

CIS 110

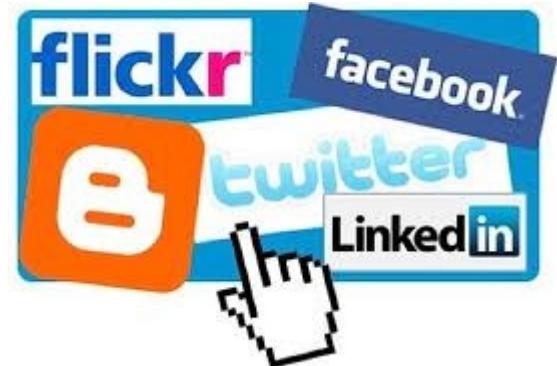
Introduction to Computer Programming

Harry Smith

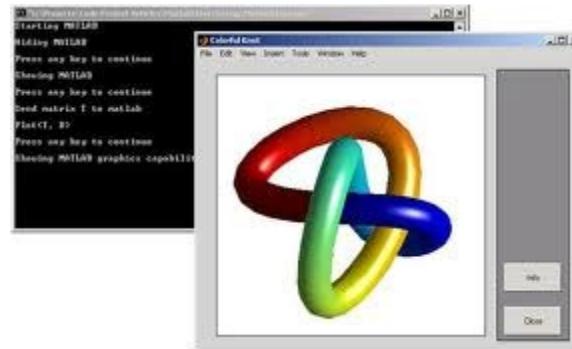
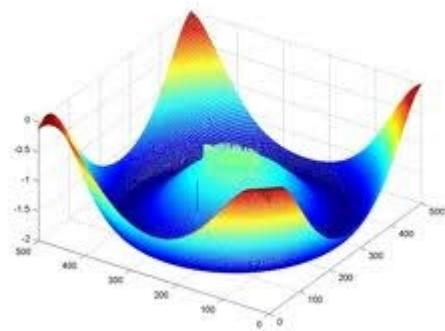
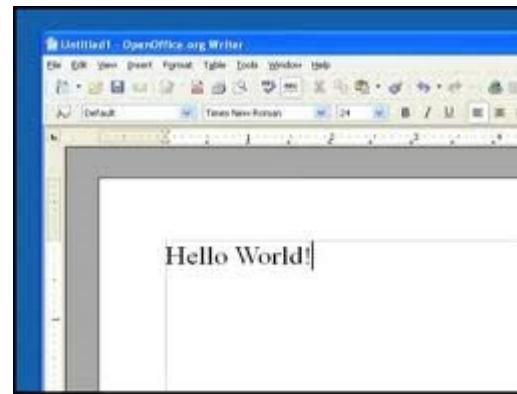
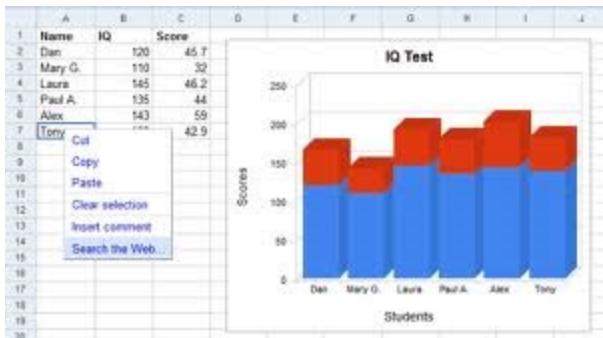
www.cis110.com

What is Computing?

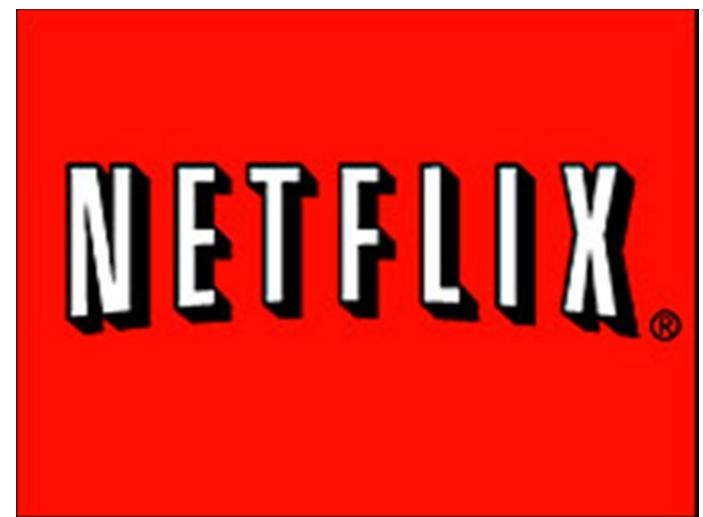
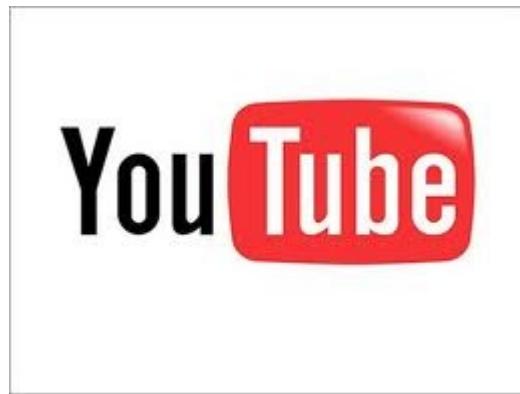
Computing: internet, e-mail, network...



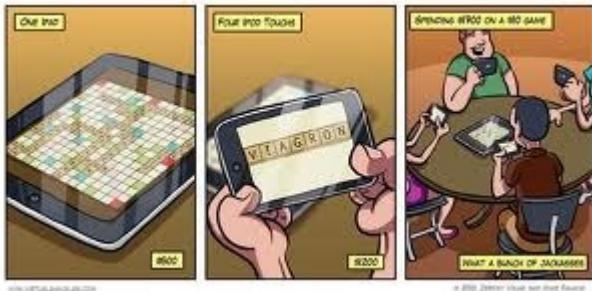
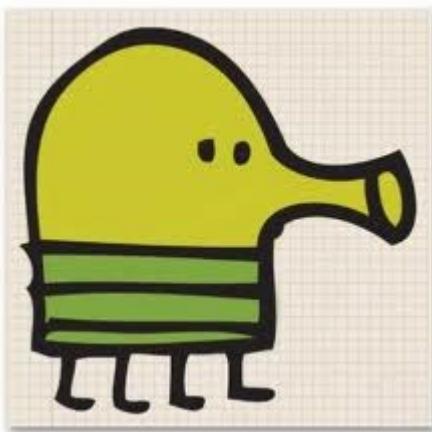
Computing: Productivity...



