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## Reminders

- Assignment due on monday at 23:55 (late submission until wednesday, -5% per day)
- This is an *extremely* easy assignment
- READ CAREFULLY
- Submit only .java files and .class files, and nothing else
- Submit to the box named "Assignment 1 box", and the bonus question to "Assignment 1 glory"

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## Review

- Objects are composite data
- The data type of an object is a class
- The methods of a class are operations that can be applied to objects of that class (method invocation, or method call)

*objectref.methodname(parameters)*

- Strings are objects
- String methods

`int length()`

`char charAt(int index)`

`boolean equals(String s)`

`String substring(int initialIndex, int endIndex)`

- If a method `m` returns a value of type `t`, then a method call to `m` can be used in any expression of type `t`

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## Class libraries

- Classes have a dual role:
  - as data types (of objects)
  - as modules
- Methods can be seen as “services” provided by these modules
- A *class library* is a collection of classes which has already been created by someone else, and which we can use in our programs
- Java has a Standard Library which includes classes for many different purposes
- Class libraries are organized in *packages*
- A *package* is a collection of classes

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## Class libraries

- Some packages from the Standard Java Library include:
  - `java.applet`: for creating programs which are easily transported accross the Web
  - `java.awt`: for creating GUIs (Graphical User Interfaces)
  - `java.io`: for handling files in secondary storage, or some communications
  - `java.lang`: general support
  - `java.math`: computations with high precision
  - `java.security`: support for security
  - `java.text`: for text manipulation
  - `java.util`: general utilities
- The full list of packages and classes in the Standard Library can be found at:

<http://java.sun.com/j2se/1.4.2/docs/api/>

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## Class libraries

- Whenever we want to use a class `C` from a package `p`, we must use the import declaration at the top of the file:

```
import p.C;
```

- For example, the `Keyboard` class is defined in the package `cs1`, so we must use

```
import cs1.Keyboard;
```

whenever we want to use it.

- Another example: the package `java.util` includes many useful classes such as `Currency` and `Calendar`. To use them we must add at the top of the file:

```
import java.util.Currency;  
import java.util.Calendar;
```

---

## Class libraries

- If we want to import all classes of a package `p`, we use

```
import p.*;
```

- For instance:

```
import java.util.*;
```

- The package `java.lang` is automatically imported in every program.
- Class `String` is defined in the `java.lang` package
- Class `Math` is also defined in the `java.lang` package

---

## Static methods

- So far, all method calls that we have used take the form

*objectreference.methodname(parameters)*

- But there are some methods that take the form

*classname.methodname(parameters)*

- These are called *static methods*
- Static methods do not represent operations on objects, but services provided by a class
- For example:

```
i = Keyboard.readInt();
```

---

## Static methods and class libraries

The Math class has many useful static methods, such as:

Method	Description
<code>static int abs(int num)</code>	returns the absolute value of <code>num</code>
<code>static double pow(double num, double power)</code>	returns $\text{num}^{\text{power}}$
<code>static double sqrt(double num)</code>	returns $\sqrt{\text{num}}$
<code>static double sin(double angle)</code>	returns $\sin(\text{angle})$
<code>static double cos(double angle)</code>	returns $\cos(\text{angle})$
<code>static double tan(double angle)</code>	returns $\tan(\text{angle})$
<code>static double floor(double num)</code>	returns the largest integer less or equal to <code>num</code>
<code>static double ceil(double num)</code>	returns the smallest integer greater or equal to <code>num</code>



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## Static methods and class libraries

```
double cathetus1, cathetus2, hypotenuse;  
cathetus1 = 3.0;  
cathetus2 = 4.0;  
hypotenuse = Math.sqrt( Math.pow( cathetus1, 2 ) +  
                        Math.pow( cathetus2, 2 ) );
```

---

# Statements

- Variable declaration

```
type variable;
```

- Assignment

```
variable = expression;
```

- Method invocation

```
objectreference.methodname(parameters);
```

or

```
classname.methodname(parameters);
```

---

# Statements

- Variable declaration

```
type variable;
```

- Assignment

```
variable = expression;
```

- Method invocation

```
objectreference.methodname(parameters);
```

or

```
classname.methodname(parameters);
```

- Conditional
- Loop

---

# Conditionals

- The conditional statement is a statement used to make decisions: take different courses of action depending on some given condition
- There are several (syntactic) forms of conditionals
- The simplest form is:

```
if (boolean_expression) {  
    list_of_statements;  
}
```

