Introduction to Java

Michelle Brush
Senior Software Architect
Cerner Corporation

Class Structure

- The Why and What of Java
- Basic Logic
- Object-Oriented Programming
- **When Things Go Wrong**
- Common Java APIs
- JUnit
- Generics
- Putting It All Together I & II

Things that can go wrong....

- Compiler errors
- Runtime errors (bugs)
- Exceptions

Things that can go wrong....

- **Compiler errors**
- Runtime errors (bugs)
- Exceptions

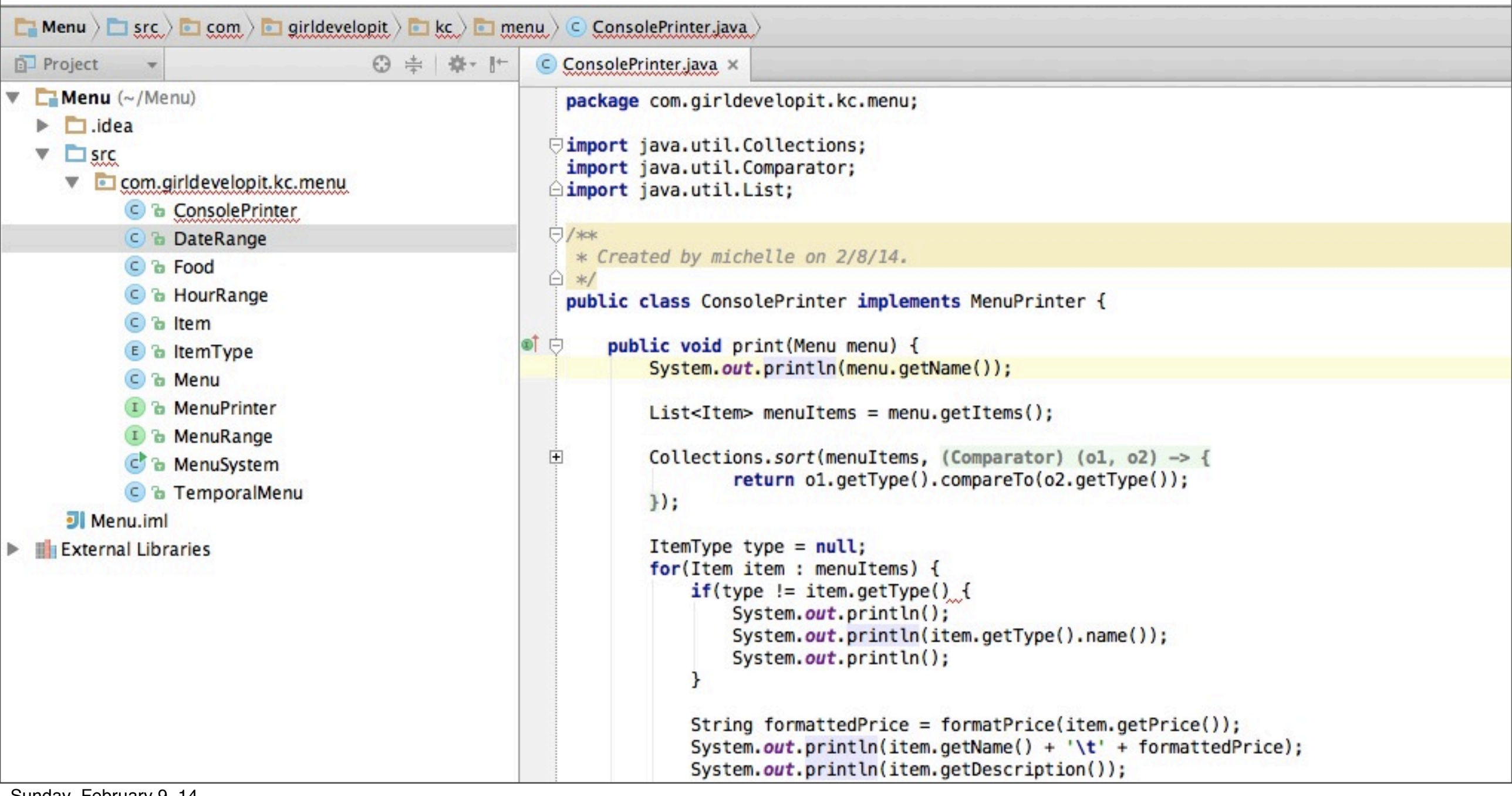
Compiler Errors

Programming languages have **syntax** that you must follow.

Compiler errors happen when your code doesn't follow the **syntax**.

I have no idea what you want me to do.

Red Squiggles



Messages


Messages Make
Information: Using javac 1.7.0_45 to compile java sources
Information: java: Errors occurred while compiling module 'Menu'
Information: Compilation completed with 1 error and 0 warnings in 3 sec
Information: 1 error
Information: 0 warnings
/Users/michelle/Menu/src/com/girldevelopit/kc/menu/ConsolePrinter.java
Error:(26, 38) java: ')' expected

How to Resolve the Error

- Read the error in the message view.
- Read the line of code it references.
- Check your assumptions.
- All else fails, Google it!

Compiler Error Demo

Remember...

Computers are 3 year olds that are really good at math and have huge memories.

- They are obstinate.
- They have a poor vocabulary.
- They are never wrong.

Things that can go wrong....

- Compiler errors
- **Runtime errors (bugs)**
- Exceptions

Bugs

9/9

0800 Arctan started
1000 " stopped - arctan ✓ { 1.2700 9.037 847 025
9.037 846 ?95 correct
13"u_c (032) MP - MC ~~1.9821647000~~ ~~2.13047641 5 (-3)~~ 4.615925059(-2)
(033) PRO 2 2.130476415
correct 2.130676415
Relays 6-2 in 033 failed special speed test
In relay " 11.00 test.
Relays changed
1100 Started Cosine Tape (Sine check)
1525 Started Multy Adder Test.

1545 Relay #70 Panel F
(moth) in relay.
First actual case of bug being found.
1700 1630 Arctangent started.
closed down.

Relay 2145
Relay 3370

Bugs

Root cause:

The code isn't doing what you think it is.

Solution:

Figure out what the code is really doing.

