



Java Basics

Lecture: January 26, 2012 (On-line Lecture 1)

CMPSCI 121, Spring 2012

Introduction to Problem Solving with Computers

Prof. Erik Learned-Miller

Logistics

- Previous lectures are on-line. See links on syllabus page.
- Some of you have just been enrolled in Spire, but may not have OWL accounts yet. We will try to do that today.

Assignments due next Tuesday

- Read Chapter 0
- Do “Configuration Tester”
- OWL Survey
- OWL Tutorial
- Figure out how to install and start DrJava

You might as well get started on...

- Chapter 1 Reading
- Chapter 1 Embedded Exercises
- Chapter 2 Reading.....

Late Assignments

- With a class this large, we just can't manage late assignments.
- Instead, we give you an allowance of assignments you can “drop”.
- **WARNING:** An assignment that is 1 minute late will get a 0. Don't turn it in at the last second!

Trying again, and multiple turn-ins

- Embedded E-book exercises
 - Try as many times as you want
- Weekly OWL Exercises
 - Check UNIT menu. If number of tries is limited, it will tell you total, and also number you have left.
- Programming Assignments
 - Turn in as many times as you want. Turn in a version well before the deadline!

Dropping Assignments

- Embedded E-book exercises
 - Can't drop any of these
- 12 Weekly OWL exercises
 - You can drop lowest 2 of these
- 8 Programming Assignments
 - You can drop 1 of these

Dropping Assignments

- Dropping assignments is meant for when you are sick or have an unavoidable conflict.
- If you drop 2 assignments early (when you're not sick), and then you can't finish a 3rd one because you're sick, you will get a 0 for it.

My recommendation

- Since the hardest assignments are at the end of the class, and...
- You want to save your “drops” as long as possible...
 - *Don't skip any assignments until the end of the term, or unless you're really sick.*
 - *If you're really sick (or have another SERIOUS excuse, like death in the family), get a doctors note in case it lasts for more than 2 assignments.*

On-line lectures

The screenshot shows the OWL iJava 1.3 web application interface. At the top left is the OWL logo. To its right, the text "iJava 1.3" is displayed. Below the logo, there are two dropdown menus, both containing the text "Welcome to iJava". In the top right corner, there is a "Chapter Overview" button. The main content area features a green heading "Welcome to iJava" followed by a horizontal line. Below this line is a large, stylized "iJava" logo where the 'i' is a blue-outlined character and "Java" is in a light blue font. At the bottom of this section, there is a link that says "Click to test your browser for compatibility." On the right side of the page, there is a "Reference Tools" dropdown menu with a list of links: "Lectures", "FAQ", "Java API", "My Scores", "Glossary", "Movie Index", and "Source Code Files". A green arrow points to the right next to the "FAQ" link. Below the "Reference Tools" menu is a "Chapter Outline" box containing the links "Welcome to iJava" and "Preface".

On-line lectures

OWL iJava 1.3

Welcome to iJava

Welcome to iJava

Chapter Overview

Welcome to iJava

References Tools

- Lectures
- Java API
- My Scores
- Glossary
- Movie Index
- Source Code Files

Chapter Outline

- Welcome to iJava
- Preface

iJava

Click to test your browser for compatibility.

On-line lectures

	<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
	Parent Directory		-	
	DebugA.mp4	25-Jul-2011 14:04	21M	
	DebugB.mp4	25-Jul-2011 14:05	30M	
	DebugC.mp4	25-Jul-2011 14:05	43M	
	Lecture1-Intro-Movie.mp4	19-Jan-2011 16:02	61M	
	Lecture2-JVM-Movie.mp4	22-Jan-2011 11:42	34M	
	Lecture3-ObModelMovie.mp4	26-Jan-2011 15:30	29M	
	Lecture4-ObModelStrings.mp4	28-Jan-2011 16:22	37M	
	Lecture5-Scanner.mp4	02-Feb-2011 21:03	37M	
	Lecture6-ScannerAPI.mp4	05-Feb-2011 10:22	21M	

Basic terminology and structure

- Memory
- Central processing unit (CPU)
- Secondary storage
- Input and output devices (IO devices)