Computing: Entertainment...



Computing: Entertainment...



“Computer science is no more
about computers than
astronomy is about telescopes”

- Edsger Dijkstra

Cutting Edge Computer Science

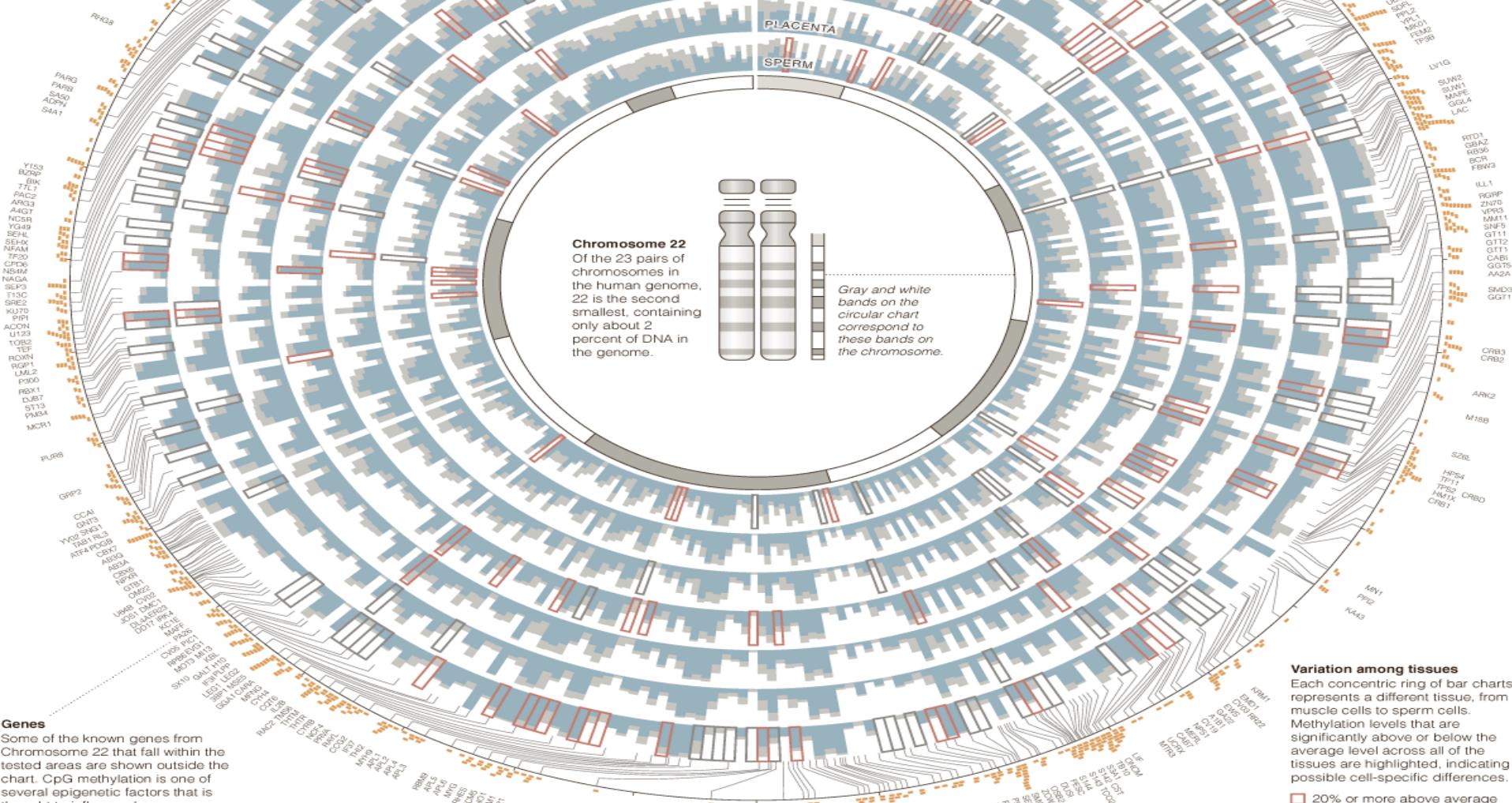
Mapping the Epigenome

DNA contains the genetic blueprint for all human cells, but the reading and execution of the blueprint inside each cell is controlled in part by chemical markers attached to the DNA. Scientists have begun to map some of these epigenetic markers, including CpG methylation.



CpG methylation

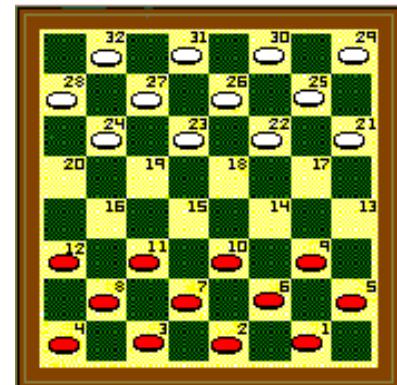
DNA is a code written with four letters: **A**, **T**, **C** and **G**, each standing for one nucleotide. In CpG methylation, a small marker called a methyl group attaches to the DNA at a CpG site, where a **C** and a **G** nucleotide sit next to each other.