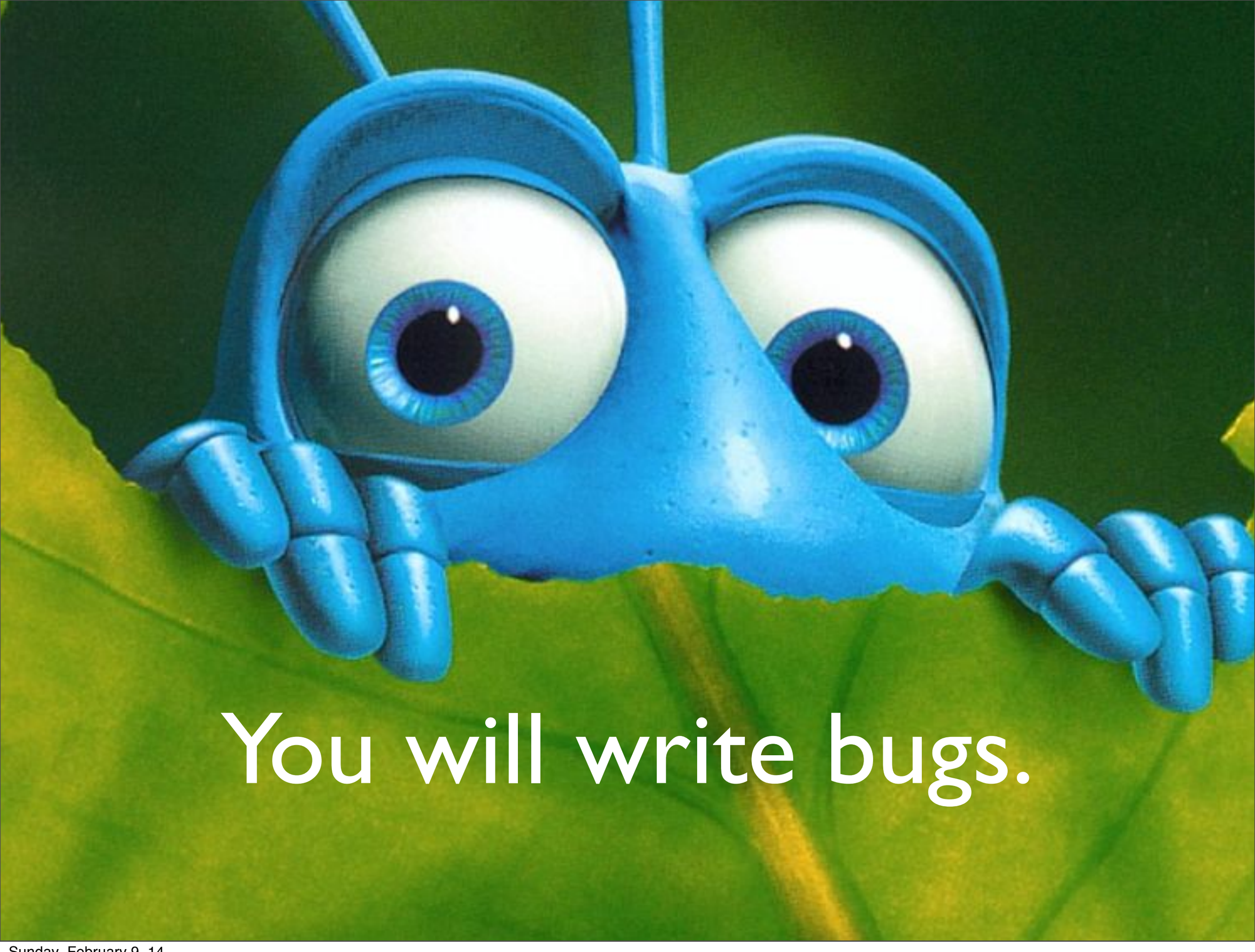
Check your assumptions.

as·sump·tion
/əˈsəm(p)SHən/

noun
plural noun: **assumptions**

1. a thing that is accepted as true or as certain to happen, without proof.
   "they made certain assumptions about the market"
   synonyms: supposition, presumption, belief, expectation, conjecture, speculation, surmise, guess, premise, hypothesis; More

2. the action of taking or beginning to take power or responsibility.
   "the assumption of an active role in regional settlements"
   synonyms: seizure, arrogation, appropriation, expropriation, commandeering, confiscation, hijacking, wresting More


You will write bugs.


Assume it's your code.

Things that can go wrong....

- Compiler errors
- Runtime errors (bugs)
- **Exceptions**

Reporting Errors

- You will write code with bugs.
- Other people will write code with bugs.
- Is there anything you can do?


CPU ID:GenuineIntel 5.2.c irql:1f SYSVER 0xf0000565
Dll Base DateStmp - Name
80100000 3202c07e - ntoskrnl.exe
80001000 31ed06b4 - atapi.sys
802c6000 31ed06bf - aic78xx.sys
802d1000 31ec6c7a - CLASS2.SYS
fc698000 31ec6c7d - Floppy.SYS
fc90a000 31ec6df7 - Fs_Rec.SYS
fc864000 31ed868b - KSecDD.SYS
fc6d8000 31ec6c90 - i8042prt.sys
fc874000 31ec6c94 - kbdclass.sys
feffa000 31ec6c62 - mga_mil.sys
fc708000 31ec6ccb - Msfs.SYS
fefbc000 31eed262 - NDIS.SYS
fefa4000 31f91a51 - mga.dll
feb8c000 31ec6e6c - TDI.SYS
feacf000 31f130a7 - tcpip.sys
fc550000 31601a30 - el59x.sys
fc718000 31ec6e7a - netbios.sys
fc870000 31ec6c9b - Parallel.SYS
fc5b0000 31ec6cb1 - Serial.SYS
fea3b000 31f7a1ba - mup.sys
Dll Base DateStmp - Name
80010000 31ee6c52 - hal.dll
80006000 31ec6c74 - SCSIPORT.SYS
802cd000 31ed237c - Disk.sys
8037c000 31eed0a7 - Ntfs.sys
fc6a8000 31ec6ca1 - Cdrom.SYS
fc9c9000 31ec6c99 - Null.SYS
fc9ca000 31ec6c78 - Beep.SYS
fc86c000 31ec6c97 - mouclass.sys
fc6f0000 31f50722 - VIDEOPORT.SYS
fc890000 31ec6c6d - vga.sys
fc4b0000 31ec6cc7 - Npfs.SYS
a0000000 31f954f7 - win32k.sys
fec31000 31eedd07 - Fastfat.SYS
feaf0000 31ed0754 - nbf.sys
feab3000 31f50a65 - netbt.sys
fc560000 31f8f864 - afd.sys
fc858000 31ec6c9b - Parport.sys
fc954000 31ec6c9d - ParVdm.SYS
fea4c000 31f5003b - rdr.sys
fe9da000 32031abe - srv.sys
Address dword dump Build [1381] - Name
fec32d84 80143e00 80143e00 80144000 ffdff000 00070b02 - KSecDD.
801471c8 80144000 80144000 ffdff000 c03000b0 00000001 - ntoskrn
801471dc 80122000 f0003fe0 f030eee0 e133c4b4 e133cd40 - ntoskrn
80147304 803023f0 0000023c 00000034 00000000 00000000 - ntoskrn
Restart and set the recovery options in the system control panel
or the /CRASHDEBUG system start option.

do nothing?

do nothing?