Memory

- Bits and Bytes
 - Binary numbers
 - Convention: 0 is low voltage, 1 is high voltage
- How does the computer remember a number?
 - *Take a class in digital logic or digital circuit design.*
- How to represent things other than numbers?
 - Letters? (Morse Code)
 - Colors?
 - More conventions
- Volatility

Conventions

- Question: How to store a letter with nothing but 1's and 0's?
 - Answer: A ***convention*** that everyone agrees on.
- Example: Morse code

Morse Code

International Morse Code

1. A dash is equal to three dots.
2. The space between parts of the same letter is equal to one dot.
3. The space between two letters is equal to three dots.
4. The space between two words is equal to seven dots.

A	• —	U	• • —
B	— • • •	V	• • • —
C	— • — •	W	• — —
D	— • •	X	— • • —
E	•	Y	— • — —
F	• • — •	Z	— — • •
G	— — •		
H	• • • •		
I	• •		
J	• — — —		
K	— • —		
L	• — • •		
M	— —		
N	— •		
O	— — —		
P	• — — •		
Q	— — • —		
R	• — •		
S	• • •		
T	—		
		1	• — — —
		2	• • — —
		3	• • • —
		4	• • • • —
		5	• • • • •
		6	— • • • •
		7	— — • • •
		8	— — — • •
		9	— — — — •
		0	— — — — —

Chart of the Morse code letters and numerals.^[1]

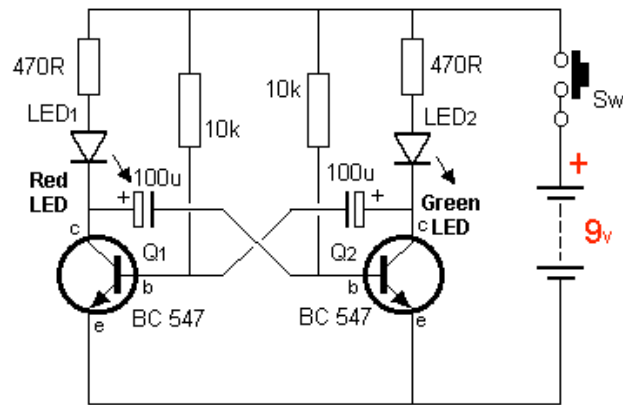
More conventions

- How do I store a single color in a computer?
- Another convention:
 - 000000 = red
 - 000001 = blue
 - 000010 = green
 - ...
 - 111111 = yellow

To store an image...

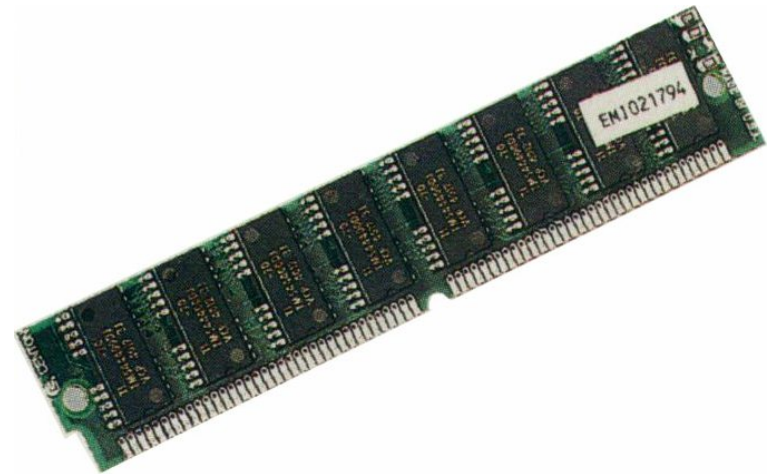
- Just store the numbers associated with the color of each pixel, and then do “color by number” to recreate the image.

Memory (Primary storage)



THE FLIP FLOP CIRCUIT

Remembers 1 bit.



Memory module.
Remembers
1,000,000,000 bits!!!