- For example:

```
if (winter && temperature >= -30.0f) {  
    System.out.print("I'm going ");  
    System.out.println("skiing!");  
}
```

---

## Boolean expressions

Boolean operator	Meaning
&&	Logical conjunction (AND)
	Logical disjunction (OR)
!	Logical negation (NOT)

---

# Conditionals

- Conditionals are statements, so they go inside methods

```
public class SomeProgram {
    public static void main(String[] args)
    {
        boolean winter = true;
        float temperature = -10.0f;

        if (winter && temperature >= -10.0f) {
            System.out.print("I'm going ");
            System.out.println("skiing!");
        }
    }
}
```

---

# Conditionals

- The following is very, very, very, very very, very, very, very wrong!

```
public class SomeProgram {
    boolean winter = true;
    float temperature = -10.0f;

    if (winter && temperature >= -10.0f) {
        System.out.print("I'm going ");
        System.out.println("skiing!");
    }
}
```

---

# Conditionals

- Semantics
- A conditional

```
if (condition) {  
    list_of_statements  
}
```

is executed as follows:

1. The *condition* is evaluated, yielding `true` or `false`
2. If the result of evaluating the condition is `true`, then
  - (a) the list of statements is executed,
  - (b) and when it finishes, computation continues directly after the conditional
3. Otherwise, if the result of evaluating the condition is `false`, then
  - (a) the list of statements is ignored,
  - (b) and computation continues directly after the conditional

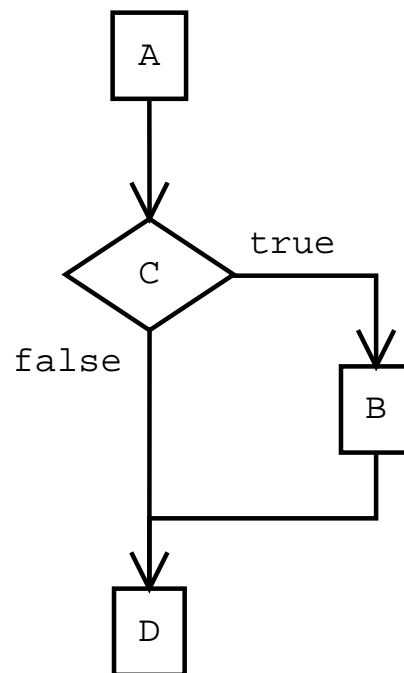


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# Conditionals

```
A;  
if (C) {  
    B;  
}  
D;
```

- Control flow diagram



---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

# Conditionals

The house is, hmm... safe

The policeman eats donuts

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```



---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

# Conditionals

The policeman eats donuts

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_aware;  
alarm_on = false;  
lights_on = false;  
vicious_dog_is_aware = true;  
  
if (alarm_on || lights_on && vicious_dog_is_aware)  
{  
    System.out.print("The house is, hmm...");  
    System.out.println(" safe");  
}  
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_aware;  
alarm_on = false;  
lights_on = false;  
vicious_dog_is_aware = true;  
  
if (alarm_on || lights_on && vicious_dog_is_aware)  
{  
    System.out.print("The house is, hmm...");  
    System.out.println(" safe");  
}  
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```



---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
System.out.println("The policeman eats donuts");
```

---

# Conditionals

- Conditionals with alternatives

```
if (boolean_expression) {  
    list_of_statements_1;  
}  
else {  
    list_of_statements_2;  
}
```

- For example:

```
if (!raining) {  
    System.out.println("Go out");  
}  
else {  
    System.out.println("Stay in");  
}
```

---

# Conditionals

- A conditional

