CIS 110

Introduction to Computer Programming

Dr. Paul “Will” McBurney

www.cis110.com

What is Computing?

Computing: internet, e-mail, network…

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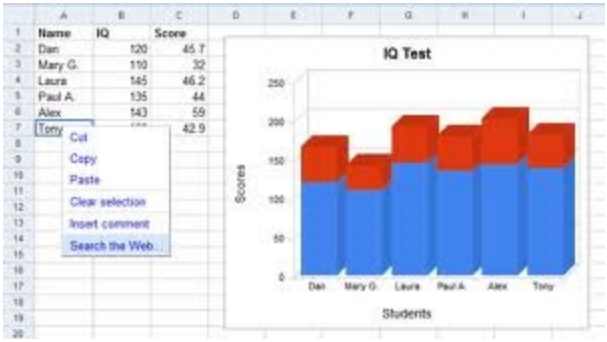
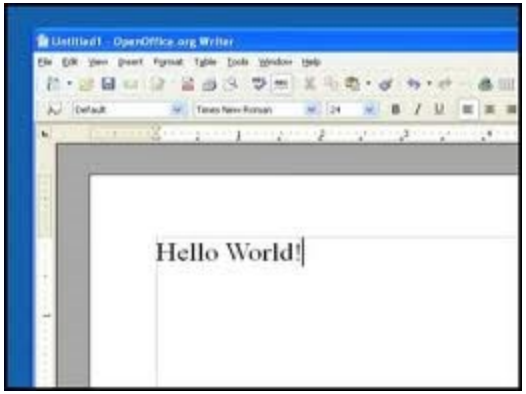
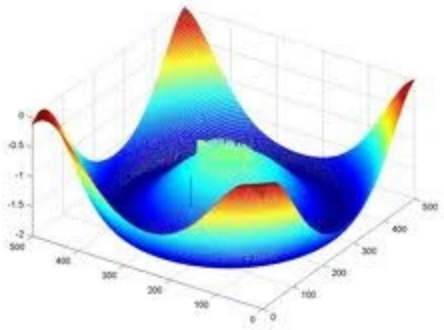
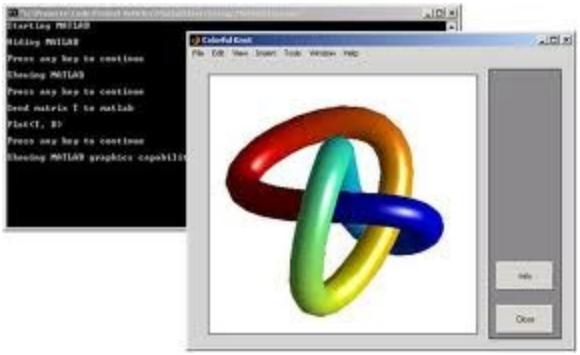
Computing: Productivity…