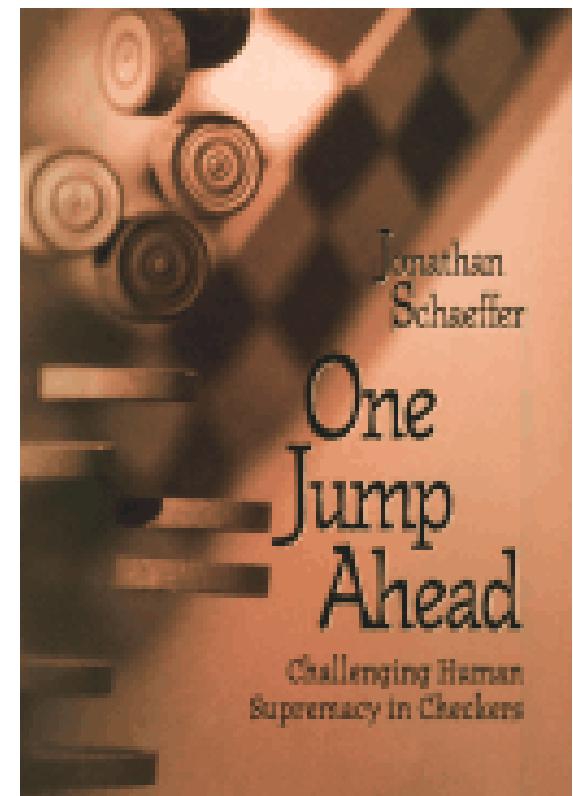
Chinook

- Chinook is the World Man-Machine Checkers Champion, developed by researchers at the University of Alberta.
- It earned this title by competing in human tournaments, winning the right to play for the (human) world championship, and eventually defeating the best players in the world.
- Visit <http://www.cs.ualberta.ca/~chinook/> to play a version of Chinook over the Internet.
- The developers have fully analyzed the game of checkers and have the complete game tree for it.
 - Perfect play on both sides results in a tie.
- “One Jump Ahead: Challenging Human Supremacy in Checkers” Jonathan Schaeffer, University of Alberta (496 pages, Springer. \$34.95, 1998).

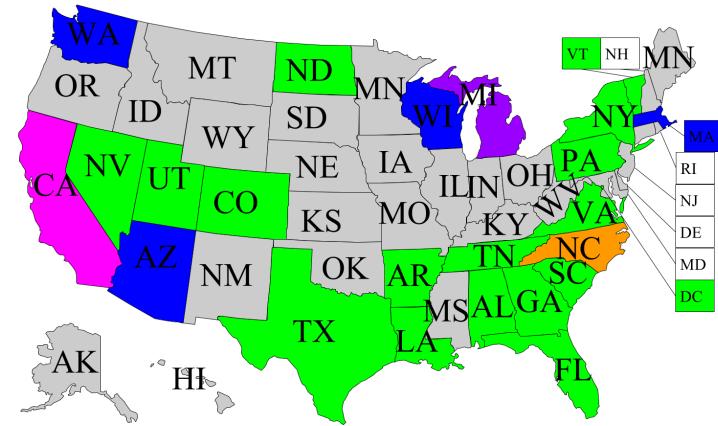
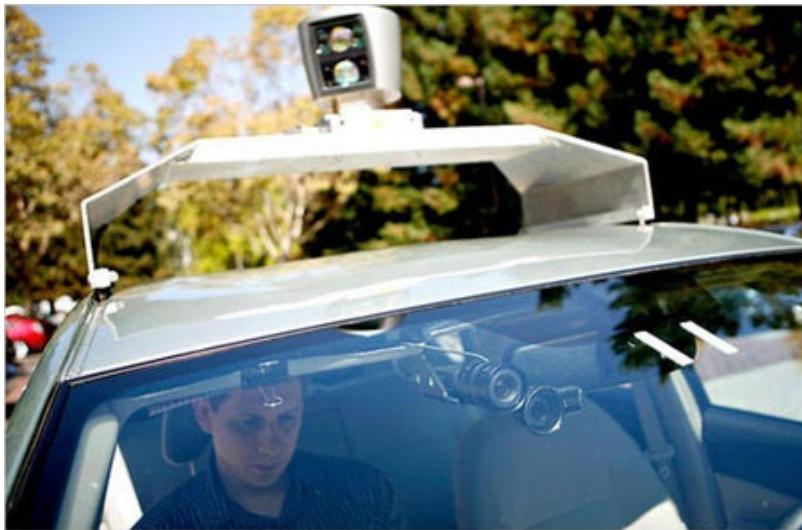
The board set for play



Red to play



Autonomous Cars



As of 2016

Legend

With Driver: [Enacted](#) | [Executive Order](#) | [In Progress](#)

Driverless: [Enacted](#) | [Executive Order](#) | [In Progress](#)