The application Firefox quit unexpectedly.
Mac OS X and other applications are not affected.
Click Relaunch to launch the application again. Click Report to see more details or send a report to Apple.
Ignore
Report...
Relaunch

Error Handling

Code written to try to ***handle errors*** *that happen so that the program* ***recovers*** *or* ***fails gracefully****.*

Error Handling

In Java, error handling is ***exception handling****.*

Exceptions

Exceptions are **objects**.

They are "**thrown**" when something potentially bad happens.

You can "**catch**" them.

Exceptions

You don't always have to **catch** them.

Throwing

You **throw** an exception when something bad happens.

```
throw new RuntimeException(“Error!”);
```

Catching

```
try {
    //some operation
} catch (Exception e) {
   //handle it
}
```

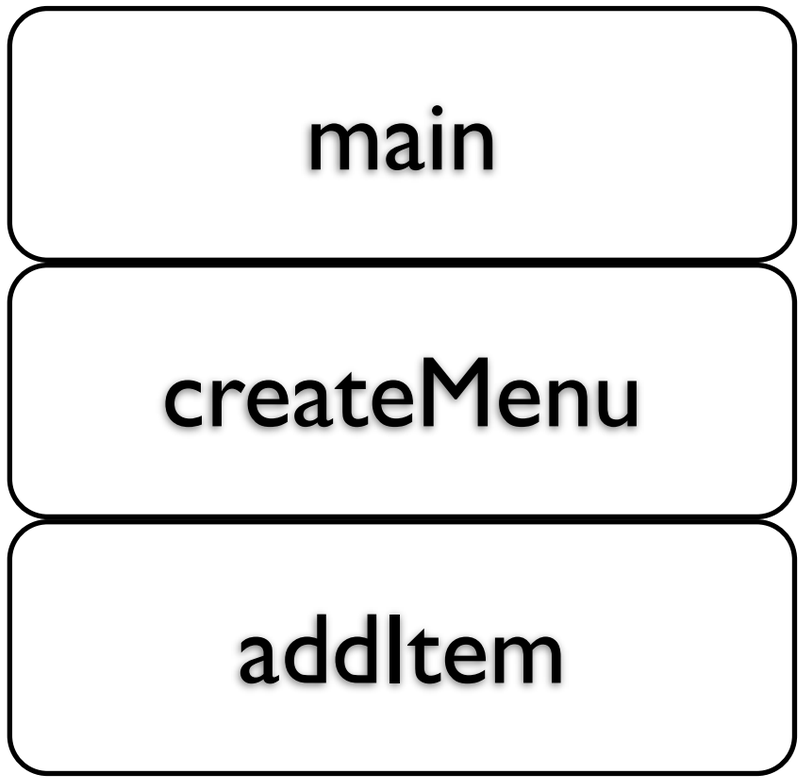
You **catch** an exception
so that you can handle it.

Catching

```
try {
    //some operation
} catch (Exception e) {
   //handle it
}
```

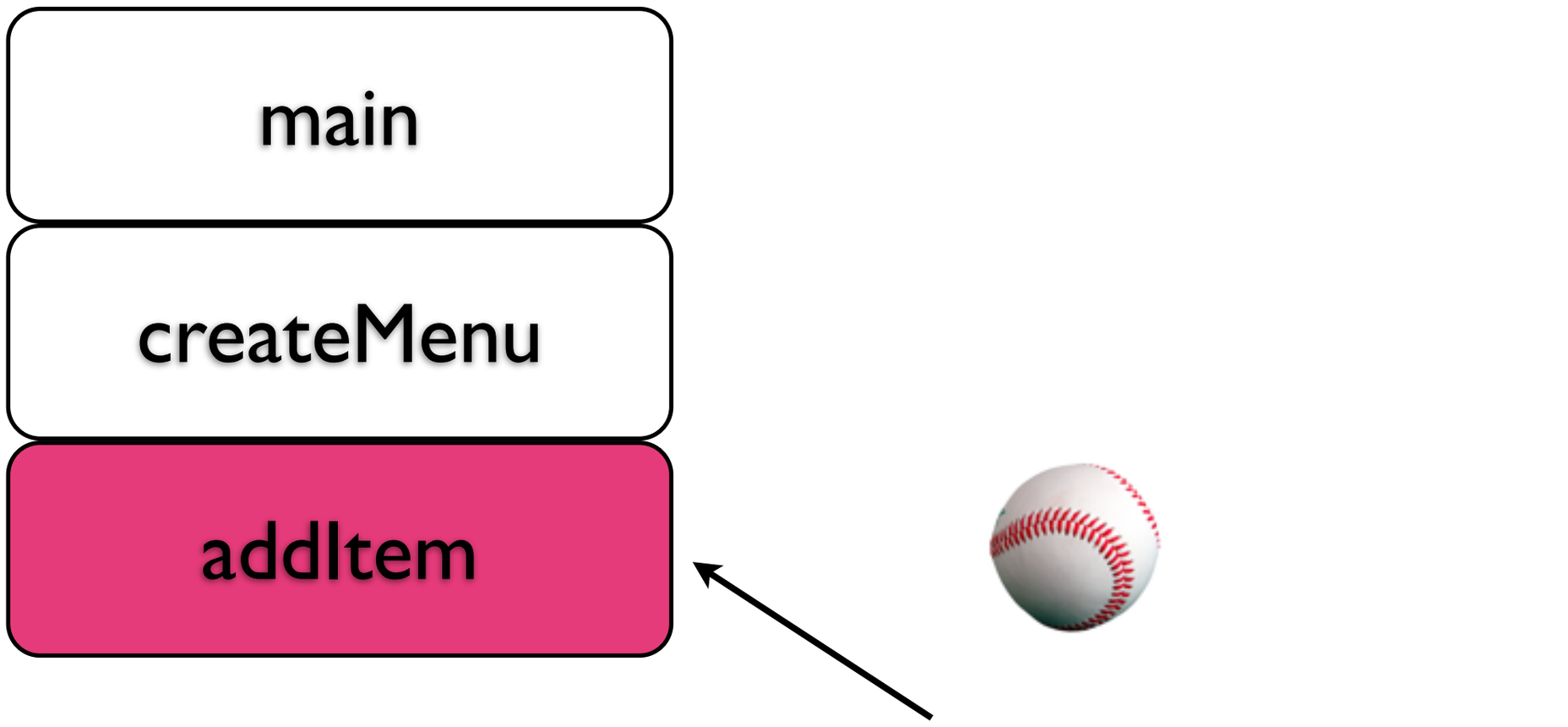
You don't have to catch all exceptions. You can let them **propagate**.

