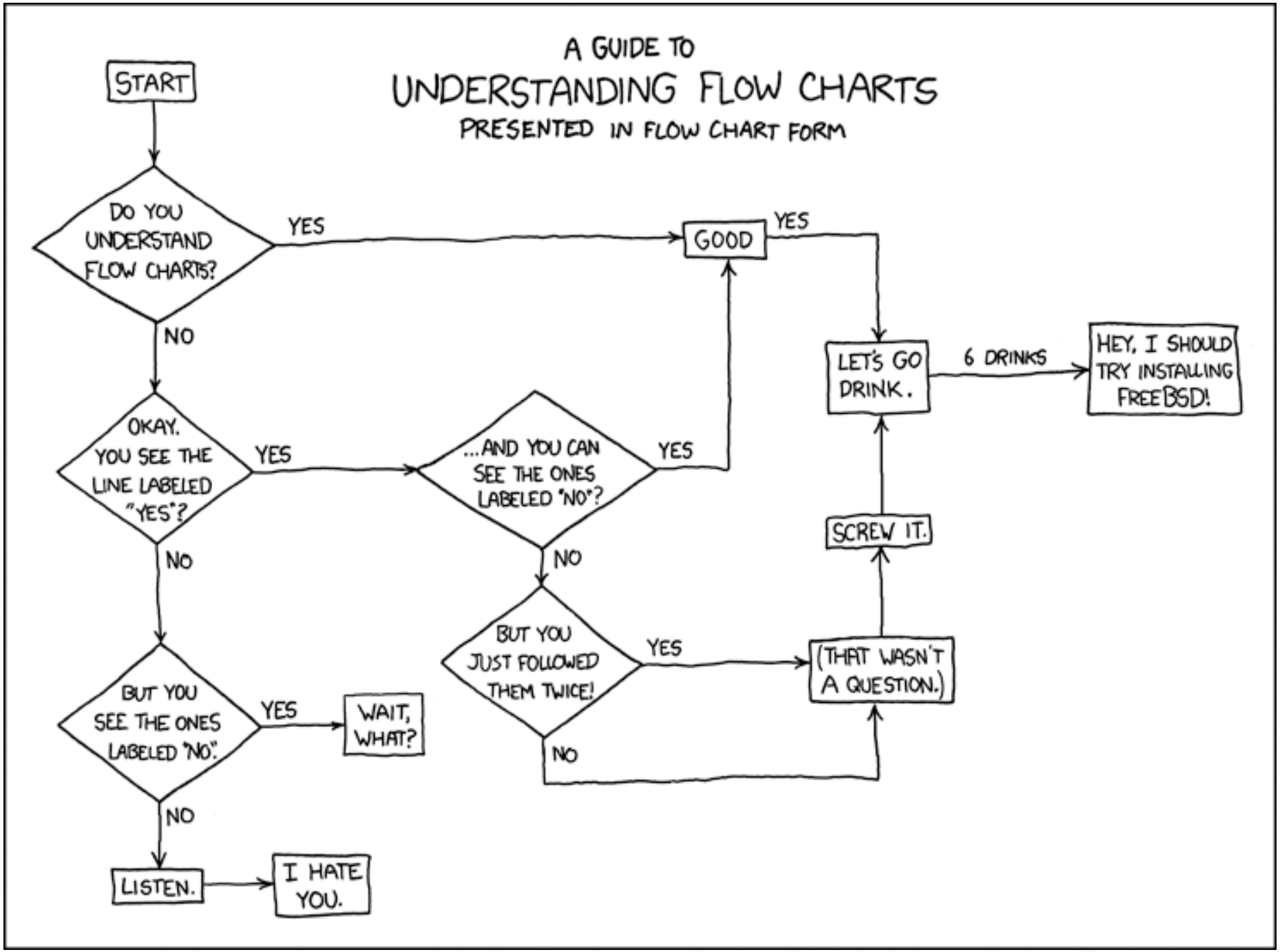
Building Java Programs

Chapter 4
Lecture 8: `Scanner`; `if/else`

reading: 3.3 – 3.4, 4.1, 4.5



https://xkcd.com/518/

Scanner

- **`Scanner`**: An object that can read input from many sources.
  - Communicates with `System.in`
  - Can also read from files (Ch. 6), web sites, databases, …

- The `Scanner` class is found in the `java.util` package.

```
import java.util.*;   // so you can use Scanner
```

- Constructing a `Scanner` object to read console input:

```
Scanner name = new Scanner(System.in);
```

  - Example:

```
Scanner console = new Scanner(System.in);
```

`Scanner` methods

Method	Description
`nextInt()`	reads an `int` from the user and returns it
`nextDouble()`	reads a `double` from the user
`next()`	reads a one-word `String` from the user
`nextLine()`	reads a one-*line* `String` from the user

- Each method waits until the user presses Enter.
- The value typed by the user is returned.

```
System.out.print("How old are you? ");   // prompt
int age = console.nextInt();
System.out.println("You typed " + age);
```

- **prompt**: A message telling the user what input to type.

