

Program Logic to Java

GEEN163

“In theory, theory and practice are the same. In practice, they're not.”

Yogi Berra

Founders' Day

- The Founders' Day Convocation is **Thursday**, March 21 from 10:00 – 12:00 in the Harrison Auditorium
- Classes are suspended during that time
- The lab quiz will be next week instead of this week

Exam

- The second exam will be in lecture on **Friday**, March 22
- The exam will cover everything since the first exam
 - If statements
 - Loops
 - Files
- A sample exam is available on Blackboard under course materials

Thinking About Programs

- If you do not know how to do something, it is very difficult to explain to someone else how to do it
- If you do not know how to solve a problem, it is very difficult to write a program to do it
- It is very useful to think about what a program must do and in what order the steps must be taken

Logical Ordering

- Some things must happen before others
- If you are going to read a number and display it, the read must come before the display

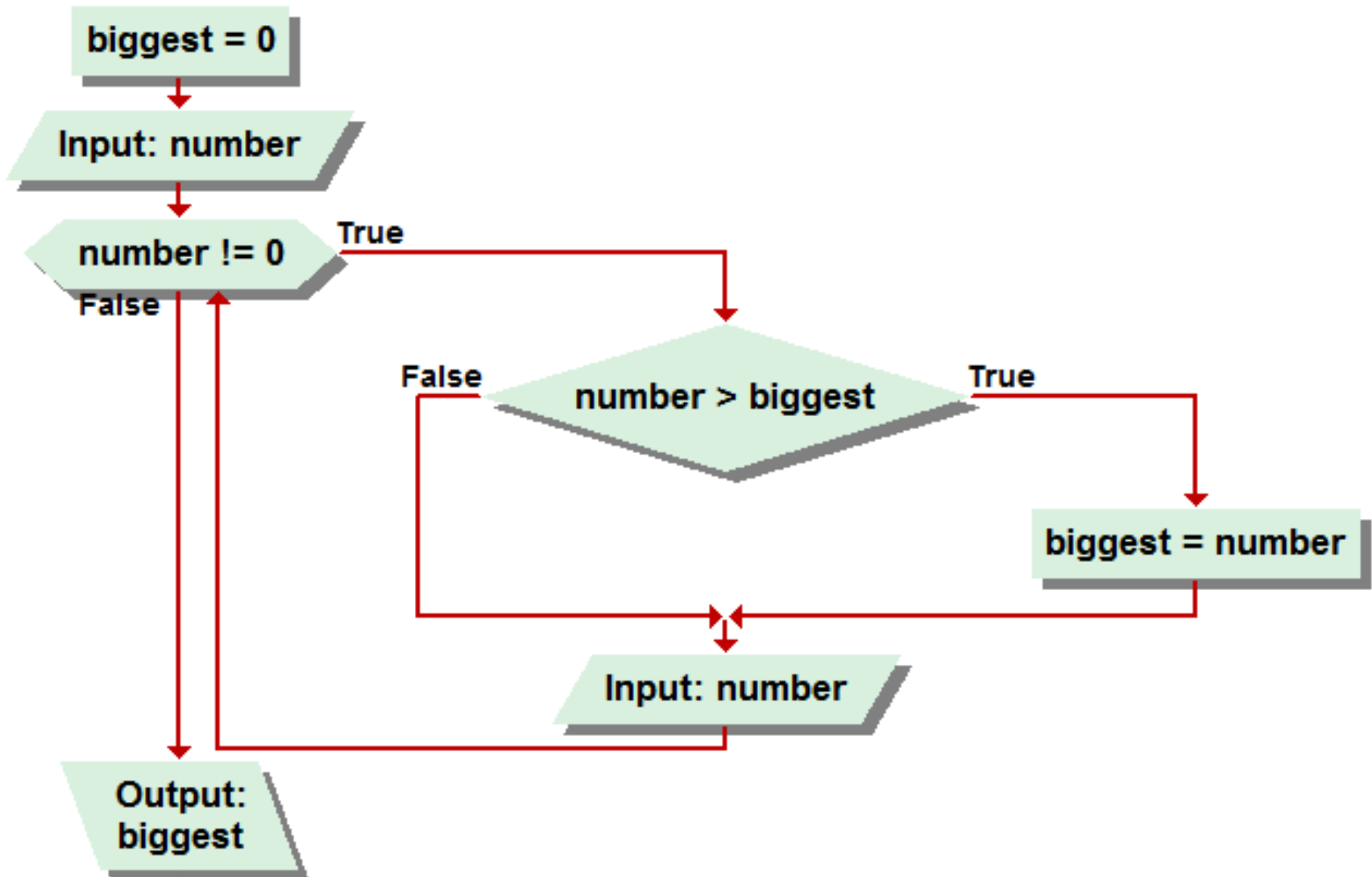
Variables Needed