Driverless assuming already enacted with driver

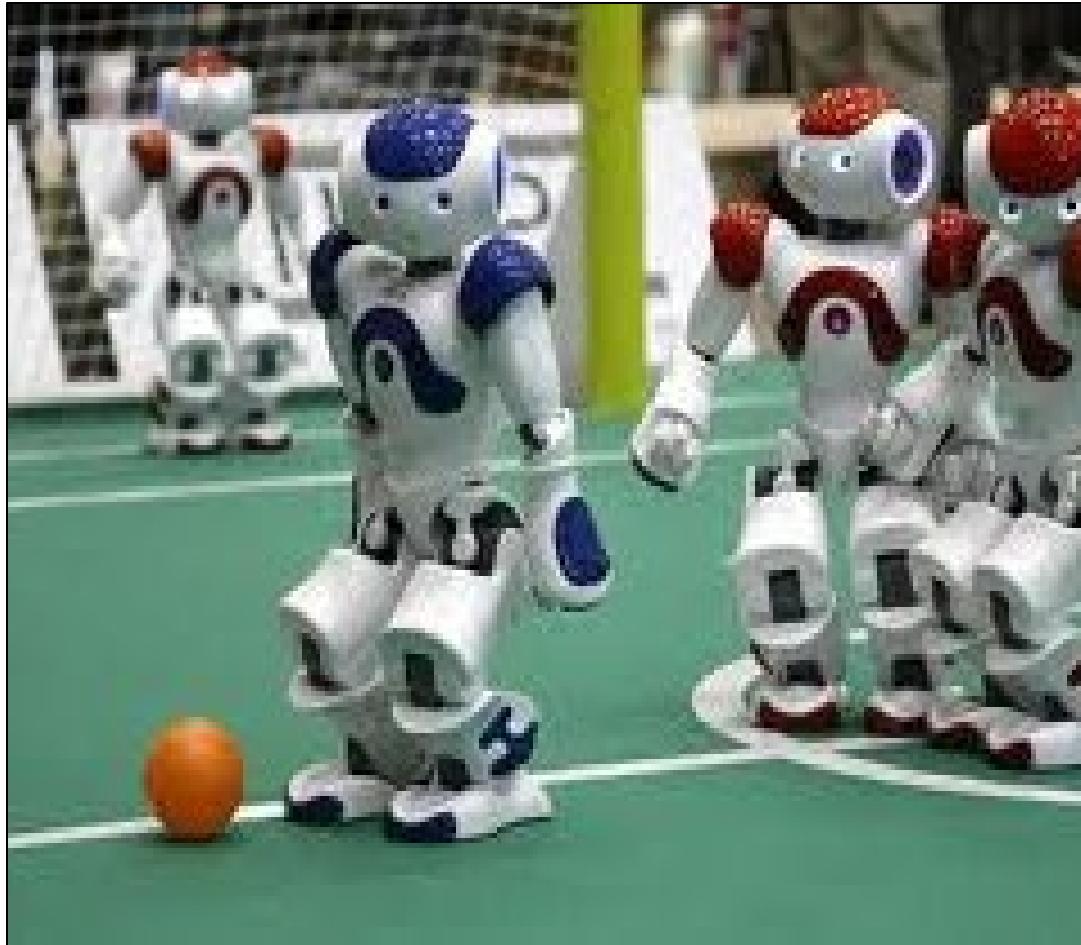


2011 Jeopardy!



- In February 2011, IBM Watson bested Brad Rutter (biggest all-time money winner) and Ken Jennings (longest winning streak)
- IBM is currently applying Watson's technology to medical diagnosis and legal research

Robot Soccer



Aibo League



UPennalizers
Robot Soccer Team

Areas in Computer Science



Artificial
Intelligence



Robotics



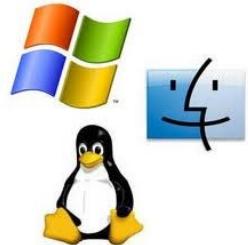
Human-Computer
Interaction



Computer
Graphics



Computer
Vision



Operating
Systems



Computer
Networking



Databases



Computer
Security



Ubiquitous
Computing

What is Computer Science?

Computer science is the study of solving problems using computation

- Computers are part of it, but the emphasis is on the problem solving aspect



Computer scientists work across disciplines:

Mathematics

Biology (bioinformatics)

Chemistry

Physics

Geology

Geoscience

Archeology

Psychology

Sociology

Cognitive Science

Medicine/Surgery

Engineering

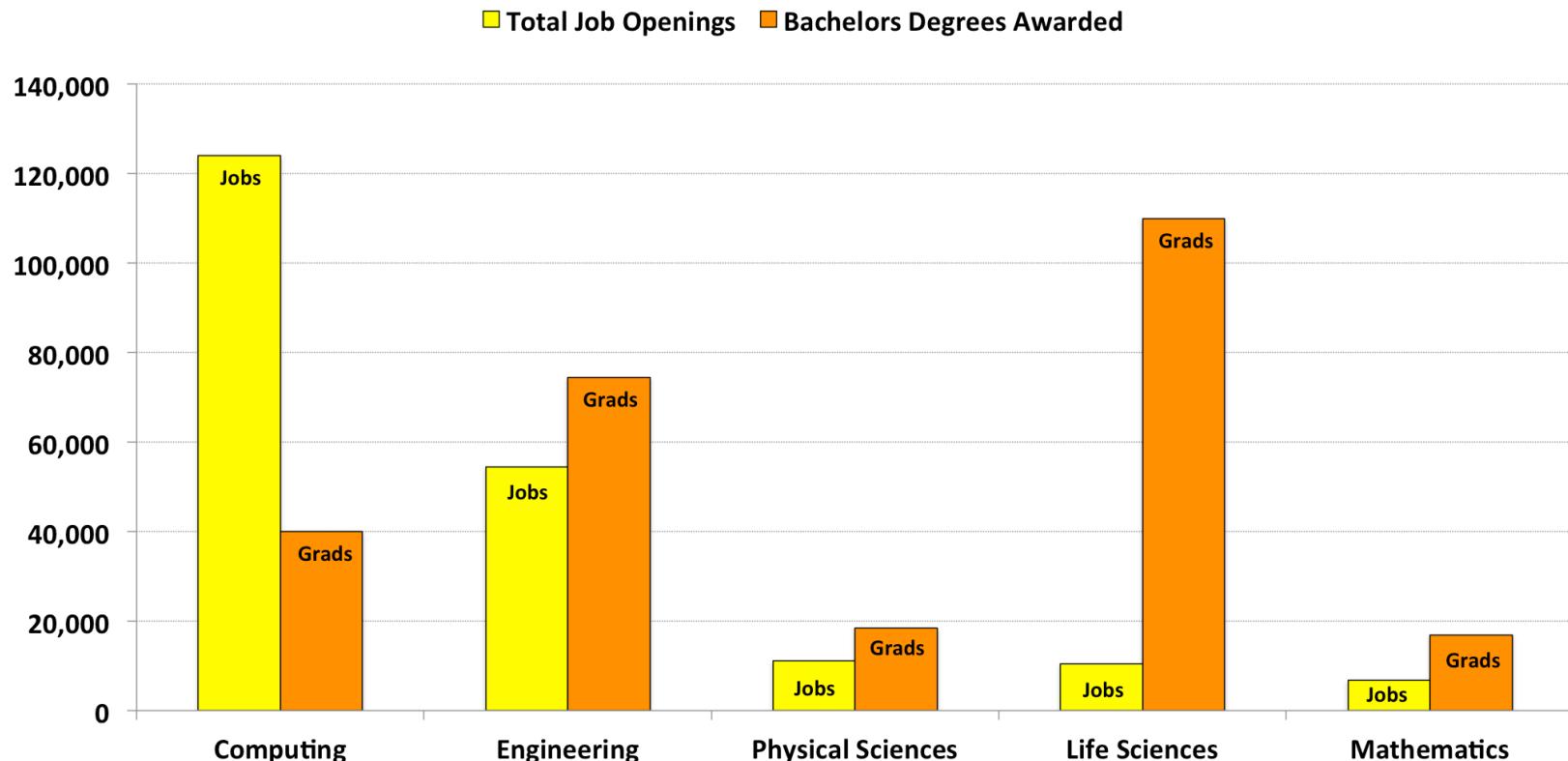
Linguistics

Art

...

