marginal Tax Rate</i>	<i>Single</i>	<i>Married Filing Jointly or Qualifying Widow(er)</i>	<i>Married Filing Separately</i>	<i>Head of Household</i>
<b>10%</b>	\$0 – \$8,350	\$0 – \$16,700	\$0 – \$8,350	\$0 – \$11,950
<b>15%</b>	\$8,351 – \$33,950	\$16,701 – \$67,900	\$8,351 – \$33,950	\$11,951 – \$45,500
<b>25%</b>	\$33,951 – \$82,250	\$67,901 – \$137,050	\$33,951 – \$68,525	\$45,501 – \$117,450
<b>28%</b>	\$82,251 – \$171,550	\$137,051 – \$208,850	\$68,526 – \$104,425	\$117,451 – \$190,200
<b>33%</b>	\$171,551 – \$372,950	\$208,851 – \$372,950	\$104,426 – \$186,475	\$190,201 – \$372,950
<b>35%</b>	\$372,951+	\$372,951+	\$186,476+	\$372,951+



# Problem: Computing Taxes, cont.

```
if (status == 0) {  
    // Compute tax for single filers  
}  
else if (status == 1) {  
    // Compute tax for married file jointly  
    // or qualifying widow(er)  
}  
else if (status == 2) {  
    // Compute tax for married file separately  
}  
else if (status == 3) {  
    // Compute tax for head of household  
}  
else {  
    // Display wrong status  
}
```

ComputeTax

Run



# Your Turn!

Given an int number, e.g.:

```
int number = 10;
```

Write code that, if the number is a multiple of 5, it prints HiFive, and if the number is divisible by 2, it prints HiEven.