- When you write a program, consider the variables necessary
- You will probably need a variable to hold each input
- You will probably need a variable to hold the result of a calculation

Loops and Ifs

- If a program has to do something many times, it will need a loop
- The parts of the program that are not repeated will be outside the loop
- If a program does something different sometimes, the program will have an if statement

What variables are needed?



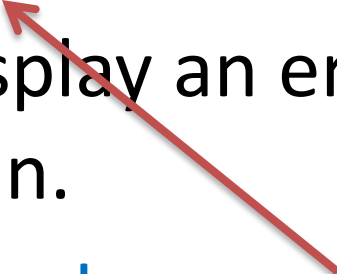
Solution

- The program uses two variables
- biggest
- number

Problem Description

- Read a positive number. If the number is not greater than zero, display an error message and ask the user again.

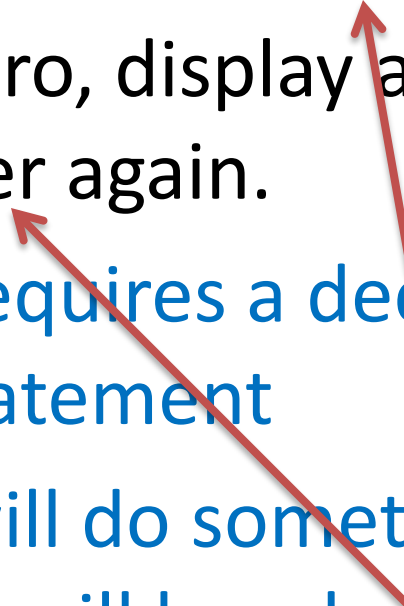
Problem Description

- Read a positive number. If the number is not greater than zero, display an error message and ask the user again.
 - This program only needs one variable
 - Since we have not been told it is a whole number, it should be defined as a double
- 

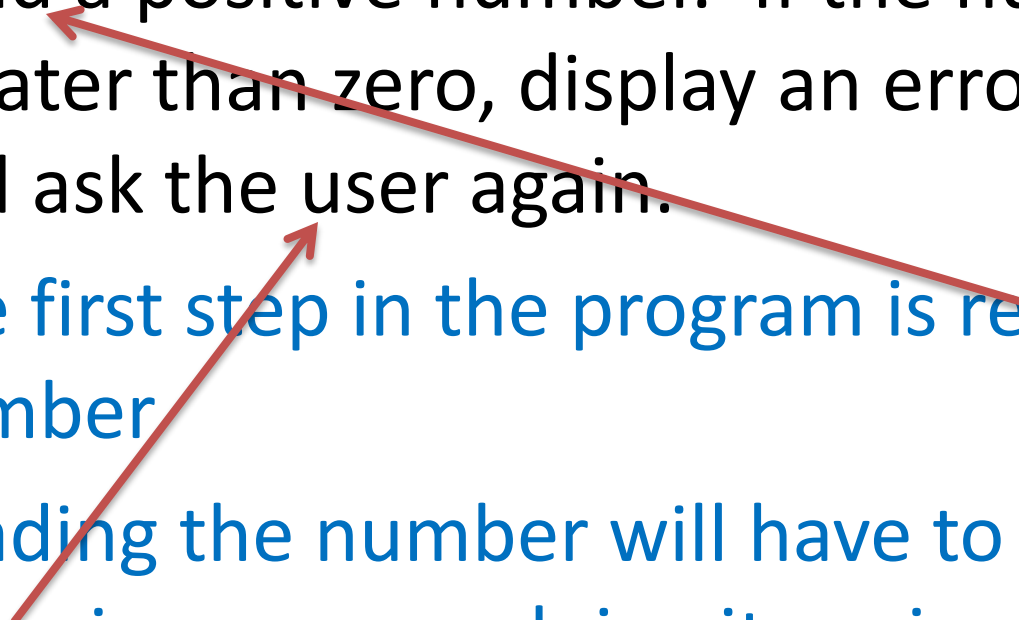
Java Implementation

```
double number;
```

