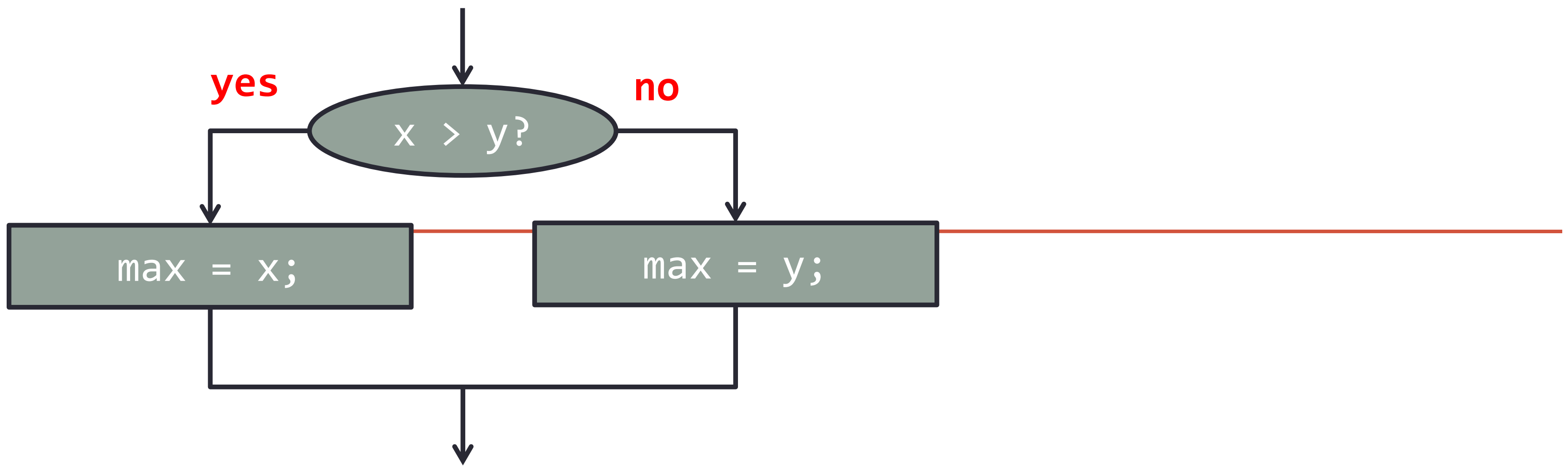
CONDITIONAL EXECUTION: PART 2



logical AND	logical OR	logical NOT
&&	||	!

Outline

- Review: The `if-else` statement
- The `switch` statement
- A look at enumerations

Review

- Conditional Execution
  - if … then
  - if … then … else
  - Nested if … then statements

Flow of Control

- *Flow of control* is the order in which a program performs actions.
  - Up to this point, the order has been sequential.
- Conditional execution: A *branching statement* chooses between two or more possible actions.
- Iteration: A *loop statement* repeats an action until a stopping condition occurs.

Multibranch `if-else` Statements

- Syntax

```
if (Boolean_Expression_1)
    Statement_1
else if (Boolean_Expression_2)
    Statement_2
else if (Boolean_Expression_3)
    Statement_3
else if …
else
    Default_Statement
```

The Conditional Operator

```
if (n1 > n2)
     max = n1;
else
     max = n2;
```

can be written as

```
max = (n1 > n2) ? n1 : n2;
```

- The `?` and `:` together are call the *conditional operator* or *ternary operator.*
- A shortcut for the full if…else statement
- Should only be used for very short pieces of code

The Conditional Operator

- The conditional operator is useful with print and println statements.

```
System.out.print("You worked " +
    ((hours > 1) ? "hours" : "hour"));
```

Short-circuit Evaluation

- Sometimes only part of a boolean expression needs to be evaluated to determine the value of the entire expression.
  - If the first operand associated with an `||` is `true`, the expression is `true`.
  - If the first operand associated with an `&&` is `false`, the expression is `false`.
- This is called *short-circuit* or *lazy* evaluation.

Short-circuit Evaluation

- Short-circuit evaluation is not only efficient, sometimes it is essential!
- A run-time error can result, for example, from an attempt to divide by zero.

```
if ((number != 0) && (sum/number > 5))
```

- *Complete evaluation* can be achieved by substituting `&` for `&&` or `|` for `||`.

Expanded Precedence Rules

Highest Precedence

First: the unary operators +, −, ++, −−, and !