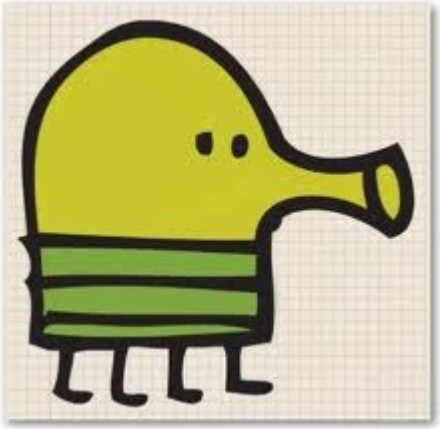


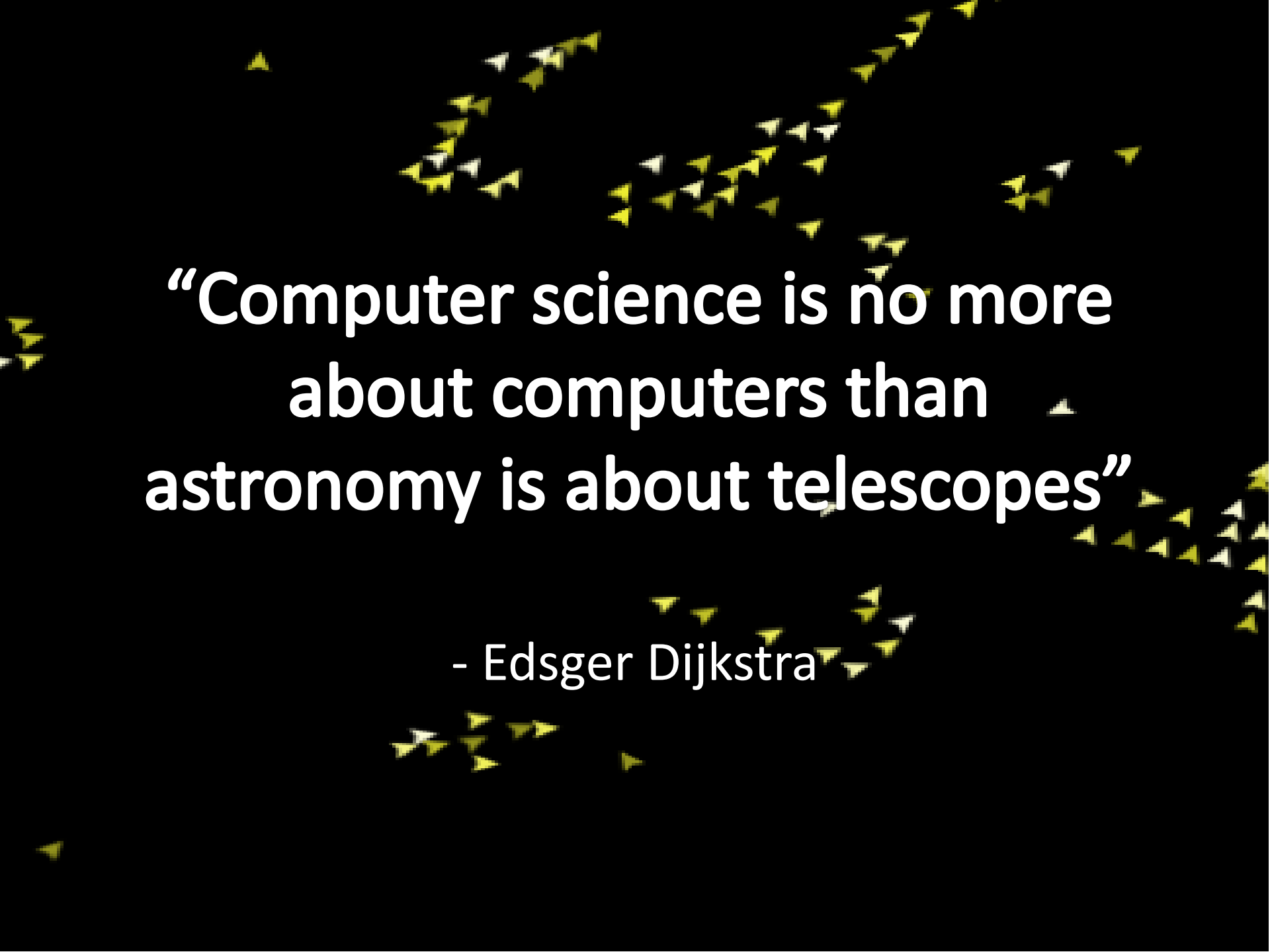
Computing: Entertainment…

YouTube

NETFLIX®

Computing: Entertainment…




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

Cutting Edge Computer Science

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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** nucelotide sit next to each other.

Reading the chart

The outer ring represents 35 million base pairs in Chromosome 22. Orange marks highlight areas of the chromosome that were tested for CpG methylation in a pilot study by the Human Epigenome Project.

1 million base pairs

Measuring CpG methylation

Bar charts indicate the average amount of CpG methylation found within the tested areas. Each chart covers 100,000 base pairs. Some charts have been shifted, shown with connecting lines.

AMOUNT OF METHYLATION
- 0 to 20%
- 20 to 80%
- 80 to 100% of CpG sites

MUSCLE
LIVER
HEART
WHITE BLOOD CELL
SKIN
PLACENTA
SPERM

Chromosome 22

Of the 23 pairs of chromosomes in the human genome, 22 is the second smallest, containing only about 2 percent of DNA in the genome.

Gray and white bands on the circular chart correspond to these bands on the chromosome.