Analyzing the Problem

- Read a positive number. If the number is not greater than zero, display an error message and ask the user again.
 - The program requires a decision, so there will be an Java if statement
 - The program will do something multiple times, so there will be a loop
- 
- Two red arrows originate from the second and third bullet points. One arrow points from the word 'decision' in the second bullet point to the word 'display' in the first bullet point. The other arrow points from the word 'loop' in the third bullet point to the word 'ask' in the first bullet point.


Analyzing the Problem

- Read a positive number. If the number is not greater than zero, display an error message and ask the user again.
 - The first step in the program is reading a number
 - Reading the number will have to be inside a loop since we are doing it again
- 

Java Implementation

```
double number;  
{  
    System.out.print("Enter a number >");  
    number = keyboard.nextDouble();  
}
```



Analyzing the Problem

- Read a positive number. If the number is not greater than zero, display an error message and ask the user again.
 - The java **if** statement will test if the number is less than or equal to zero
 - When the Java **if** is true (*that is number ≤ 0*) the program will display an error message
 - Display is done with `System.out.println`
- 

Java Implementation

```
double number;  
{  
    System.out.print("Enter a number >");  
    number = keyboard.nextDouble();  
    if (number <= 0) {  
        System.out.println("Be positive!");  
    }  
}
```

Analyzing the Problem

- Read a positive number. If the number is not greater than zero, display an error message and ask the user again.
 - The loop condition is the same as the **if** condition, *number* ≤ 0
 - We always want to execute the loop at least once to read the number. Therefore a do while loop is appropriate
- 

Java Implementation

```
double number;  
do {  
    System.out.print("Enter a number >");  
    number = keyboard.nextDouble();  
    if (number <= 0) {  
        System.out.println("Be positive!");  
    }  
} while (number <= 0);
```

Problem Description

- For a 400 pixel wide by 600 pixel tall picture, set the Red intensity to zero using `setRed(int x, int y, int intensity)`

Analyzing the Problem

- For a 400 pixel wide by 600 pixel tall picture, set the Red intensity to zero using `setRed(int x, int y, int intensity)`
- There will have to be a loop for the 400 x pixels and a loop for the 600 y pixels

What Sets All Red Pixels to Zero?

click on the next slide

```
for( x = 0; x < 400; x++) {  
  for( y = 0; y < 400; y++) {  
    setRed(x,y,0);  
  }  
}
```

A

```
for( x = 0; x < 400; x++) {  
  setRed(x,y,0);  
}  
for( y = 0; y < 400; y++) {  
  setRed(x,y,0);  
}
```

B

```
for( x = 0; x < 400; x++) {  
  setRed(x,y,0);  
  for( y = 0; y < 400; y++) {  
    setRed(x,y,0);  
  }  
}
```

C

```
for( x = 0; setRed(x,y,0); x+400) {  
  for( x = 0; setRed(x,y,0); x+600){  
  }  
}
```

D

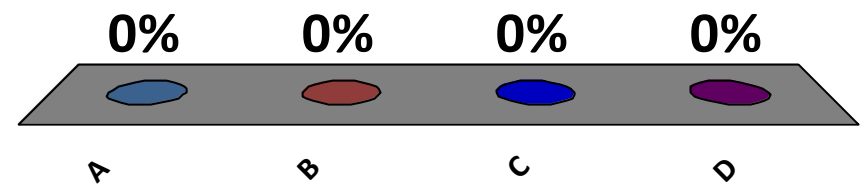
What Sets All Red Pixels to Zero?