Computing is important

Annual Total U.S. STEM Jobs Thru 2022 vs. Recent College Grads

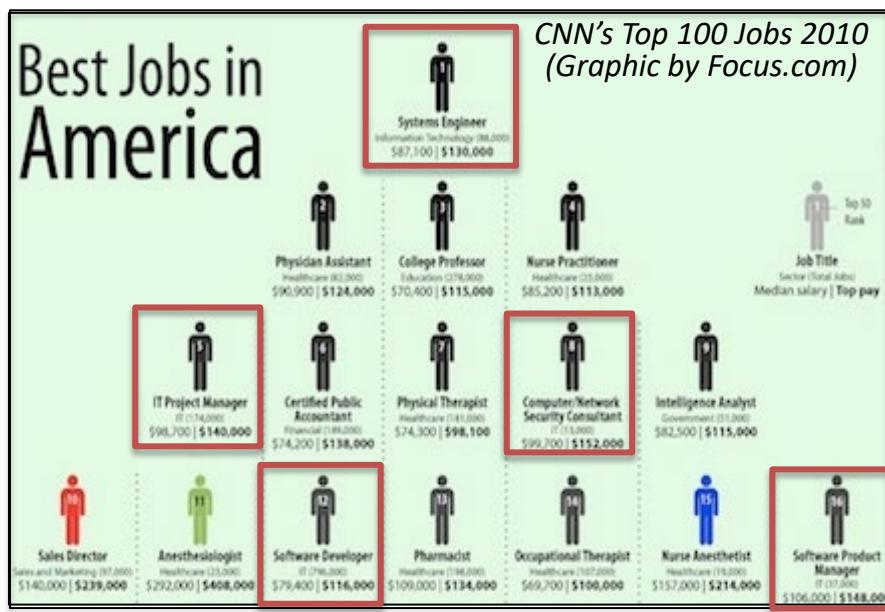


Data Sources: US-BLS Employment Projections, 2012-2022 (www.bls.gov/emp/ep_table_102.htm)

National Science Foundation NCSES (www.nsf.gov/statistics/nsf13327/pdf/tab26.pdf,tab33.pdf,tab34.pdf,tab35.pdf,tab46.pdf)

Computing is Consistently Ranked Among the Best Occupations

CS-Related Jobs Highlighted in Red



BEST JOBS
U.S. News & World Report
RANKINGS

The 25 Best Jobs of 2017

#1	Software Developer	#6	Statistician
#2	Dentist	#7	Pediatrician
#3	Physician's Assistant	#8	Obstetrician and Gynecologist
#4	Nurse Practitioner	#8	Oral and Maxillofacial Surgeon
#5	Orthodontist	#8	Physician

CS Careers Rank Highly In:

- Job satisfaction
- Salary
- Work/life balance
- Growth potential
- Employment rate
- Work environment



Computer science tops list of best major for jobs

BY RACHEL GOTTFRIED

Computer science graduates now get more offers of employment than any other major. This is the first time since 2008 that computer science has topped the list: previously, accounting majors had the highest offer rate.

In 2011, 56.2% of computer science majors received job offers, compared to only 53.8% of accounting majors. The offer rate for computer science majors increased 13.8% this year from the previous year.

Computer science and accounting majors are in high demand because both are needed in a wide range of industries.

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“There are many different companies that need to hire computer scientists,” said Mimi Collins, director of communications at the National Association of Colleges and Employers.

“They aren’t tied to one particular industry—majors like nursing do not enjoy that benefit.”

Although this is good news for computer science grads, it might not be for the computer industry. According to Collins, “One computer science graduate may have 10 offers as opposed to one accounting graduate that’s getting five offers.” So, computer science majors may be getting more offers, but this is only because there is a shortage of people who graduate with such a degree.

According to Collins, companies like to hire recent graduates because they have the latest skills.

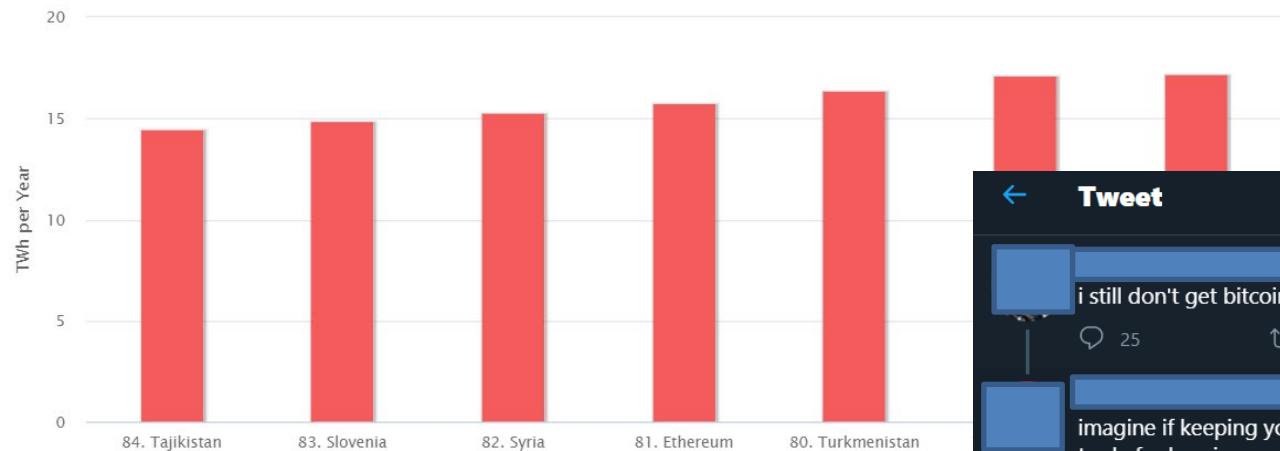
“Things change very quickly, especially in computer science,” said Collins. “Many organizations have a formal track where they want to bring in new college graduates and train them the way they want them to be trained.”