Exceptions

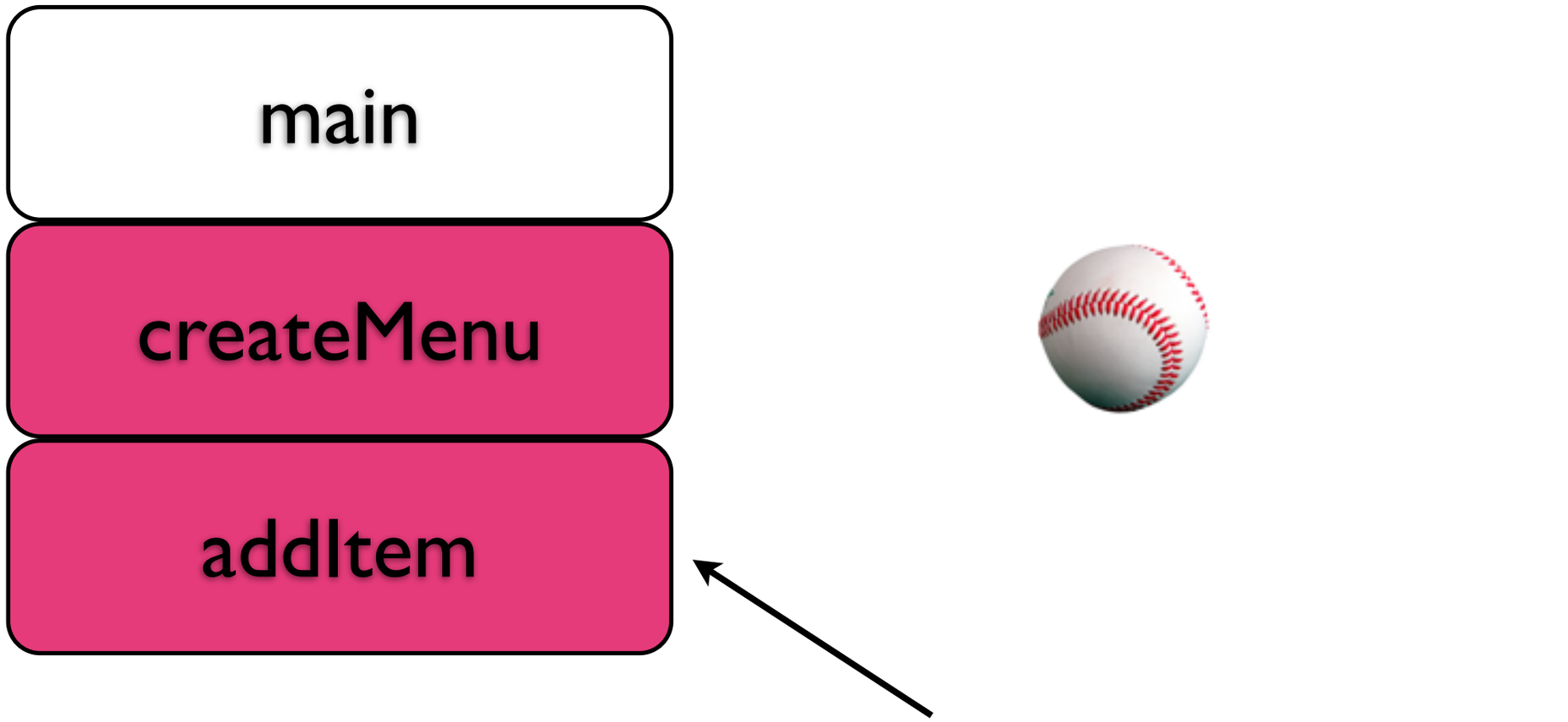


When an exception is thrown, the program immediately **jumps out** of the current function.