A. A

B. B

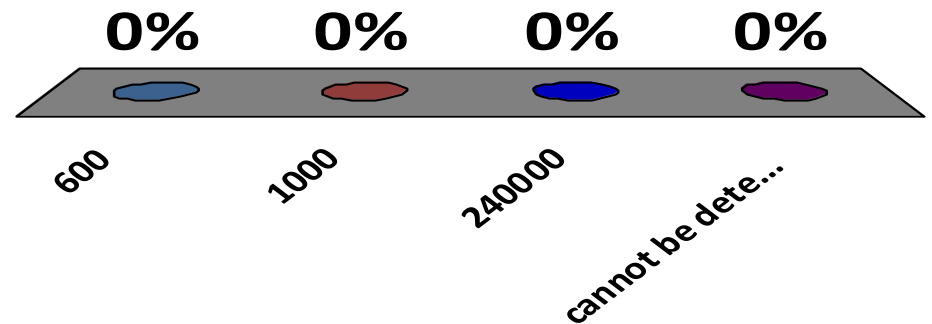
C. C

D. D



How many calls will be made to setRed?

- A. 600
- B. 1000
- C. 240,000
- D. cannot be determined



Problem Description

- Read the first ten integers from the file "numbers.txt" and display them on the screen

Analyzing the Problem

- Read the first ten integers from the file "numbers.txt" and display them on the screen
- The first steps are to create a Scanner object to read from the file
- The last step should be to close the file

Java Implementation

```
java.io.File dog = new java.io.File("numbers.txt");  
Scanner cat = new Scanner( dog );
```

```
cat.close();
```

Analyzing the Problem

- Read the first ten integers from the file "numbers.txt" and display them on the screen
- There must be a loop that repeats 10 times
- Since we know how many times to loop, a **for** loops would be appropriate

Java Implementation

```
java.io.File dog = new java.io.File("numbers.txt");
```

```
Scanner cat = new Scanner( dog );
```

```
for (int counter = 0; counter < 10; counter++) {
```

```
}
```

```
cat.close();
```

Analyzing the Problem

- Read the first ten integers from the file "numbers.txt" and display them on the screen
- `nextInt()` can be used to read a number
- `System.out.println` can be used to display the number
- The read must come before the display

Java Implementation

```
java.io.File dog = new java.io.File("numbers.txt");
Scanner cat = new Scanner( dog );
int bull;
for (int counter = 0; counter < 10; counter++) {
    bull = cat.nextInt();
    System.out.println(bull);
}
cat.close();
```


Modify the Program

- Modify the program so that it will work correctly if there are less than 10 numbers in the file
- Work with your team to define the answer

Possible solution

```
java.io.File dog = new java.io.File("numbers.txt");
Scanner cat = new Scanner( dog );
int bull;
for (int counter = 0; counter < 10 && cat.hasNext();
     counter++) {
    bull = cat.nextInt();
    System.out.println(bull);
}
cat.close();
```

Another Possible solution

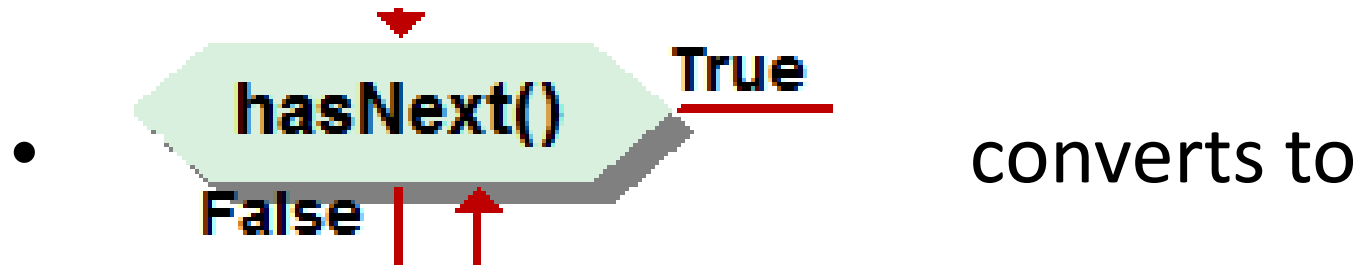
```
java.io.File dog = new java.io.File("numbers.txt");
Scanner cat = new Scanner( dog );
int bull;
loop: for (int counter = 0; counter < 10; counter++) {
    if (!cat.hasNext()) {
        break loop;
    }
    bull = cat.nextInt();
    System.out.println(bull);
}
cat.close();
```