Genes

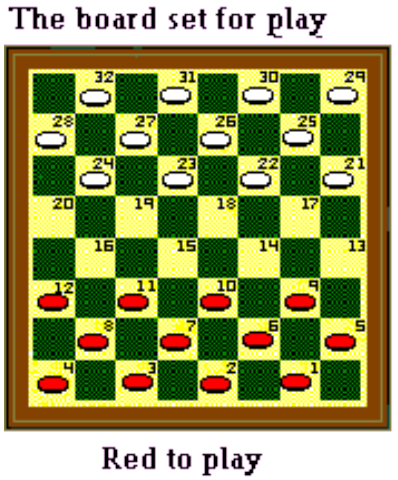
Some of the known genes from Chromosome 22 that fall within the tested areas are shown outside the chart. CpG methylation is one of several epigenetic factors that is

Variation among tissues

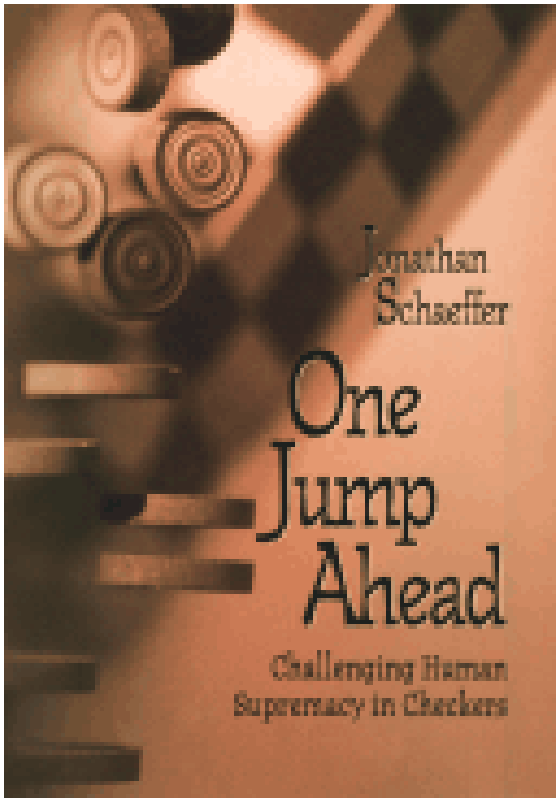
Each concentric ring of bar charts represents a different tissue, from muscle cells to sperm cells. Methylation levels that are significantly above or below the average level across all of the tissues are highlighted, indicating possible cell-specific differences.

- 20% or more above average

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).



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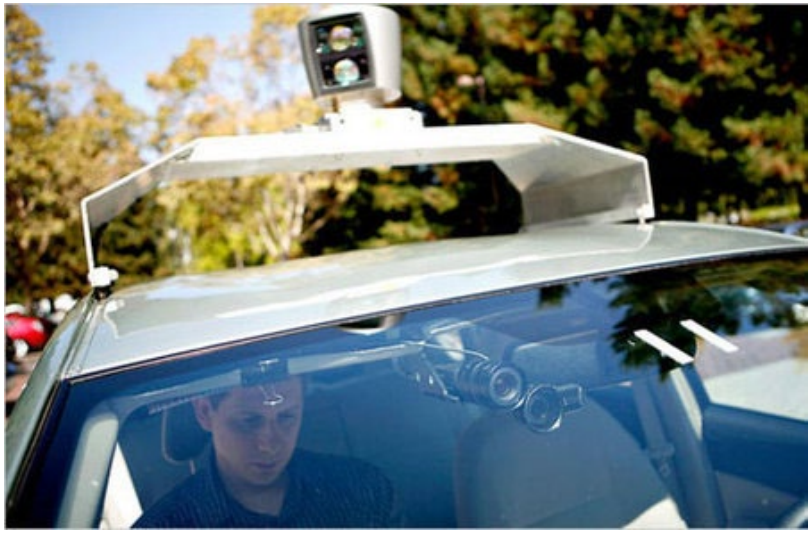
Autonomous Cars



- Nevada made it legal for autonomous cars to drive on roads in June 2011
- Three more US States (California, Florida, Michigan) and DC have enacted similar laws

Penn's Autonomous Car →
(Ben Franklin Racing Team)

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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