Exceptions



Exceptions



Exceptions

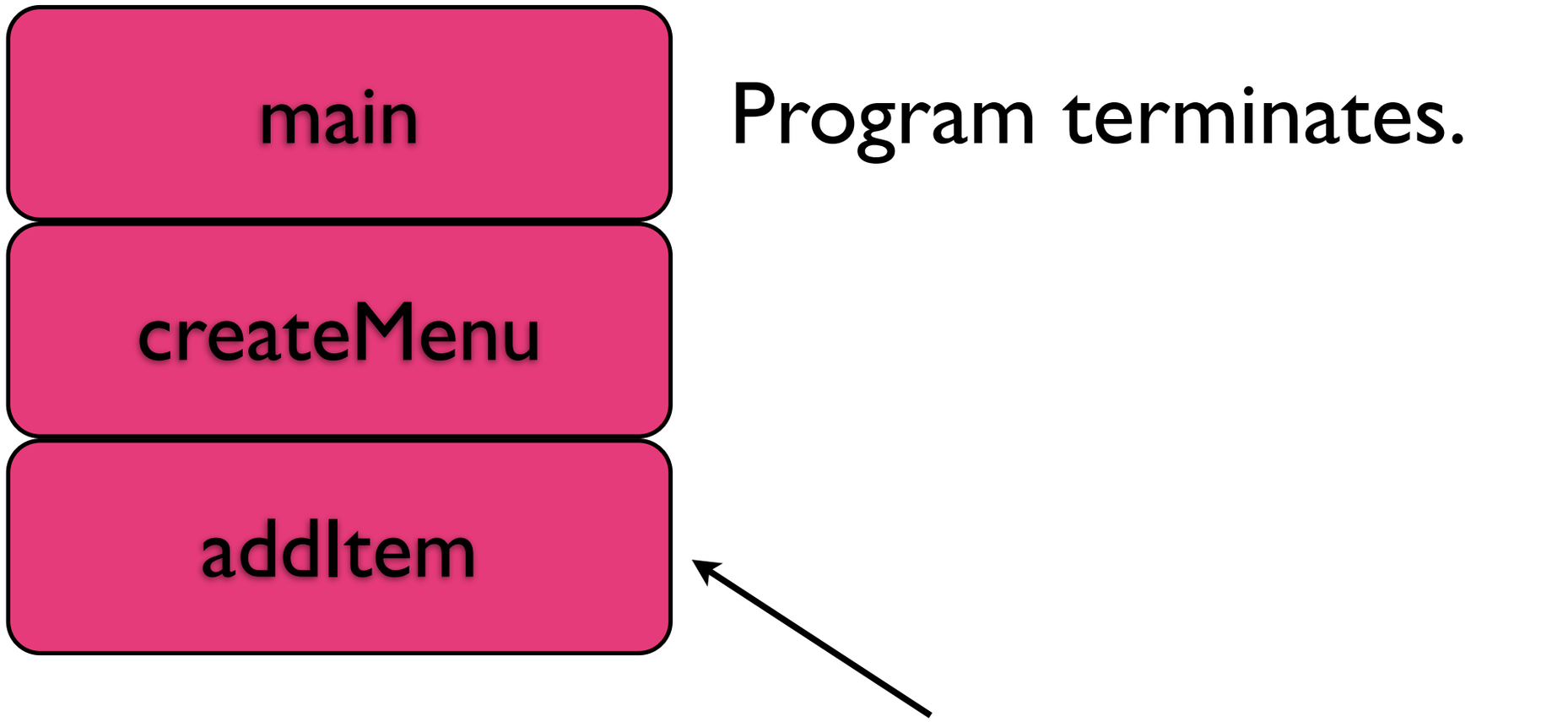
main

createMenu

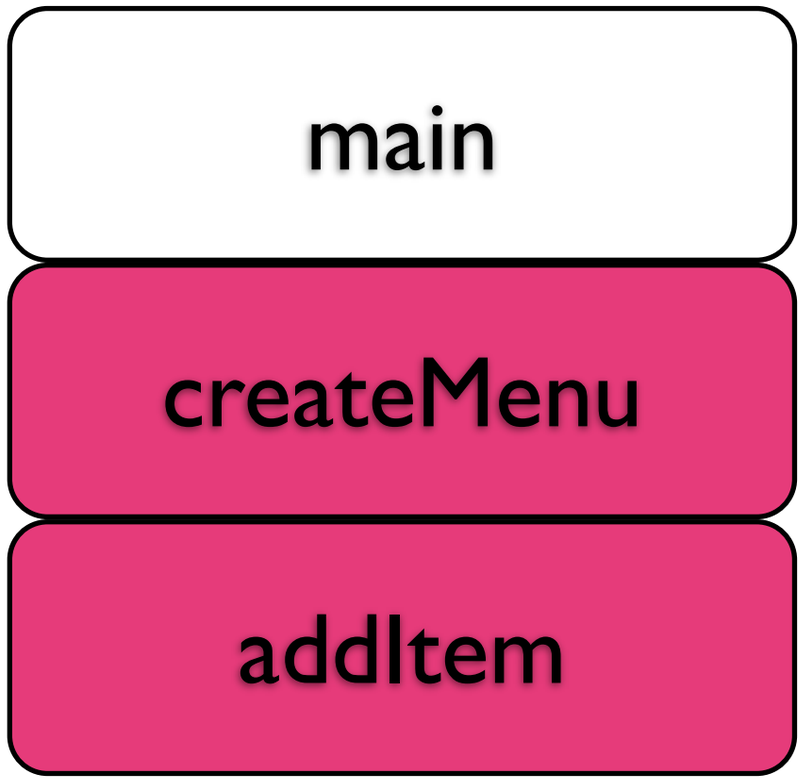
addItem

```
throw new RuntimeException();
```

Exceptions


main
createMenu
addItem
Program terminates.
throw new RuntimeException();

Exceptions




```
try {
    menu.addItem(...)
} catch(NullPointerException e){
    //handling code
}
```

```
throw new RuntimeException();
```