Flowcharts

- Flowcharts are a way to visually describe the logic of a program
- It can be helpful to write a flowchart for a program and then convert the flowchart to Java

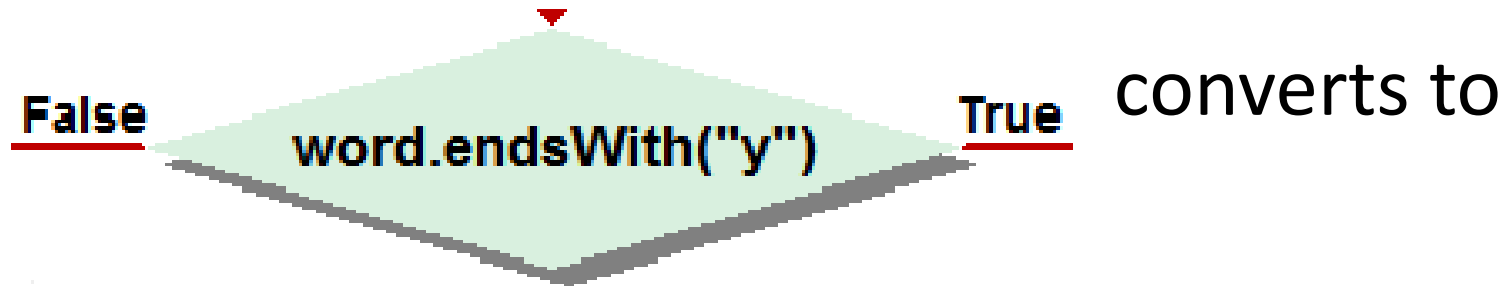
Flowchart to Java

- **input:word** converts to
`word = keyboard.next();`
- **output: word** converts to
`System.out.println(word);`



```
while ( inFile.hasNext() )
```