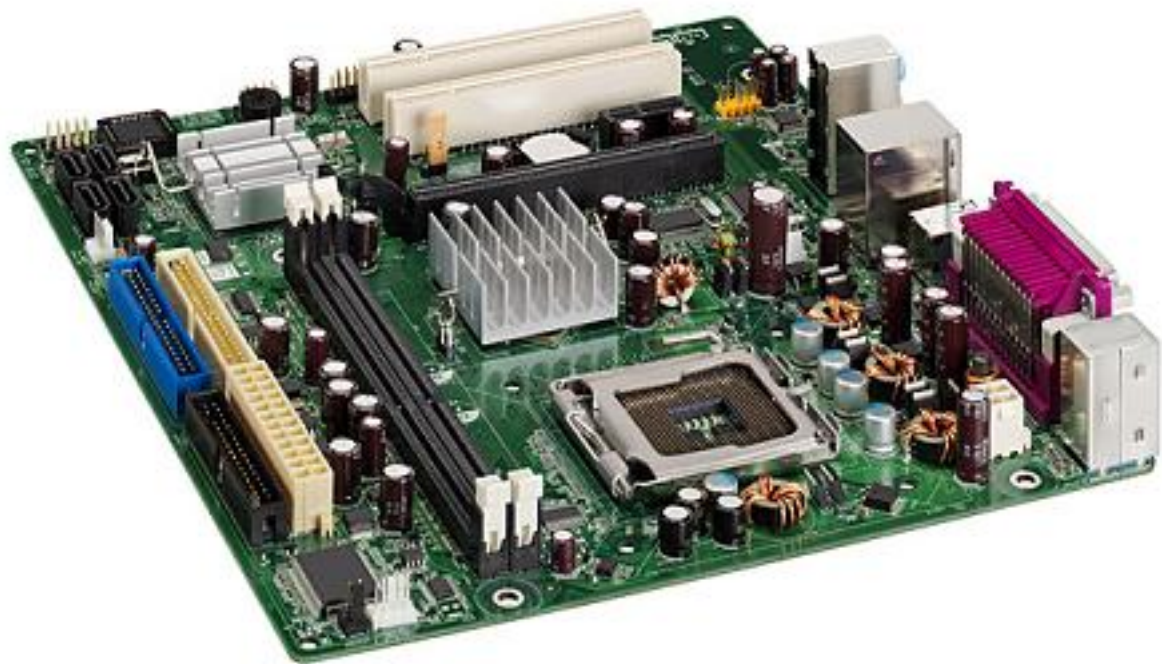
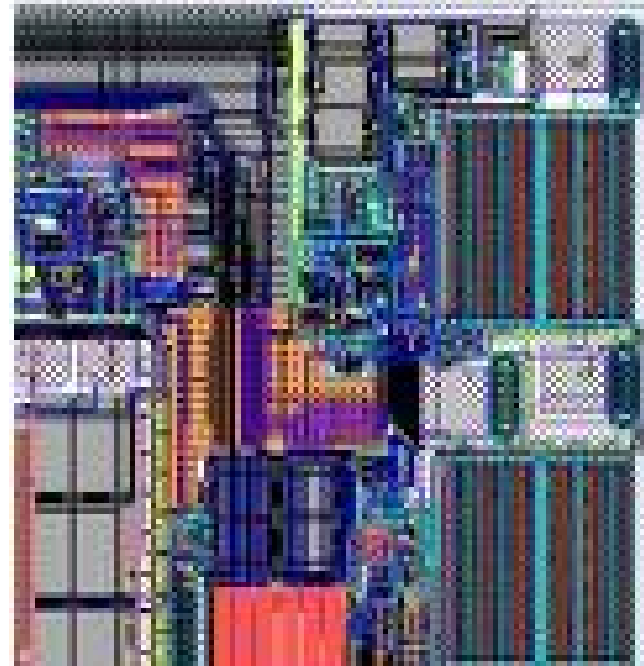
“volatile memory”

Central Processing Unit (CPU)

- Solves math problems.
 - Not built to move data around or store data
- Examples:
 - Intel's *Pentium*
 - Intel's *Xeon*
 - Advanced Micro Devices *Opteron*
 - The good old days:
 - 80386, 6502, Z80.
- Multi-core chips: multiple CPU's on a chip.
 - Like having more than one TA.
 - Great, but can be tough to manage!