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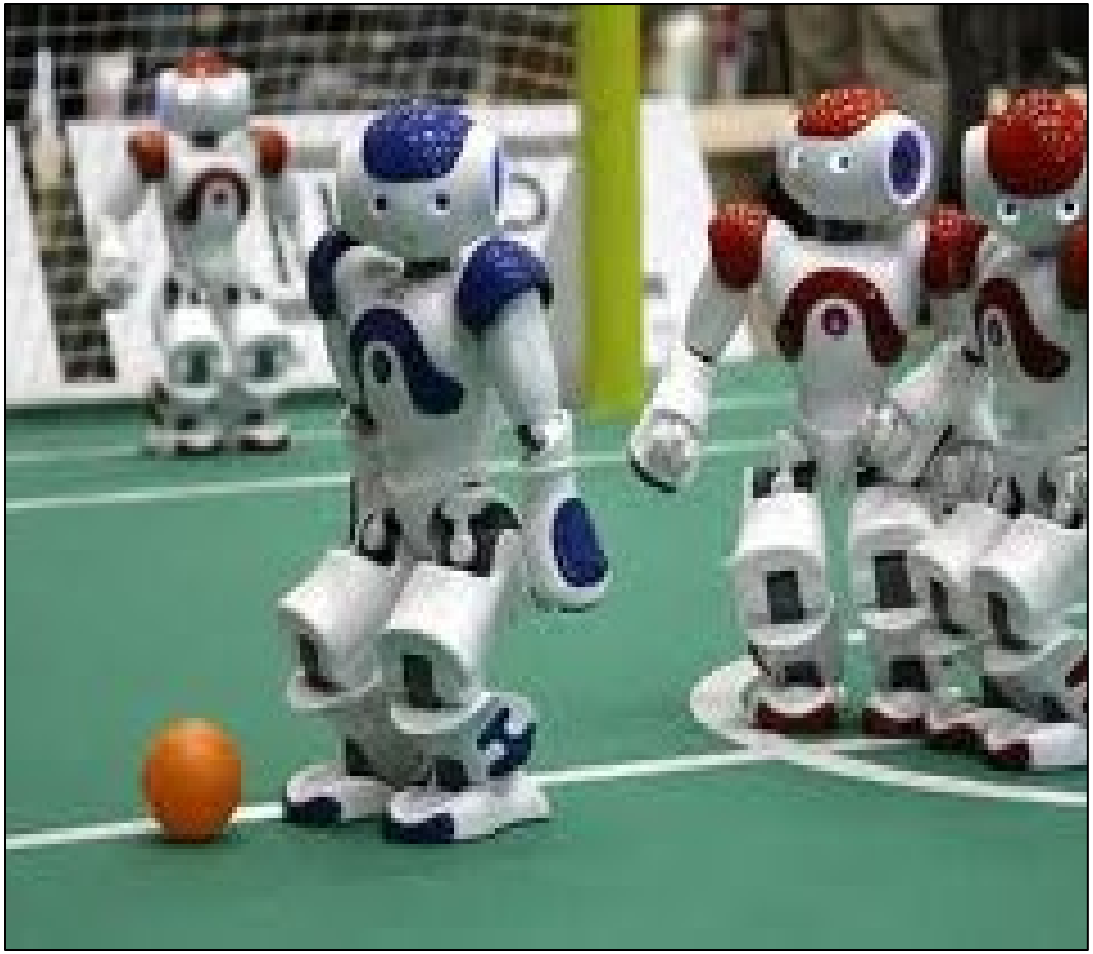
Robot Soccer



Aibo League

UPennalizers
Robot Soccer Team

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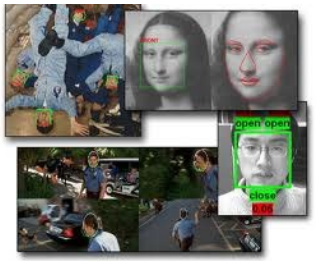
Areas in Computer Science

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	Geoscience	Medicine/Surgery
Biology (bioinformatics)	Archeology	Engineering
Chemistry	Psychology	Linguistics
Physics	Sociology	Art
Geology	Cognitive Science	…

