Decisions, Decisions, Decisions

GEEN163 Introduction to Computer Programming

"You've got to be very careful if you don't know where you are going, because you might not get there."

Yogi Berra

TuringsCraft Assignment

- Answer any of the 62 questions in sections 5.1 – 5.5 of the TuringsCraft tutoring system
- You will earn **3** points for each correct answer up to a maximum of 100
- Due midnight on Tuesday, September 27, 2016

More Tutoring Available

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Computers are more than calculators

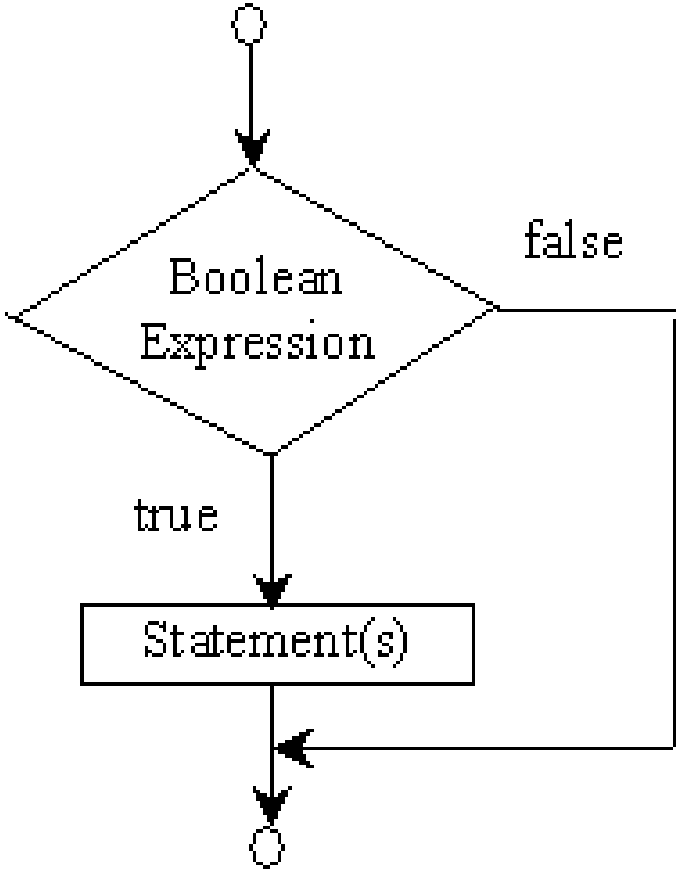
- So far your programs have just done mathematical calculations
- Most programs need to make decisions
- The Java "`if`" statement is used to make decisions in a program

if Statement

```
if ( paid > bill) {
    change = paid – bill;
}
```

If the contents of paid are greater than the contents of bill, then the change statement will be executed

if Logic



if Syntax

```
if ( true or false decision )
    next statement;
```

- The program will execute the next statement if and only if the decision is true
- The next statement can be a single Java statement or a block
- Whitespace is optional

Logical Expressions

- The logical decision of an if statement must be a logical expression
- The most common logical expression is the comparison of two variables
- The result of a logical expression must be either true or false
- Comparisons are of the format

cat *operator* dog

cat > dog

Java Comparison Operators

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

Watch Out for Double Equals

```
if (ant = bat)        /* Incorrect */
```

```
if (ant == bat)       /* Correct */
```

Blocks

- In Java, a block is a bunch of code surrounded by **{** curly brackets **}**
- Almost anyplace you might put a single statement, you can put a block of statements

hint:

- *When you type a left curly bracket, immediately type a right curly bracket and then backup between them*

Blocks and Statements

- The statement following an **`if`** can be a single statement or a block

```
if (cow < bird)
    cat = dog;
tree = bird;  // always executed
```

```
if (cow < bird) {
    cat = dog;
    tree = bird;  //executed only if cow < bird
}
```

Write some Java

```
int dog = ?, cat = ?, cow = 7;
```

if dog is greater than cat, set cow to 5;