Annabelle Evans graduated as a computer science major from the University of Southern California in 2008. “When I picked my major, I knew there wouldn’t be a lack of jobs as a computer scientist, and that was part of the appeal,” she said. Evans now works at Google. ■

...many different companies ... need to hire computer scientists.
They aren't tied to one particular industry.

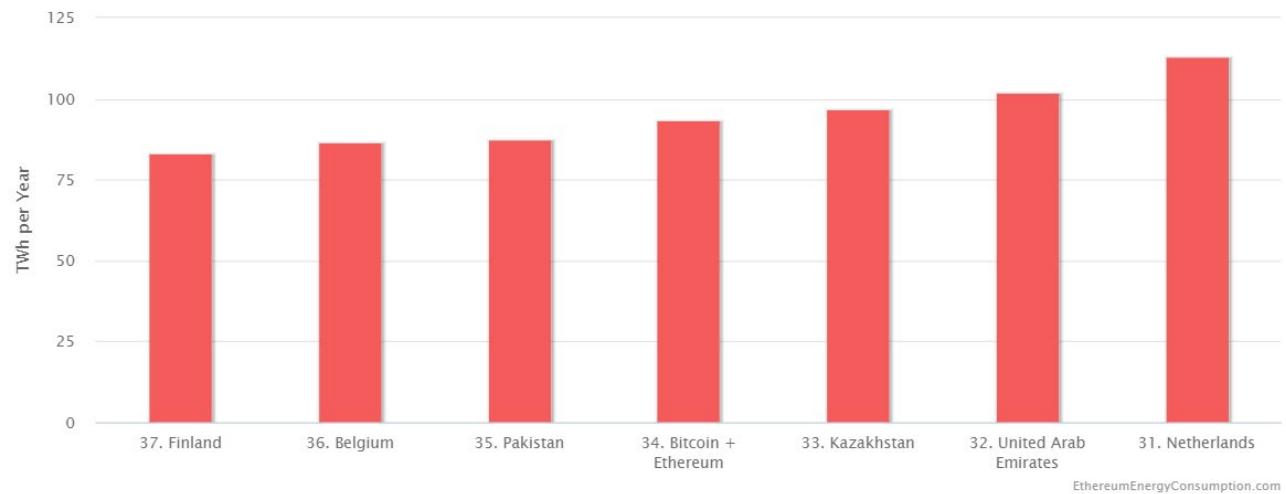
Computing has consequences

Energy Consumption by Country inc. Ethereum



Since Bitcoin and Ethereum are by far the largest proof-of-work based coins it is also worth considering their combined ranking.

Energy Consumption by Country inc. Bitcoin & Ethereum



Journal #87 - December 2017

Jackie Wang

"This Is a Story About Nerds and Cops": PredPol and Algorithmic Policing



Administrivia

Overview

CIS 110: Introduction to Programming and Computer Science

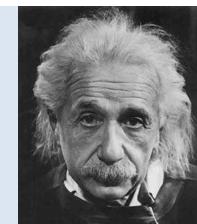
Goals:

- How can we use computers to solve problems?
- How can we formulate problems so that we can solve them via computation?

Topics:

- **Programming** in Java
- Computer organization and assembly language
- **Applications** to science, engineering, and art

“ Computers are incredibly fast, accurate, and stupid; humans are incredibly slow, inaccurate, and brilliant; together they are powerful beyond imagination. ” – Albert Einstein



The Basics

Instructor: Harry Smith

- Harry's Regular Office Hours: [Thursdays, 10am-12pm on Zoom](#)
- sharry@seas.upenn.edu – only for personal or sensitive communication; everything else should be sent through Piazza.

TA Office Hours:

- Help with debugging
- Office Hours on [OHQ.io](#), Mon-Thurs 11am-1pm & 3pm-9pm
- Only use Piazza, office hours, or email to contact your TAs.
 - **Do not send a Slack DM to a TA unless you've spoken with them directly about it ahead of time.**

Full details: www.cis110.com

Grading

Grade Breakdown:

- Homeworks: 64%
- Exam 1: 12%
- Exam 2: 12%
- Check-in Quizzes : 12%

Exam 1: Mar 19th on GradeScope (timing TBD)

Exam 2: Apr 21st on GradeScope (timing TBD)

Notes:

- You can check your grades on GradeScope

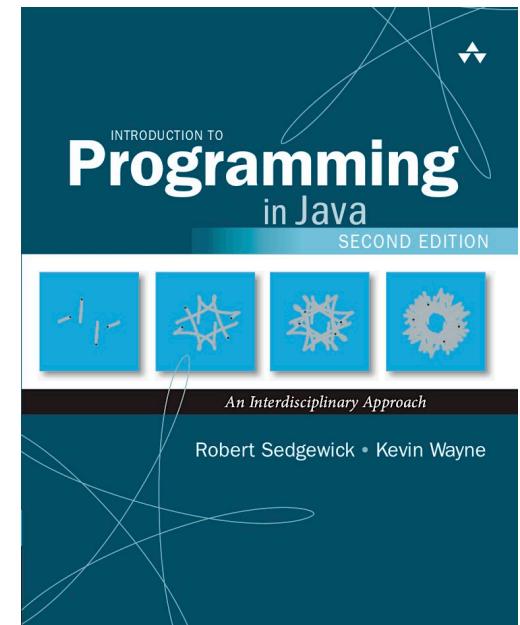
Course Materials

Course Website: www.cis110.com

- Programming assignments and checklists
- Course schedule
- Lecture slides

Optional Textbook: Sedgewick and Wayne

- The course loosely follows this book
- We do not teach directly from it
 - You may find it useful to have a written reference
- The “booksite” is a fair-game reference for you to use
 - <https://introcs.cs.princeton.edu/java/home/>



Homework Programming Assignments

Due: 11:59pm on Thursday nights on GradeScope

- ◆ 4 late days to use throughout semester (max 2 per homework)
- ◆ No other late submissions allowed
- ◆ Lowest homework dropped
- ◆ See course webpage for other policies

Computing equipment:

- Your desktop/laptop
- Codio

Advice

- ◆ Start on HWs early! Debugging can take time.
- ◆ Back up your work like crazy.
- ◆ Office hours are less crowded if you show up early in the week
- ◆ Do not hesitate to ask for help. If you have been trying to debug something for an hour and are getting frustrated, remember that we are there to help you.
- ◆ Your best sources for help are the instructors, the TAs and Piazza.
- ◆ Please read and follow the collaboration policy
- ◆ Do not use Stack Overflow or other online discussion boards

Two Sample Weeks in the Life of CIS 110

Day	Activity	Due
Monday	Lecture (9-9:50am)	Quiz 4 by 8:59am
Tuesday		
Wednesday	Lecture (9-9:50am)	
Thursday	Videos for next week + Quiz 5 released	HW01 by 11:59pm
Friday	Lecture (9-9:50am)	
Saturday		
Sunday		
Monday	Lecture (9-9:50am)	Quiz 5 by 8:59am
Tuesday		
Wednesday	Lecture (9-9:50am)	
Thursday	Videos for next week + Quiz 6 released	HW01 by 11:59pm
Friday	Lecture (9-9:50am)	

Action Items

1. [Register for Piazza!](#)
2. [Register for Codio!](#)
3. [Join our Course Slack!](#)
4. Familiarize yourself with the course rhythm:
 1. Lecture MWF
 2. HWs due Thursdays (usually)
 3. Videos released on Thursday evening; watch them by Monday morning!
 4. Rinse and repeat.

Navigating Codio

When you first open a project:

The screenshot shows the Codio IDE interface. At the top is a dark blue header bar with the Codio logo, menu items (Project, File, Edit, Find, View, Tools, Education, Help), and various system icons (Compile, View Running Program, Configure, user HSMITH1, power, and refresh).

The main area has a left sidebar titled "Filetree" which lists the contents of the "Live Coding-2" project. It includes a lock icon, a folder icon for ".settings", and files "cis110.jar", "junit-platform-console-standalone.jar", and "linter.py".

The central workspace is currently empty, displaying the message: "Looks like you don't have any files open right now. Click a file from the file tree to open it, or [create a new file](#)."

A callout box on the left side of the workspace contains the following text:

The filetree

All files you use will live here.

You can click on them to show them in the editor.

Below the workspace, there's a small footer with the Codio logo and the text "javascript:void(0)" and "Engineering".

Looks like you don't have any files open right now.

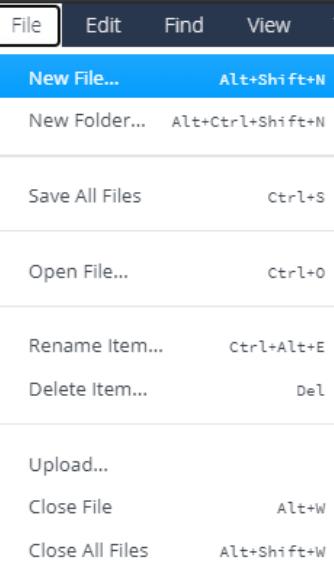
Click a file from the file tree to open it, or [create a new file](#).

Some other things to try...

- Open a Terminal window : Tools->Terminal menu or Shift+Alt+T
- Open any file by typing its name File->Open File menu or Ctrl+O
- Create multiple code editing panels : View->Panels
- Information about the Box : Project->Box Info menu
- Install languages, databases and other software : Tools->Install Software menu
- Uploading your Box public keys to GitHub or BitBucket : Codio->Account menu then select Applications
- Find and upload your public keys to any remote server : Codio->Account menu then select SSH Keys

Filetree X
HSMITH1
Live Coding-2

- Live Coding-2 (master)
 - .settings
 - cis110.jar
 - junit-platform-console-starter.jar
 - linter.py



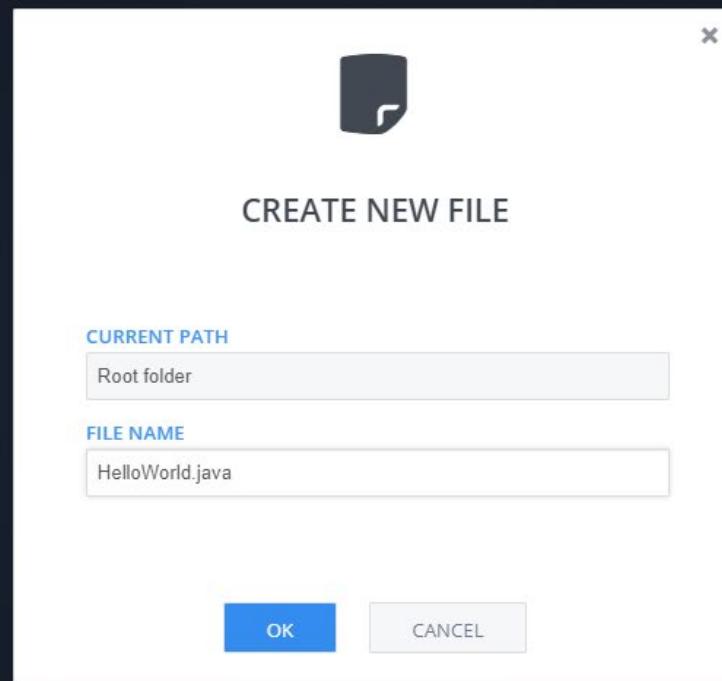
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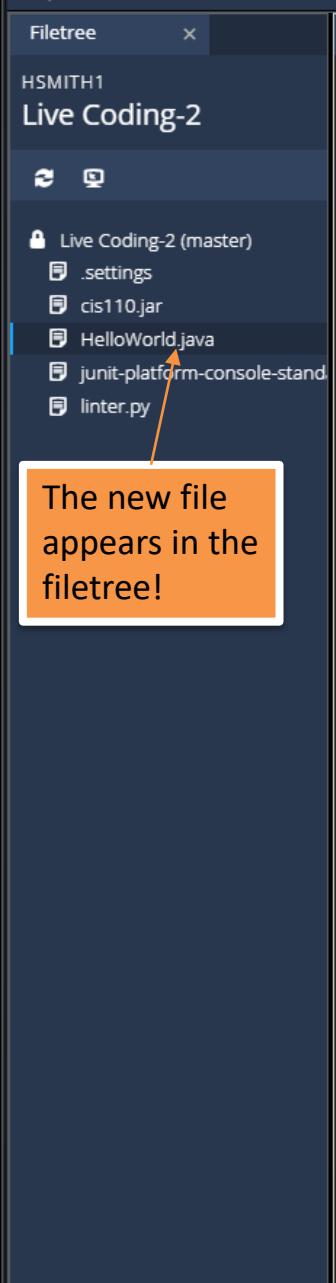
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Coding-2

Coding-2 (master)
settings
is110.jar
unit-platform-console-stand
nter.py



The new file appears in the filetree!