```
if (condition) {  
    list_of_statements_1  
}  
else {  
    list_of_statements_2  
}
```

is executed as follows:

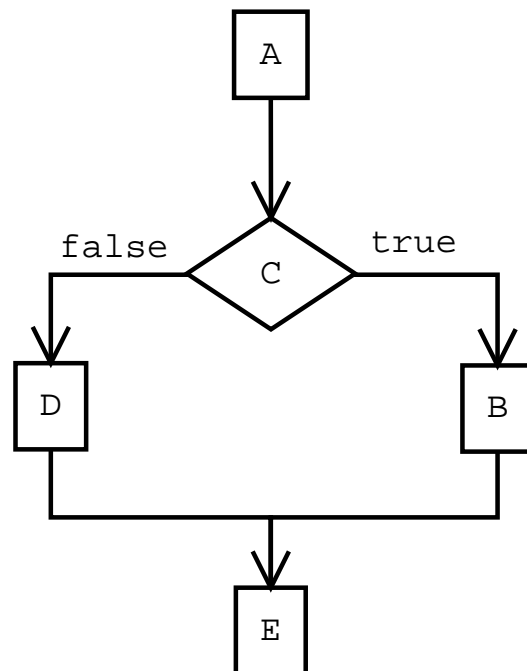
1. The *condition* is evaluated, yielding `true` or `false`
2. If the result of evaluating the condition is `true`, then
  - (a) the list of statements 1 is executed,
  - (b) and when it finishes, computation continues directly after the conditional
3. Otherwise, if the result of evaluating the condition is `false`, then
  - (a) the list of statements 2 is executed,
  - (b) and when it finishes, computation continues directly after the conditional

---

# Conditionals

```
A;  
if (C) {  
    B;  
}  
else {  
    D;  
}  
E;
```

- Control flow diagram



---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

# Conditionals

The house is, hmm... safe

The policeman eats donuts

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
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if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
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}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
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if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```



---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
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{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
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vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = true;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

# Conditionals

The house is vulnerable

The policeman eats donuts

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```



---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

## Conditionals

```
boolean alarm_on, lights_on, vicious_dog_is_awake;
alarm_on = false;
lights_on = false;
vicious_dog_is_awake = true;

if (alarm_on || lights_on && vicious_dog_is_awake)
{
    System.out.print("The house is, hmm...");
    System.out.println(" safe");
}
else {
    System.out.print("The house is ");
    System.out.println("vulnerable");
}
System.out.println("The policeman eats donuts");
```

---

# Conditionals

- Nested conditionals: Conditionals are statements and therefore they can go inside other conditionals

```
if (!raining) {  
    if (season.equals("winter")) {  
        walk = true;  
    }  
    score = 8;  
}
```

---

# Conditionals

- Nested conditionals

```
if (moving) {  
    System.out.println("Moving");  
}  
else {  
    if (sleeping) {  
        System.out.println("Sleeping");  
    }  
}
```



---

# Conditionals

```
if (moving) {
    if (walking) {
        state = "Walking";
    }
    else {
        state = "Running";
    }
}
else {
    if (sleeping) {
        state = "Sleeping";
    }
    else {
        state = "Thinking";
    }
}
```

---

# Conditionals

```
if (moving) {
    body_active = true;
    if (walking) {
        state = "Walking";
    }
    else {
        state = "Running";
    }
    System.out.println("Moving");
}
else {
    body_active = false;
    if (sleeping) {
        state = "Sleeping";
    }
    else {
        state = "Thinking";
    }
}
```

---

# Conditionals

- Assignment is not equality, and therefore it cannot be used in the condition of a conditional or in any other boolean expression
- An incorrect usage of assignment as equality

```
int x = 4, y = 3;
boolean z = false;
y = y + 1;
if (x = y) { // WRONG
    z = true;
}
```

- A correct use of equality

```
int x = 4, y = 3;
boolean z = false;
y = y + 1;
if (x == y) { // correct
    z = true;
}
```

---

# Conditionals

- Order matters

```
int a;
String b = "";
a = 7;
if (a < 10) {
    b = "first case";
    a = a + 4;
}
else {
    b = "second case";
}
// a == 11 and b is "first case"
```

---

# Conditionals

- Order matters

```
int a;
String b = "";
a = 7;
if (a < 10) {
    b = "first case";
    a = a + 4;
}
if (a == 11) {
    b = "second case";
}
// a == 11 and b is "second case"
```

---

# Conditionals

- Order matters

```
int a;
String b = "";
a = 11;
if (a < 10) {
    b = "first case";
    a = a + 4;
}
if (a == 11) {
    b = "second case";
}
// a == 11 and b is "second case"
```

---

# Conditionals

- Order matters

```
int a;
String b = "";
a = 12;
if (a < 10) {
    b = "first case";
    a = a + 4;
}
if (a == 11) {
    b = "second case";
}
// a == 12 and b is ""
```