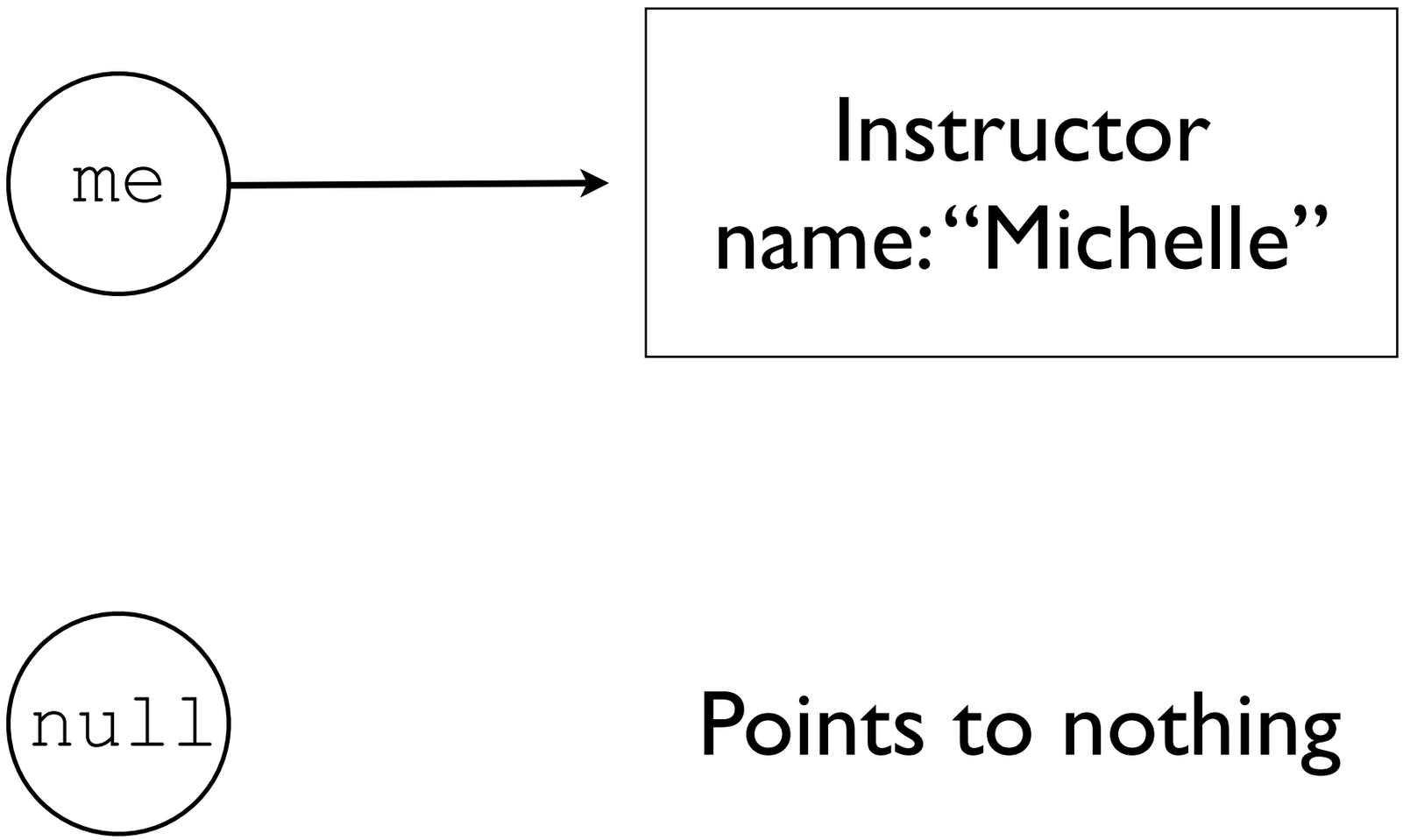
Why?

- A function gets bad parameters.
- The computer ran out of memory.
- A file couldn't be opened.
- Something didn't exist.
- Something isn't configured properly.

Most Common

An object is **null**.

What is null?



Null

Null is a reference to nothing.

Where do null objects come from?

```
//We explicitly create them.
Object obj = null;
```

Where do null objects come from?

```
//We fail to initialize a member.
public class Food {
    private String name;
    private String description;
    public Food(String name) {
        this.name = name;
    }
```

Where do null objects come from?

```
//We get them from a function.

Object obj = getObject();
```

(getObject could return null.)

What happens if we use null?

```
Object obj = null;

//Throws an exception
obj.equals(“happy”);
```

NullPointerException

http://docs.oracle.com/javase/7/docs/api/java/lang/NullPointerException.html

What do I do?

- if I have a bug?
- if there's an exception?

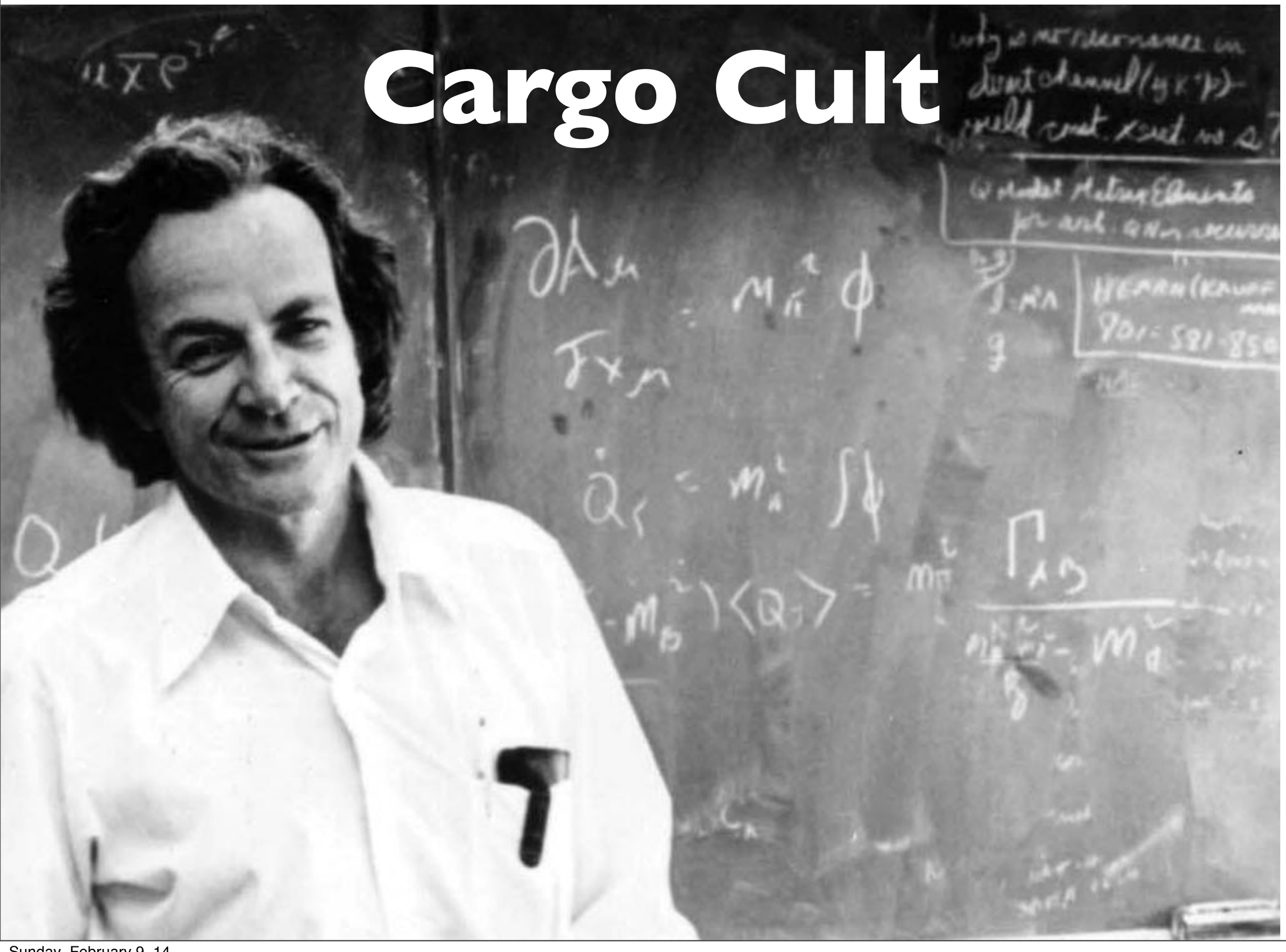
DEBUG!