The editor

HelloWorld.java (an empty file) is now open in the editor for editing!

This is the
Syllabus page
of the website

CIS 110 - Introduction to Computer Programming

Homework ▾ Syllabus Staff Office Hours Grade Calculator SRS Policies ▾ Exams ▾ Resources ▾ Wellness

CIS 110 Syllabus

- This is a tentative syllabus and schedule. Topics, reading assignments, and due dates are subject to change. This syllabus will be updated throughout the semester, so please reload this page before lectures to get the up to date version.
- Lecture recordings are available to registered students on the [course canvas page](#). Recordings are added within an hour of lecture's end.

Date	Topics	Example Code	HW Assigned	HW Due	Lecture Recording	Module Videos	Announcements
Wed, Jan 20, 2021	Introduction	HelloWorld.java					First Day of Classes!
Fri, Jan 22, 2021	Drawing		HW00 - Hello, World!				
Mon, Jan 25, 2021	Variables & Types						

```
/* Name: Harry Smith
 * PennKey: sharry
 *
 * Execution: java HelloWorld
 *
 * Prints "Hello, World!". By tradition, this is everyone's first program.
 */
public class HelloWorld {
    /**
     * This is a comment, it is not code.
     */
    // this is also a comment
    public static void main(String args[]) {
    }
}
```

Highlight everything, and then COPY it...

Filetree x HSMITH1 Live Coding-2

Live Coding-2 (master)
.settings
cis110.jar
HelloWorld.java
junit-platform-console-standalone.jar
linter.py

```
1  /*  Name: Harry Smith
2   *  PennKey: sharry
3   *
4   *  Execution: java HelloWorld
5   *
6   *  Prints "Hello, World!". By tradition, this is everyone's first Java program.
7   *
8   */
9
10 public class HelloWorld {
11     /**
12      * This is a comment
13      */
14
15     // this is also a comment
16     public static void main(String args[]) {
17
18         }
19     }
```

..and PASTE IT into here!

Our First Program

```
public class HelloWorld {  
    /**  
     * This is a comment, it is not code.  
     */  
  
    // this is also a comment  
  
    public static void main(String args[]) {  
        Code goes here!  
    }  
}
```

```
public class HelloWorld {  
    /**  
     * This is a comment, it is not code.  
     */  
    // this is also a comment
```

Class Name
(must
match the
filename)

```
public static void main(String args[]) {
```

Code goes here!

```
}
```

```
public class HelloWorld {  
    /**  
     * This is a comment, it is not code.  
     */  
    // this is also a comment
```

Comments
(notes, not
run as
code!)

Class Name
(must
match the
filename)

```
public static void main(String args[]) {
```

Code goes here!

```
}  
}
```

```
public class HelloWorld {  
    /**  
     * This is a comment, it is not code.  
     */  
    // this is also a comment
```

Comments
(notes, not
run as
code!)

Class Name
(must
match the
filename)

```
public static void main(String args[]) {
```

Code goes here!

This is called “the body of our main
method.”

```
}
```

Filetree x

HSMITH1

Live Coding-2



Live Coding-2 (master)

.settings

cis110.jar

junit-platform-console-stand

linter.py

The filetree

All files you
use will live
here.

You can click
on them to
show them in
the editor.

Compile button

Click this button to
compile all .java files in
your filetree.

View Running Program

Button
Shows you the visual
output of your program.

Looks like you don't have any files open right now.

Click a file from the file tree to open it, or [create a new file](#).

Some other things to try...

- Open a Terminal window : Tools->Terminal menu or Shift+Alt+T
- Open any file by typing its name File->Open File menu or Ctrl+O
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Codio Project File Edit Find View Tools Education Help Compile View Running Program Configure... HSMITH1

Filetree x HelloWorld.java Compile x

Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 5.4.0-1035-aws x86_64)

* Documentation: <https://help.ubuntu.com/>

*

* Welcome to the Codio Terminal!

*

* <https://docs.codio.com/project/ide/boxes/#overview>

*

* Your Codio Box domain is: boxer-chicago.codio.io

*

Last login: Wed Mar 18 13:09:10 2020 from 192.168.10.41

javac -cp .:junit-platform-console-standalone-1.3.2.jar:cis110.jar *.java

codio@boxer-chicago:~/workspace\$ javac -cp .:junit-platform-console-standalone-1.3.2.jar:cis110.jar *.java

codio@boxer-chicago:~/workspace\$ █

The Terminal
This is space where we can write individual commands to communicate with the computer.

Codio Project File Edit Find View Tools Education Help Compile View Running Program Configure... HSMITH1

Filetree x HelloWorld.java Compile x

Welcome to Ubuntu 14.04.5 LTS (GNU/Linux 5.4.0-1035-aws x86_64)

```
* Documentation: https://help.ubuntu.com/
*
* Welcome to the Codio Terminal!
*
* https://docs.codio.com/project/ide/boxes/#overview
*
* Your Codio Box domain is: boxer-chicago.codio.io
*
Last login: Tue Jan 19 22:43:37 2021 from 192.168.10.93
codio@boxer-chicago:~/workspace$ javac -cp .:junit-platform-console-standalone-1.0.0-M1:junit-jupiter-engine-5.7.0:cis110.jar *.java
codio@boxer-chicago:~/workspace$ java HelloWorld
Hello, World!
codio@boxer-chicago:~/workspace$ █
```

The Output

Whatever we asked our program to print will appear on the following line(s). In this case, our program prints "Hello, World!"

Running our program

We typed "java" followed by our program's name ("HelloWorld"). Then hit enter.