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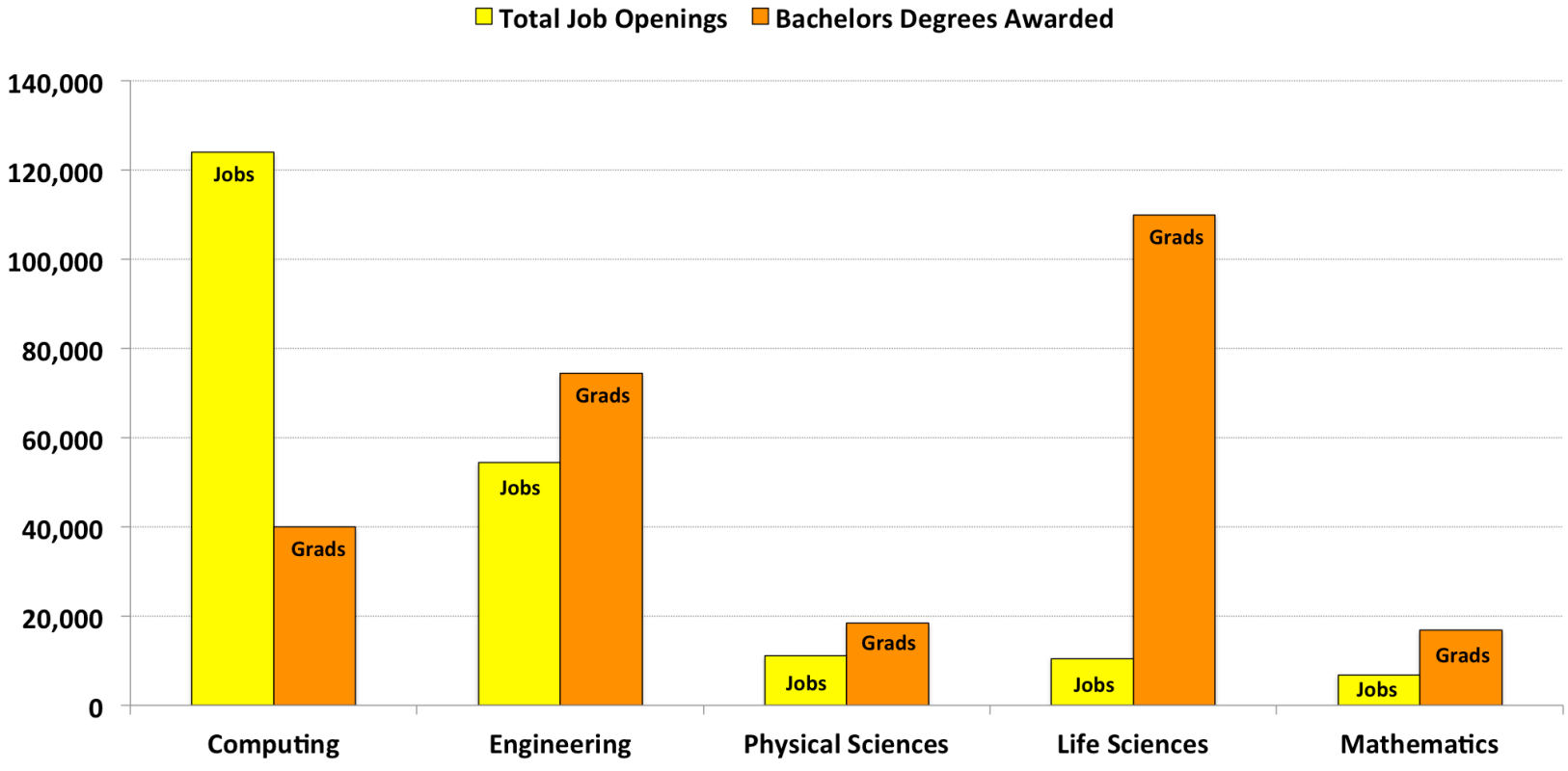
Computing is important

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*)