Second: the binary arithmetic operators *, /, %

Third: the binary arithmetic operators +, −

Fourth: the boolean operators <, >, <=, >=

Fifth: the boolean operators ==, !=

Sixth: the boolean operator &

Seventh: the boolean operator |

Eighth: the boolean operator &&

Ninth: the boolean operator ||

Lowest Precedence

Precedence Rules

- In what order are the operations performed?

```
score < min/2 - 10 || score > 90
score < (min/2) - 10 || score > 90
score < ((min/2) - 10) || score > 90
(score < ((min/2) - 10)) || score > 90
(score < ((min/2) - 10)) || (score > 90)

score < (min/2 - 10 || score > 90)
```

Input Validation

- You should check your input to ensure that it is within a valid or reasonable range. For example, consider a program that converts feet to inches. You might write the following:

```
int feet = keyboard.nextInt();
int inches = feet * 12;
```

- What if:
  - The user types a negative number for feet?
  - The user enters an unreasonable value like 100? Or a number larger than can be stored in an int? (2,147,483,647)

Input Validation

- Address these problems by ensuring that the entered values are reasonable:

```
int feet = keyboard.nextInt();
if ((feet >= 0) && (feet < 10))
{
  int inches = feet * 12;
  ...
}
```

The `switch` Statement

- Syntax

```
switch (Controlling_Expression)
{
    case Case_Label:
        Statement(s);
        break;
    case Case_Label:
    …
    default:
    …
}
```

The `switch` Statement

- The `switch` statement is a mutltiway branch that makes a decision based on an *integral* (integer or character) expression and in newer versions of Java, also the String type.
- The `switch` statement begins with the keyword `switch` followed by an integral expression in parentheses and called the *controlling expression.*

The `switch` Statement

- A list of cases follows, enclosed in braces.
- Each case consists of the keyword `case` followed by
  - A constant called the *case label*
  - A colon
  - A list of statements.
- The list is searched for a case label matching the controlling expression.

The `switch` Statement

- The action associated with a matching case label is executed.
- If no match is found, the case labeled `default` is executed.
  - The `default` case is optional, but recommended, even if it simply prints a message.
- Repeated case labels are not allowed.

The `switch` Statement

- The action for each case typically ends with the word `break`.
- The optional `break` statement prevents the consideration of other cases.
- The controlling expression can be anything that evaluates to an integral type.

```java
int month = Integer.parseInt(args[0]);

switch (month)
{
    case 1: System.out.println("January");
            break;
    case 2: System.out.println("February");
            break;
    case 3: System.out.println("March");
            break;
    case 4: System.out.println("April");
            break;
    case 5: System.out.println("May");
            break;
    case 6: System.out.println("June");
            break;

 …

    case 12: System.out.println("December");
            break;
    default: System.out.println("Invalid month");
            break;
}
```

Enumerations

- Consider a need to restrict contents of a variable to certain values
- An enumeration lists the values a variable can have
- Example

```
enum MovieRating {E, A, B}
MovieRating rating;
rating = MovieRating.A;
```

Enumerations

- Now possible to use in a **`switch`** statement

```
switch (rating)
{
   case E: //Excellent
      System.out.println("You must see this movie!");
      break;
   case A: //Average
      System.out.println("This movie is OK, but not great.");
      break;
   case B: // Bad
      System.out.println("Skip it!");
      break;
   default:
      System.out.println("Something is wrong.");
}
```

Enumerations

- An even better choice of descriptive identifiers for the constants

```
enum MovieRating
      {EXCELLENT, AVERAGE, BAD}
rating = MovieRating.AVERAGE;

case EXCELLENT:  ...
```

```java
enum Month {JANUARY, FEBRUARY, MARCH, APRIL, MAY, JUNE, JULY,
        AUGUST, SEPTEMBER, OCTOBER, NOVEMBER, DECEMBER}
    public static void main(String[ ] args)
    {
        Month month = Month.SEPTEMBER;
        int numDays = 0;
        switch (month)
        {
            case JANUARY:
            case MARCH:
            case MAY:
            case JULY:
            case AUGUST:
            case OCTOBER:
            case DECEMBER:
                numDays = 31;
                break;
            case APRIL:
            case JUNE:
            case SEPTEMBER:
            case NOVEMBER:
                numDays = 30;
                break;
            case FEBRUARY:
                numDays = 28;
                break;
            default: System.out.println("Invalid month");
            break;
        }
}
```

Summary

- Review: The `if-else` statement
- The `switch` statement
- A look at enumerations

You Try It

- Write a program with a switch statement that reports whether you passed or failed based on the character entered at the command line. A, B, and C are passing, D and F are not.

- Submit your program, named Grades.java, to the Activity03 dropbox on Moodle. You get 1 point for turning something in, 2 points if it is correct. Hmmm. Let’s say you get 1 additional point if you use an enumeration and get the code right. So that means up to 3 points for this one.
- Don’t forget! Always put your (full) name and a description in a header comment!