

## Welcome to A Brave New World Honors 220A

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### Plan for today:

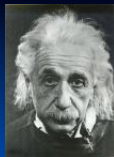
- Whirlwind tour of some facts about computer science and a few of the topics we will be discussing this quarter.
  - Introductions and Administrivia
  - Short videos on robotics and discussion
  - Questionnaire
- Some slides from Bernard Chazelle and many from Ed Lazowska

## What is this course about?

- Some of the big ideas, the coolest applications and the deepest principles in computer science
  - The mathematical foundations of computing
  - The World Wide Web and its economic and social ramifications
  - Computers and their impact on the arts
  - How computational thinking can help cure cancer
  - Secrets and lies, knowledge and trust
  - The mystery of intelligence: What is knowledge? Can computers think? Will computers ever be considered conscious? Where will all this progress take us?
- The future
  - How is the way we do science going to change?
  - How is our economic system going to change?
  - How is our society going to change?
  - How are our brains going to change as a result of all this interaction with technology?
- The concerns

**Predicting  
the future is  
not easy!**

*Albert Einstein (1932)*



“ There is not the slightest indication that nuclear energy will ever be obtainable. ”

*Lord Kelvin (1824-1907)*



“ X-rays will prove to be a hoax ”

“ Radio has no future. ”

“ There ’ s nothing to be discovered in physics today. ”

Thomas Watson  
IBM Chairman (1943)



"I think there is a world market for maybe five computers."

"Where... ENIAC is equipped with 18,000 vacuum tubes and weighs 30 tons, computers in the future may have 1,000 vacuum tubes and perhaps weigh just one-half ton."

Popular Mechanics, 1949

"There is no reason why anyone would want to have a computer in their home."

Ken Olsen, President of Digital Equipment Corporation, 1977

Gordon Moore  
Intel Co-founder (1965)



"Computing power doubles every two years."

Moore's Law

## Exponential Growth

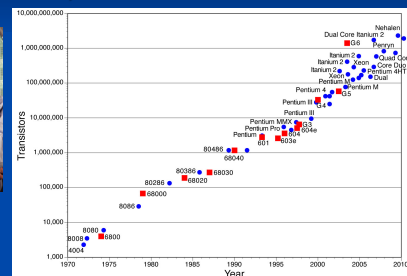
- Would you rather take a job where your salary started at \$16/year and doubled every year or a job that pays \$50,000/year forever?
  - 2 years: \$64/year
  - 10 years: \$16,000
  - 20 years: ~ 17 million
  - 25 years: > 500 million
- This is what happened in the computer industry!

## Exponential Growth

- First commercial computer 1950: 100,000 additions/sec
- Fastest computer now: ~10 quadrillion additions/sec
- Factor of 100 billion
- Comparison:
  - First airplane 1903: 10mph
  - Fastest today: ~ 2500 mph
  - Factor of 250

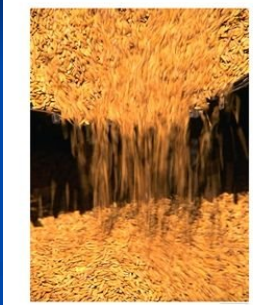
## Exponential progress

- Gordon Moore, 1965



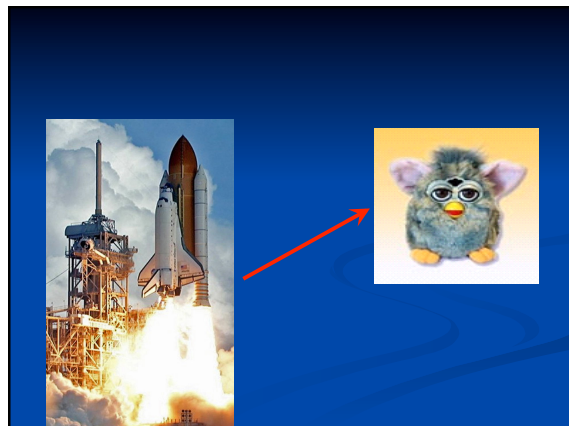
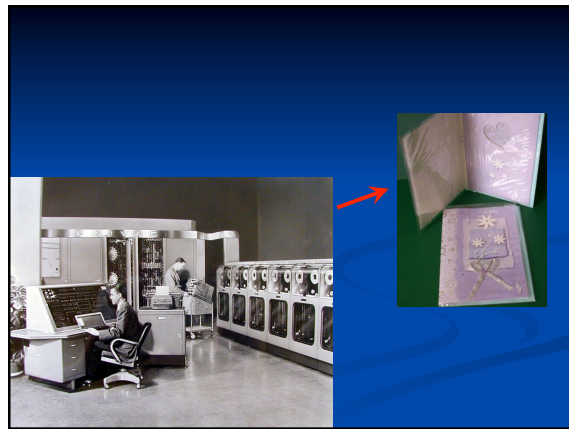
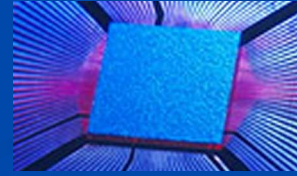
# 10,000,000,000,000,000,000 grains of rice