Flowchart to Java

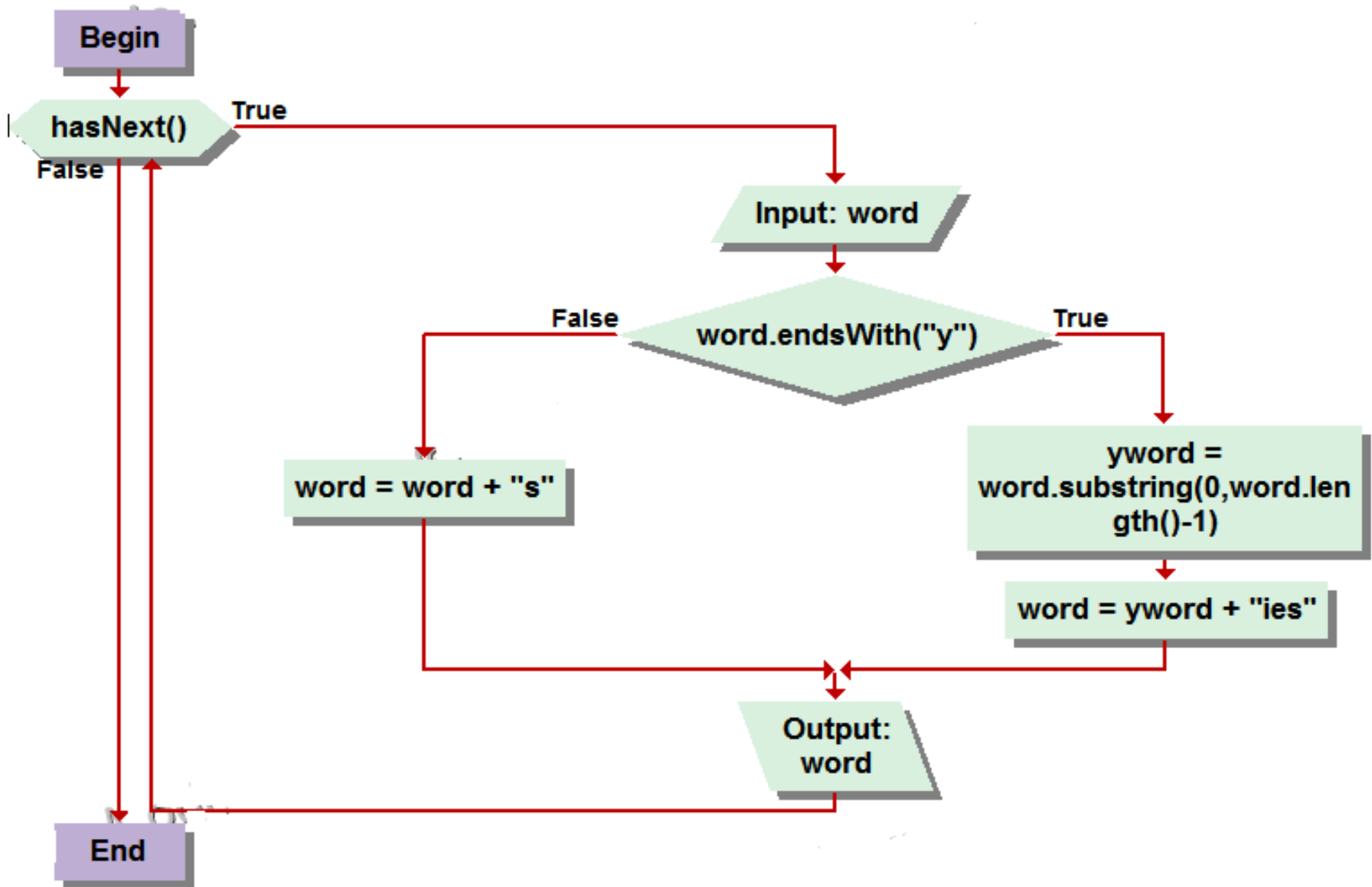


```
if (word.endsWith("y")) {  
} else {  
}
```

Problem Description

- Read an English word from a file and display the plural of the word
- For most words, you just add an "s" on the end
- If the word ends in "y", you change the "y" to "i" and add "es"
- *We will ignore the many other rules*

Making a word plural



Complete the Program

- Working with your team, complete this program to display the plural of the words

```
java.io.File dog = new java.io.File("data.txt");  
Scanner cat = new Scanner( dog );  
String word, yword;
```

Possible Solution

```
while (cat.hasNext()) {  
    word = cat.next();  
    if ( cat.endsWith( "y" ) ) {  
        yword = cat.substring( 0, cat.length()-1 );  
        word = yword + "ies";  
    } else {  
        word = word + "s";  
    }  
    System.out.println( word );  
}
```

format Method

- The `java.io.PrintWriter` class has two identical methods, `format` and `printf`, to format output
`format(String format, var1, var2, ...)`
- Writes the variables to the output as specified by the format string
- Very similar to `printf` in the C programming language

Format Descriptors

- The format string may contain text with descriptors located in it.
- The descriptors start with a percent sign, % followed optionally by a length and then a format type character

format	data type	result
'd'	int or long	The result is formatted as an integer
'f'	double or float	The result is formatted as a decimal number
's'	String	The string

Output length

- You can specify a number between the % and the descriptor character to indicate the minimum number of characters to print
- You can specify the maximum number of digits to the right of the decimal point

%*minlength*.*maxprecision*f

Format Examples

```
double e = 2.718281828459045;
```

```
System.out.format("answer is %5.3f", e);
```

will display “answer is 2.718”