Scientific Method

1. Characterize the problem.
2. Form a hypothesis.
3. Design an experiment.
4. Perform the Experiment.
5. Evaluate the result.

Don’t just throw code at the problem...

Cargo Cult



Scientific Method

1. **Characterize the problem.**
2. Form a hypothesis.
3. Design an experiment.
4. Perform the Experiment.
5. Evaluate the result.

Characterize the Problem

Date:

In the box, draw & write as many words as you can to tell about your observation

What **observations** can I make about the code?

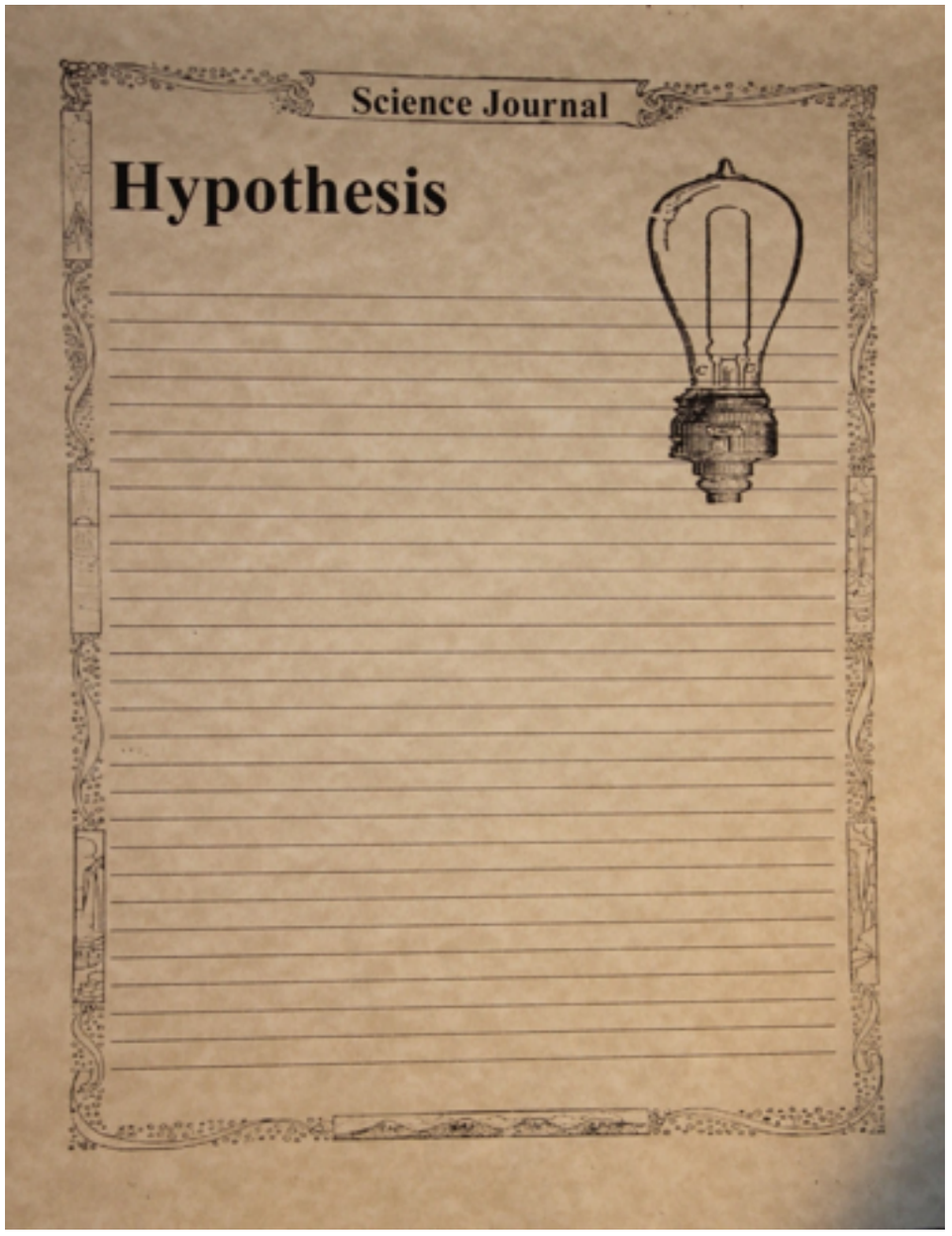
Don't forget to use your five senses!

Scientific Method

1. Characterize the problem.
2. **Form a hypothesis.**
3. Design an experiment.
4. Perform the Experiment.
5. Evaluate the result.

Form a Hypothesis

What is a reasonable **guess** as to the source of the issue?

