Advanced Branching & Looping

**BOOLEAN HAIR LOGIC**

A

B

AND

OR

XOR

```c
#include <stdio.h>
int main(void)
{
    int count;
    for (count = 1; count <= 500; count++)
        printf("I will not throw paper airplanes in class.");
    return 0;
}
```
Nested if statements

You can have as many if statements inside each other as you want.

```java
if (teacherAwake)
{
  if (studentAwake)
  {
    if (classWellPrepared)
    {
      learning = true;
    }
  }
}
```
Nested if statements

From a truth table perspective, nested loops are similar to AND

The previous if code is equivalent to:

```java
if (teacherAwake && studentAwake && classWellPrepared)
{
    learning = true;
}
```

However, sometimes you want to do other code between these evaluations.
If... if... else!

When in doubt, use parenthesis and blocks! (Some people like to put the first brace after the if, others on a new line)

What happens if you have an if if else?

(See: IfIfElse.java)
Multiway if/else

This is a special format if you put an if statement after an else

This second “if statement” only is tested when the first “if statement” is not true

No matter the conditions, only one of the if/else statements will run

(See: ElseIf.java)
A **switch** statement checks to see if a variable has a specific value.

```java
switch ( controllingVariable )
{
    case 2:
    case 4:
        System.out.println("controllingVariable is either 2 or 4");
        break;
    case 3:
        System.out.println("controllingVariable is 3");
        break;
    default:
        System.out.println("controllingVariable is not 2, 3 or 4");
        break;
}
```
Switch

If the value of the controlling variable is found in a case label, all code until a break statement is run (or the switch ends).

Switch statements only test equality (==) with case labels (not greater or less than).

(See: Switch.java)
Switch statements can be written as multiway if/else statements.

Could use just “if statements” but “else if” shows only one of these will run

(See: SwitchToFIf.java)
We will not use in this class, but if you use other people's code you will encounter

Shorthand for an if-else statement

(BOOLEAN) ? [if true] : [if false]

Example:
max = (x>y) ? x : y;
(See: MaxOp.java)
Review: Loops

We put a loop around code that we want to run more than once.

If we have an easy sequence (0, 1, 2, ... 10) of values we want to go over, for loop is nice.

Otherwise, the while loop is a bit more general and is typically more useful if we are asking the user to control the loop.
Write a program that asks the user to input a value, then show the sum from 1 to that value in the following format:

Find the sum from 1 to what value?  5

1+2+3+4+5 = 15

(See: SumToN.java)
Nested for loop

Now modify the code so it shows all sums less than or equal to the entered values, as such:

Find the sum from 1 to what value? 4
1 = 1
1+2 = 3
1+2+3 = 6
1+2+3+4 = 10
(See: SumAllToN.java)
Nested for loop

Like nested if statements, we can also make nested loops (which can cause headaches)

It might help to think of each loop as an added dimensions:

1 loop = 1 dimension (line/ruler)
2 loops = 2 dimensions (plane/square/area)
3 loops = 3 dimensions (volume/cube)
...
(See: NestedLoop.java)
Ask the user for a size of matrix, then show the identity matrix for that dimension:

What size? 4
1 0 0 0
0 1 0 0
0 0 1 0
0 0 0 1

(See: IdentityMatrix.java)