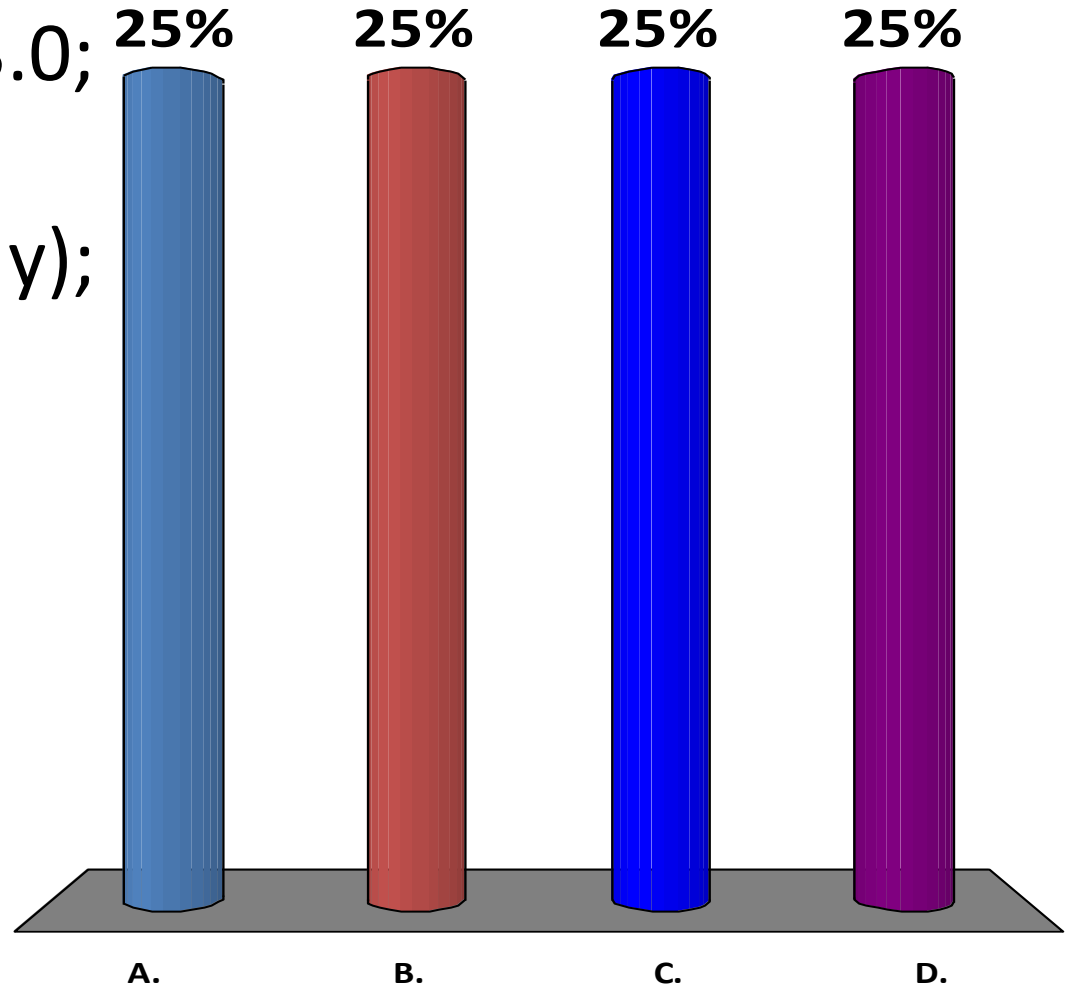
```
System.out.format("answer is %7.4f", e);
```

will display “answer is 2.7183”

What is displayed?

```
double x = 10.0;  
double y = x * 2.0 / 3.0;  
System.out.printf(  
    "y is %6.3f", y);
```

- A. y is 10.000
- B. y is 6.666
- C. y is 6.667
- D. y is 6.66666666



Write the printf statement

```
double bill, tax;
```

```
tax = cost * 0.07;
```

```
bill = cost + tax + handling;
```

```
// Display the bill with two decimal digits
```


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