CPUs



Secondary Storage



- Hard disks, floppy disks, magnetic tapes
 - Hold the data when you turn off the power
“Non-volatile” storage
 - Changes magnetization of tape
- Think of a cassette tape.

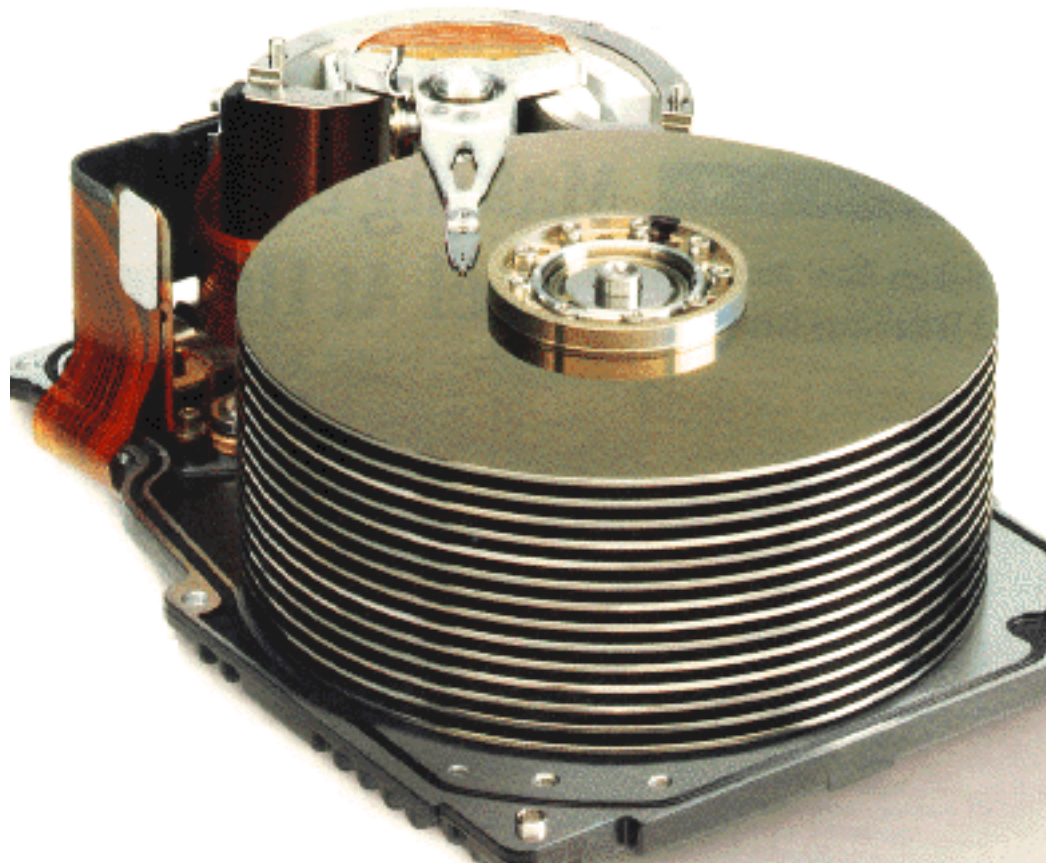




<http://www.karbosguide.com/books/pcarchitecture/images/893.jpg> ²²

Multi-platter hard drive

From Computer Desktop Encyclopedia
Reproduced with permission.
© 1997 Singapore Technologies

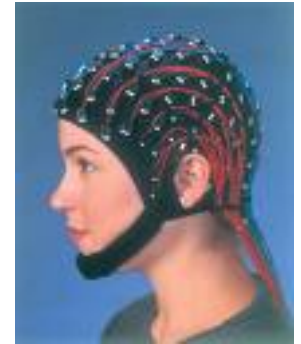


Old-school Disk Storage



<http://www.juneberry78s.com/sounds/78turntable.jpg>

Input/Output devices (IO)



- Anything that allows you to put information into your computer...
 - Keyboard, mouse, microphone, Electroencephalogram recorder!
- Or to get information out of your computer
 - Printer, monitor (screen), haptic feedback device, telepresence device, brain stimulator



Nature **442**, 164-171 (13 July 2006) | doi:10.1038/nature04970;
Received 22 March 2006; Accepted 6 June 2006