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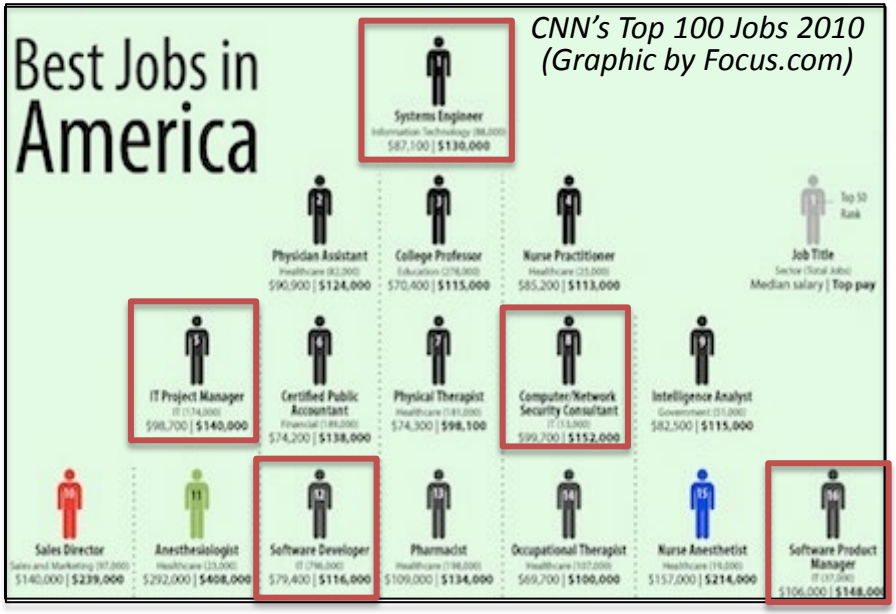
Computing is Consistently Ranked Among the Best Occupations

CS-Related Jobs Highlighted in Red



BEST JOBS U.S.News 2012

The 10 Best Jobs of 2012

#1	Registered Nurse	#6	Web Developer
#2	Software Developer	#7	Computer Systems Analyst
#3	Pharmacist	#8	Physical Therapist
#4	Medical Assistant	#9	Computer Programmer
#5	Database Administrator	#10	Occupational Therapist

Many of these positions are consolidated under Software Developer now, in 2019, which ranks in US News as the #1 job.

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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.

"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,

Evans now works at Google.

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

Administrivia

Overview

CIS 110: Introduction to Programming and Computer Science

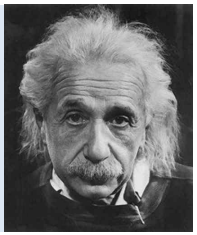
Goals:

- 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
- 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*



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The Basics

Instructor: Dr. Paul "Will" McBurney

- Cis110 website schedule page
- Levine 268 is across from Weiss Tech House
- E-mail: **cis110@seas.upenn.edu**

Recitations: Beginning 2 weeks from now (Jan 28/29).

TA Office Hours:

- Help with understanding assignment, debugging, etc.
- Bring your laptop or use lab computers
  - Lab computers in Moore office hours only
- All office hours are posted class schedule page
- Office Hours in Moore 100C and McClelland 132/133/134.

Note: Office Hours are highly recommended! Most students who have done well in this class have come to office hours multiple times!

Grading

Grade Breakdown:

- Homeworks: 50%
- Midterm Exam 1: 15%
- Midterm Exam 2: 25%
- Recitation : 6.7%
- Lecture/Clickers: 3.3%

Midterm Exam 1: *Tuesday, February 26 7:00 – 9:00 PM*

Midterm Exam 2: *Tuesday, April 23 7:00 – 9:00 PM*

Notes:

- There is no final exam in the course during the final examination period
- You can check your grades on the course website

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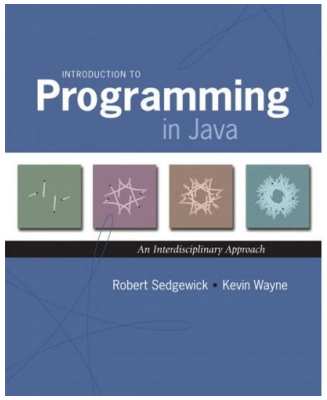
Course Materials

Course Website: **www.cis110.com**

- Programming assignments and checklists
- Assignment submission
- Lecture slides
- Discussion board (Piazza)

Required Text : Sedgewick and Wayne. Either 2nd or 3rd Edition is fine. Java hasn't changed that much. We will not give assignments out of the book, but it can provide good practice and further examples.



skim before lecture;
read thoroughly afterwards

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Homework Programming Assignments

Due: 11:59pm on (usually) Thursday nights via a web submission system

- For policies regarding late days/extensions/dropping of the lowest HW please refer to the webpage

Computing equipment:

- Your desktop/laptop
  - Setting up the software will be described in HW0 (Info on Friday)
- Moore computer labs

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 the collaboration policy
- Do not use Stack Overflow