Input tokens

- **token**: A unit of user input, as read by the `Scanner`.
  - Tokens are separated by *whitespace* (spaces, tabs, new lines).
  - How many tokens appear on the following line of input?

```
23  John Smith  42.0  "Hello world"  $2.50  "  19"
```

- When a token is not the type you ask for, it crashes.

```
System.out.print("What is your age? ");
int age = console.nextInt();
```

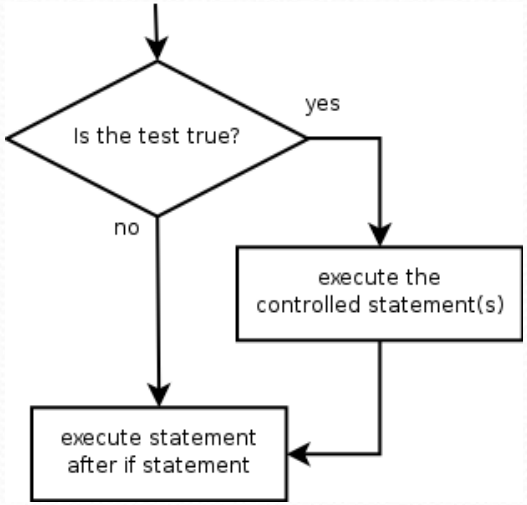
Output:

```
What is your age? Timmy
java.util.InputMismatchException
        at java.util.Scanner.next(Unknown Source)
        at java.util.Scanner.nextInt(Unknown Source)
        ...
```

The `if` statement

Executes a block of statements only if a test is true

```
if (test) {
    statement;
    ...
    statement;
}
```



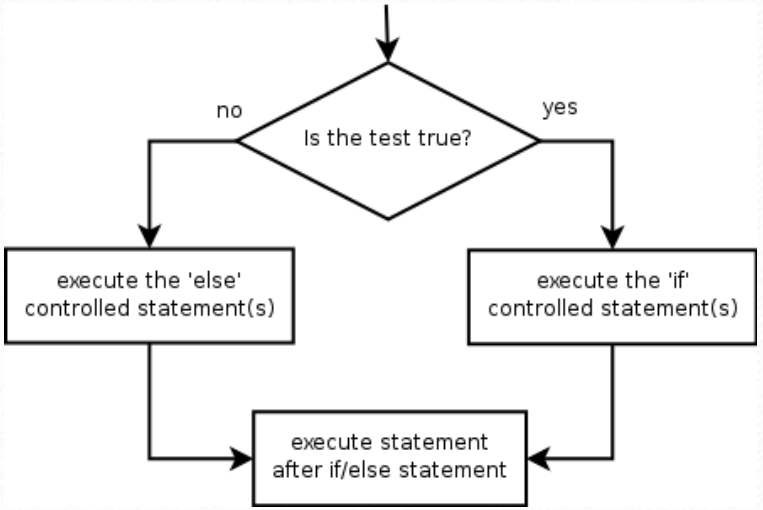
- Example:

```
double gpa = console.nextDouble();
if (gpa >= 2.0) {
    System.out.println("Application accepted.");
}
```

The `if/else` statement

Executes one block if a test is true, another if false

```
if (test) {
    statement(s);
} else {
    statement(s);
}
```



- Example:

```
double gpa = console.nextDouble();
if (gpa >= 2.0) {
    System.out.println("Welcome to Mars University!");
} else {
    System.out.println("Application denied.");
}
```

Relational expressions

- `if` statements and `for` loops both use logical tests.

```
for (int i = 1; i <= 10; i++) { ...
if (i <= 10) { ...
```

  - These are `boolean` expressions, seen in Ch. 5.

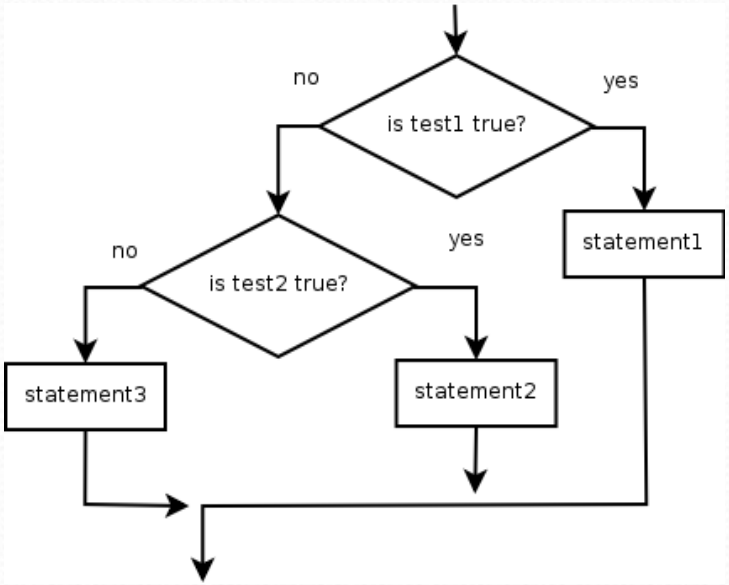
- Tests use *relational operators*:

Operator	Meaning	Example	Value
==	equals	1 + 1 == 2	true
!=	does not equal	3.2 != 2.5	true
<	less than	10 < 5	false
>	greater than	10 > 5	true
<=	less than or equal to	126 <= 100	false
>=	greater than or equal to	5.0 >= 5.0	true

Nested `if/else`

Chooses between outcomes using many tests

```
if (test) {
    statement(s);
} else if (test) {
    statement(s);
} else {
    statement(s);
}
```



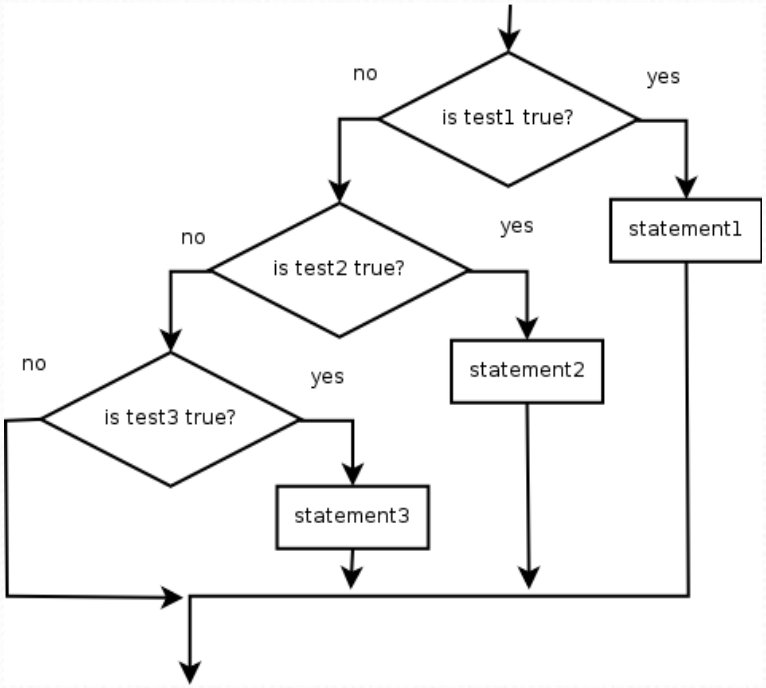
- Example:

```
if (x > 0) {
    System.out.println("Positive");
} else if (x < 0) {
    System.out.println("Negative");
} else {
    System.out.println("Zero");
}
```

Nested `if/else/if`

- If it ends with `else`, exactly one path must be taken.
- If it ends with `if`, the code might not execute any path.

```
if (test) {
    statement(s);
} else if (test) {
    statement(s);
} else if (test) {
    statement(s);
}
```



- Example:

```
if (place == 1) {
    System.out.println("Gold medal!");
} else if (place == 2) {
    System.out.println("Silver medal!");
} else if (place == 3) {
    System.out.println("Bronze medal.");
}
```

Nested `if` structures

- exactly 1 path *(mutually exclusive)*

```
if (test) {
    statement(s);
} else if (test) {
    statement(s);
} else {
    statement(s);
}
```

- 0 or 1 path *(mutually exclusive)*

```
if (test) {
    statement(s);
} else if (test) {
    statement(s);
} else if (test) {
    statement(s);
}
```

- 0, 1, or many paths *(independent tests; not exclusive)*

```
if (test) {
    statement(s);
}
if (test) {
    statement(s);
}
if (test) {
    statement(s);
}
```

Which nested `if/else`?

- **(1) if/if/if (2) nested if/else (3) nested if/else if**
  - Whether a user is lower, middle, or upper-class based on income.
    - **(2)** nested `if / else if / else`
  - Whether you made the dean's list (GPA ≥ 3.8) or honor roll (3.5-3.8).
    - **(3)** nested `if / else if`
  - Whether a number is divisible by 2, 3, and/or 5.
    - **(1)** sequential `if / if / if`
  - Computing a grade of A, B, C, D, or F based on a percentage.
    - **(2)** nested `if / else if / else if / else if / else`

Nested `if/else` question

Formula for body mass index (BMI):

$$BMI = \frac{weight}{height^2} \times 703$$

BMI	Weight class
below 18.5	underweight
18.5 - 24.9	normal
25.0 - 29.9	overweight
30.0 and up	obese

- Write a program that produces output like the following:

```
This program reads data for two people and
computes their body mass index (BMI).

Enter next person's information:
height (in inches)? 70.0
weight (in pounds)? 194.25

Enter next person's information:
height (in inches)? 62.5
weight (in pounds)? 130.5

Person 1 BMI = 27.868928571428572
overweight
Person 2 BMI = 23.485824
normal
Difference = 4.383104571428571
```