**AND, OR, and NOT—Which One Is the Answer?**

What you learn in this lesson will help you write powerful conditional statements, and can lead to some interesting logical discussions with the waitress or waiter at your favorite restaurant. Or … do you need to convince a parent about something you want to do? Boolean logic may just be the key!

### Part 1

Simple decision statements only require evaluation of one **boolean** expression; however, Java also has the ability to handle multiple **boolean** expressions. These compound conditions can easily be handled using one of Java's logical operators: **AND**, **OR**, and **NOT**.

For example, what if a student’s eligibility for extracurricular activity depended on having a GPA greater than or equal to 2.0, and no F’s in any courses. Since both conditions must be satisfied for the student to be eligible, the statement would be written as follows.

if((average >= 2.0) && (numFs == 0))  
     System.out.println("Student is eligible");  
else  
     System.out.println("Student is NOT eligible");

The **&&** symbol is a **logical**operator that represents AND. The logical operator **AND** corresponds to intersection in Boolean algebra because both parts of the condition must be true for the whole statement to be true.

### Part 2

There are also circumstances where only one part of a condition needs to be true for an entire condition to be true. For example, eligibility could also be determined using the **OR** operator shown below.

if((average < 2.0) || (numFs != 0))  
     System.out.println("Student is NOT eligible");  
else  
     System.out.println("Student is eligible");

A pair of vertical bars (e.g. **||**) is the **logical** operator for **OR**. The pipe symbol (a vertical bar) is usually found on the right side of the keyboard on the backslash key (\).

When the logical operator **OR** is used, the statement is true if one or both conditions is true. Using not equal (**!=**) in the second example makes this statement a little more awkward to interpret, but the **AND** and **OR** versions of the decision statements are equivalent.

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### Part 1

Computer simulations and models depend on the power of condition statements and logical operators. And every time you play a computer game, thousands of **boolean** expressions, including logical operators, are executed. Humans are notoriously illogical at times, so unless you are like Mr. Spock or Mr. Data from Star Trek, you probably could use a review of some principles of logic.

[**Complete the following eIMACS lab.**](https://l.flvsgl.com/GSL053b5687b4232263ee87b3c25f5b1114a)

* Java Basics
  + Variables and Expressions
    - Logical Operator [1] [2] [3] [4] [5]

For other practice options contact your instructor.

### Part 2

Take a look back at the **if-else-if** block of code written using logical operators as shown below.

…  
double average = (double)(grade1 + grade2 + grade3 + grade4 + grade5)/5;  
  
//Determine eligibility  
if(average >= 3.5)  
    isEligible = true;  
else if((average >= 2.5) && (daysAbsent < 4))  
    isEligible = true;  
else if((average >= 1.5) && (daysAbsent < 2))  
   isEligible = true;  
else  
    isEligible = false;  
  
System.out.println();  
System.out.println("Grade point average: " + average);  
System.out.println("Student eligibility status: " + isEligible);

…

* Create a new project called 03.07 Letter Grades in the Mod03 Lesson folder.
* Download the [**GPAV2.java**](https://lti.flvsgl.com/flvs-cat-content/22g2e8fh5m8qoo0ans15g6r4dd/flvs-cat-session/apcomputersciencea_v20/module03/lesson07/docs/04_07b/GPAV2.java) file and save to the newly-created folder.
* Open the file and study the source code. Specifically notice the use of the **AND** logical operator.
* What changes would you make to the program? What other circumstances might determine eligibility?

It is always better to type more code and be clear rather than to try and save time and run the risk that someone reading your program will not understand what you want to accomplish.

### Part 3

Computers operate at phenomenal speeds, store massive amounts of data, and perform complex calculations, but it is their decision-making ability that makes them such powerful tools. And all that power is based on a single word: **if**. You have processed a lot of information about conditional statements so far in this module, so it is a good time to pause and evaluate your understanding.

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* Java Basics
  + Variables and Expressions
    - Quick Reference 4
    - Test

For other practice options contact your instructor.