Neural Prosthetics



Neuronal ensemble control of prosthetic devices by a human with tetraplegia

Portability of Java

- Java gets translated to *bytecode*
 - Same bytecode used on all machines
- Each machine has a translator from bytecode to machine-specific machine language
- How does a computer do these translations?
 - *Take a class in compilers.*

Finally: Programming

```
1 public class Greetings{
2     public static void main(String[] args){
3         System.out.print("Hello ");
4         System.out.print("out ");
5         System.out.print("there");
6     }
7 }
```

Writing a program in DrJava

- Open Dr. Java
- Open a “New” edit window
 - Click on New
- Type in the program
- Save the program
 - Use the name that appears immediately after the first occurrence of the word “class”
 - Greetings
- Compile the program
 - Click compile. If errors are reported, fix errors.
- Run the program
 - Click run

Editing Programs (or “code”)

- Details of the code affect how it will work
 - Semicolons, quotations marks, parentheses, etc.
 - Follow E-book carefully.
 - Beware the single line editing window:

Example problem

OWL Question

Status 1 2 3 4 5 6 7 8 9 10 11 12 13 14
16 17 18

Every Java application contains a `main` method. This is where program execution begins. The simple program below consists solely of a `main` method in the `HelloWorld` class, and displays the message "Hello World!" on your screen.

Change the code so that instead of printing "Hello World!", the code prints "Hello Java!".

Note: be sure to capitalize both the H in Hello and the J in Java, and be sure to leave exactly one space between the two words.

```
public class HelloWorld {  
  
    public static void main(String[] args) {  
        System.out.println( "Hello World!" );  
    }  
}
```

CHECK ANSWER

Printing Strings and Numbers

- `System.out.println("Stuff I want to say.");`
Stuff I want to say.
- `System.out.println("Sch" + "wing");`
Schwing
- `System.out.println(3+5);`
8
- `System.out.println("3+5");`
3+5

Printing Strings and Numbers

- `System.out.println(5+“a”);`

5a

- `System.out.println(“a” + 5);`

a5

- Why?

- It makes sense to convert a number to a string
 - Put quotes around it.
- It doesn't (always) make sense to convert a string to a number.
 - How do we convert “Hello” to a number?

Strings and numbers

- Mixtures of strings and numbers.
 - From left to right, combine strings and numbers.
 - number + number \rightarrow number
 - string + string \rightarrow string
 - number + string \rightarrow string
 - string + number \rightarrow string (how can you remember this?)
- What will this do?
 - `System.out.println(3+5+"a"+3+5);`

Strings and numbers

- What will this do?
 - `System.out.println(3+5+"a"+3+5);`

3+5+"a"+3+5 8

3+5+"a"+3+5 8a

3+5+"a"+3+5 8a3

3+5+"a"+3+5 8a35

Confused?

- Go to DrJava and experiment!

Variables

- Variables are used to store something for later use:
 - `x = 3;`
 - `y = 5;`
 - `s = "Erik";`
 - `pi = 3.14159;`

Variable names

- Can't use arbitrary names
 - Why?
- Don't start with numbers:
 - 3x
- Don't use most special symbols:
 - xy?!!!

Declaration

- Tells Java what a variable represents

“x” is an integer.

```
int x;
```

“x” is a String.

```
String x;
```


Insight into declarations

- *Declarations tell the computer which **convention** to use.*
 - *Tells the computer how to interpret a certain set of ones and zeros in memory.*

Assignment

- Gives a variable a value.

```
x=3;
```

```
s="Hello";
```

```
y = x + 5;           // What will y be?
```

```
z=0;
```

Assignment

- Assignments are NOT statements of equality.
 - $x=y$
 - Does NOT mean that x “equals” y .
 - Instead, it means, “take the value that is currently in y and put it in x .”
- Consider this assignment:

$$x=x+1$$

This means: “take the value that is currently in x , add one to it, and then put that sum back into x ”.

Assignment

- How to say “ $x=y$ ”.
- “*x gets y*”,
- Not
 - “*x equals y*”.

Declaration and assignment together

- `int x = 3;`

Could have been instead:

- `int x;`

- `x = 3;`