Write some Java

```
int dog = ?, cat = ?, cow = 7;
```

if dog is greater than cat, set cow to 5;

```
if ( dog > cat ) {
    cow = 5;
}
```

What is displayed ?

```
int ant = 3, bird = 5;
int cat = 7, dog = 47;
if (bird >= cat) {
     dog = 13;
}
System.out.println(dog);
```

A. 5

B. 13

C. 47

D. none of the above

Now what is displayed ?

```
int ant = 3, bird = 5;
int cat = 7, dog = 47;
if (ant + bird >= cat) {
     dog = 13;
}
System.out.println(dog);
```

A. 5

B. 13

C. 47

D. none of the above

Indenting

- Although the Java compiler does not care, it is traditional to indent the statements that are executed only when the if is true

```
if ( dog > cat ) {
    cow  = 5;
    bull = 37;
}
```

Various Formats

```
if ( bull > cow ) goat = 17;

if ( bull > cow )
        goat = 17;

if ( bull > cow ) {
        goat = 17;
}
```

Indenting Required in all Assignments

- Indenting makes it easier for humans to read
- Remember that indenting does not determine the logic
- *Your programs will receive a reduced grade if they are not indented correctly*

What is displayed ?

```
int ant = 3, bird = 5;
int cat = 7, dog = 47;
if (bird >= cat)
     System.out.print(bird);
     System.out.print(cat);
System.out.println(dog);
```

A. 5 7 47

B. 7 47

C. 47

D. none of the above

Compound Logical Statements

- You can combine relational expressions with logical or Boolean operators
- Expressions can be combined with AND, OR, XOR and NOT

Boolean Operators

Operator	*Name*
!	not
&&	and
||	or
^	exclusive or

George Boole
19th century British mathematician
inventor of Boolean logic

Truth Table for NOT

dog > 5	!(dog > 5)
True	False
False	True

`!(dog > 5)` *is* `dog <= 5`

Truth Table for AND

dog >5	cat <2	dog>5 && cat<2
true	true	true
true	false	false
false	true	false
false	false	false

dog > 5 && cat < 2 is true only when
both dog is more than 5 and cat is less than 2

Truth Table for OR

dog >5	cat <2	dog >5 || cat <2
true	true	true
true	false	true
false	true	true
false	false	false

dog > 5 || cat < 2 is true when
either dog is more than 5 or cat is less than 2

Truth Table for XOR

dog >5	cat <2	dog >5 ^ cat <2
true	true	false
true	false	true
false	true	true
false	false	false

This is not used very often

Compound Logic in if

- Set grade to 4.0 if both study is greater than avg and work is equal to done

```
if( (study > avg) && (work == done)) {
        grade = 4.0;
}
```

What is displayed?

```
int ant = 3, bird = 5, cat = 7;
int dog = 47;
if((ant != bird) && (cat > bird)){
    dog = 13;
}
System.out.println(dog);
```

A. 5

B. 7

C. 13

D. 47

Now what is displayed?

```
int ant = 3, bird = 5, cat = 7;
int dog = 47;
if((ant == bird) || (cat > bird)){
    dog = 13;
}
System.out.println(dog);
```

A. 5

B. 7

C. 13

D. 47

Caution

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

```
if (radius >= 0) ;
{
        area = radius*radius*PI;
        System.out.println(radius);
}
```

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

This error often occurs when you use the next-line block style

Try It

- Print an error message if the variable loan or the variable years are less than zero

```
double loan, years;
//  input the value of loan and year

if( ? ) {
   System.out.println(“Bad stuff”);
}
```

Possible Solution

- Print an error message if the variable loan or the variable years are less than zero

```
double loan, years;
//  input the value of loan and year

if( loan < 0.0 || years < 0.0 ) {
   System.out.println(“Bad stuff”);
}
```

Incorrect Solution

- Print an error message if the variable loan or the variable years are less than zero

```
double loan, years;
//  input the value of loan and year

if( loan || years < 0.0 ) {
   System.out.println(“Bad stuff”);
}
```

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