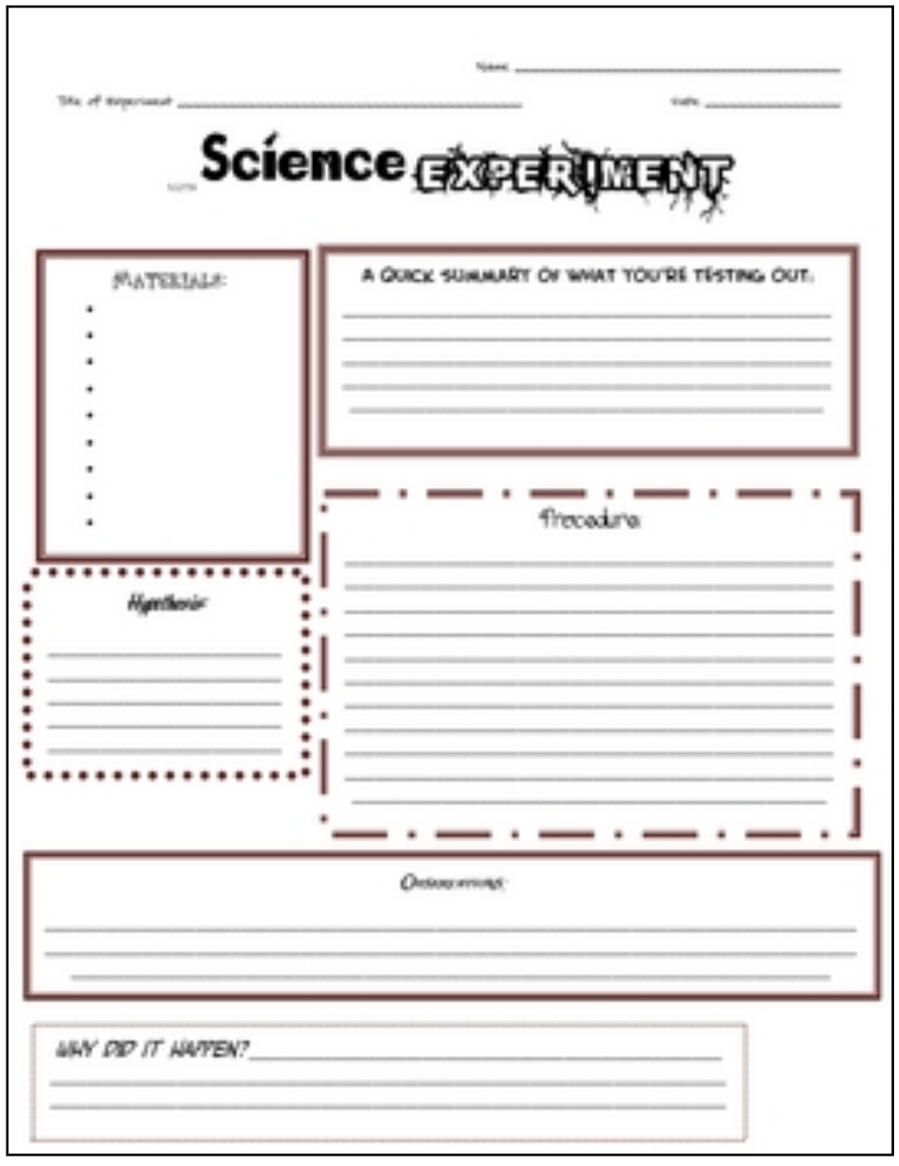


Scientific Method

1. Characterize the problem.
2. Form a hypothesis.
3. **Design an experiment.**
4. Perform the Experiment.
5. Evaluate the result.

Design an Experiment

What can I do to **test** my hypothesis?



Design the Experiment

- Test
- Debug
- Eliminate Possibilities

Scientific Method

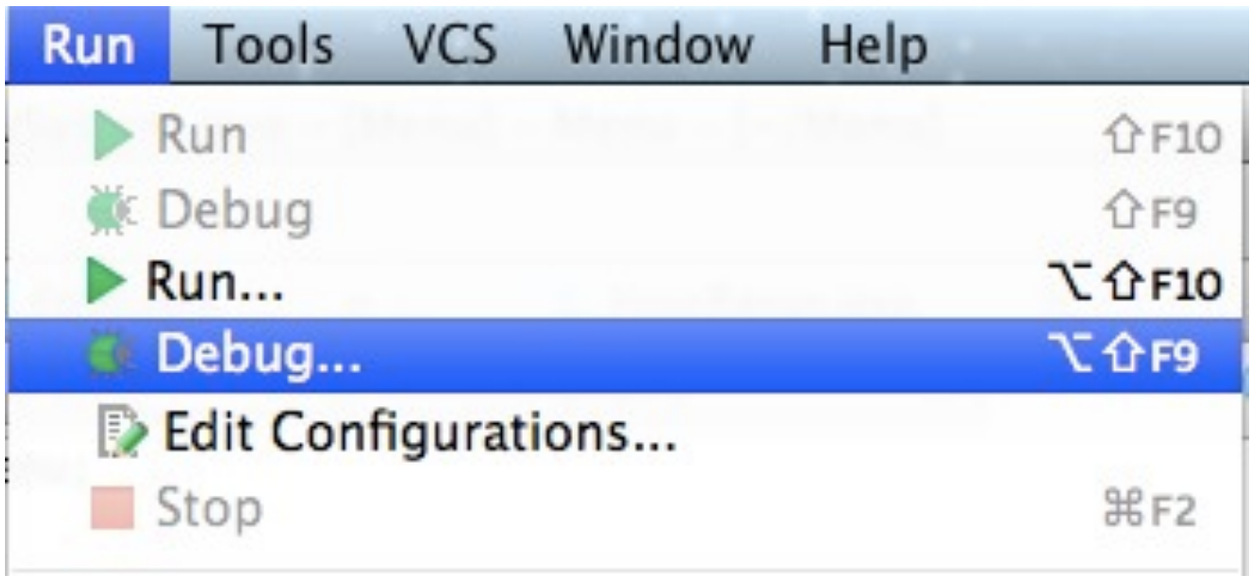
1. Characterize the problem.
2. Form a hypothesis.
3. Design an experiment.
4. **Perform the Experiment.**
5. Evaluate the result.

Test

- Try different inputs.
- Exercise different parts of the program.

Poke at the program.

Debugger


Run
Tools
VCS
Window
Help
Run ⇧F10
Debug ⇧F9
Run... ⌥⇧F10
Debug... ⌥⇧F9
Edit Configurations...
Stop ⌘F2

Debugging Terms

- Breakpoint
- Step over
- Step into
- Step out of

Scientific Method

1. Characterize the problem.
2. Form a hypothesis.
3. Design an experiment.
4. Perform the Experiment.
5. **Evaluate the result.**

Evaluate the Result

- Did what I expected to happen, happen?
- Did I see something that surprised me?
- Is the cause obvious?

If not, repeat the process.

Debugging Demo

Back to Exceptions

There are some exceptions you must handle.

CheckedExceptions

- Thrown when the error could be reasonably handled by someone.
- It's a **compiler error** if you don't recognize it.
  - try/catch
  - throws

Creating Your Own

```
class MenuException extends Exception {

    public MenuException(String message) {

       super(message);

    }

}
```

Creating Your Own

Checked	**Unchecked**
Exception class	RuntimeException class

http://docs.oracle.com/javase/tutorial/essential/exceptions/runtime.html


Fix my code.

Download

https://github.com/gdikc/IntroductionToJava

Menu under samples