- Ten quintillion:  $10 \times 10^{18}$
- The number of grains of rice harvested in 2004



# 10,000,000,000,000,000,000 transistors

- Ten quintillion:  $10 \times 10^{18}$
- The number of grains of rice harvested in 2004
- The number of transistors fabricated in 2004



Today: More than 1 billion PCs  
in use ...



Representing less than 2% of all  
processors!



## What is it about computers?

- Why is it that progress in computer science and information technology is so rapid?
- Universality!!!
  - Anything that is computable is computable on a computer

## What is it about computers?

- Universality!!!
  - Anything that is computable is computable on a computer
- What does this mean?
  - A single computer can run your word processor, and your email program and your online calendar and your favorite games and a million other different kinds of applications, many of which haven't even been thought of yet.

## What is it about computers?

- Universality = unimaginable flexibility of application
- This enabled the World Wide Web became a new and significant medium within 7 years of its introduction!

## So where is all this taking us?

- Massive changes in how we relate to one another, communicate with one another, fall in love, socialize, find each other.

facebook



twitter





## Where is all this taking us?

- Transformation in film, music, art

## So where is all this taking us?

- Access to information on an unprecedented scale

- And what about the recording of information?

POLITICAL MEMO  
With Digital Trail, an End to the Hushed Affair

## Machine learning and data mining


- Personalized shopping
- Personalized medicine
- Personalized data collection

## So where is all this taking us?

- Robots
  - Do our chores
  - Manufacture our goods
  - Respond to disasters
  - Fight our wars

## Massive data collection

## Simulation



## Sciences of The Formula

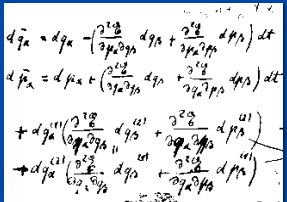
**math, physics, chemistry**


$\oint \vec{H} \cdot d\vec{l} = I + \epsilon \frac{d}{dt} \iint \vec{E} \cdot d\vec{s}$   
Ampere's Law

$\oint \vec{E} \cdot d\vec{l} = -\mu \frac{d}{dt} \iint \vec{H} \cdot d\vec{s}$   
Faraday's Law

$\oint \vec{E} \cdot d\vec{s} = \iint \vec{q}_v \cdot d\vec{v}$   
Gauss' Law

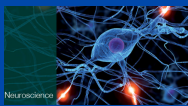
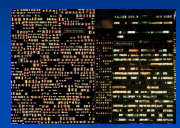
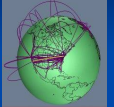
$\mu \oint \vec{H} \cdot d\vec{s} = 0$   
The Fourth Equation

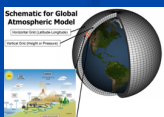






## Sciences of the Future

**Neuroscience  
Genomics  
Climate sciences**

*Bernard Chazelle (2006)*



“Computing will be the most disruptive scientific paradigm since quantum mechanics.”



**PageRank**  
web search

100 designers  
10 years

Algorithm: step by step procedure for  
100 trillion problems  
100 million years



*“Lady” Karlin (2013)*



“The future belongs to those who understand computation: its scientific, economic and social impact.”

### Time of dramatic change

- Proliferation of sensors
- Almost all information is being created in digital form.
- Dramatic cost reductions in storage
- Dramatic increases in network bandwidth
- Dramatic cost reductions and scalability improvements
- Dramatic algorithmic breakthroughs

■ Result: smart homes, smart cars, smart health, smart robots, and on and on...

## A Brave New World

- Instructor: Anna Karlin ([karlin@cs.washington.edu](mailto:karlin@cs.washington.edu))
- TAs:
  - Zorah Fung ([zorahf@uw.edu](mailto:zorahf@uw.edu))
  - Olga Zamaraeva ([olga.zamaraeva@gmail.com](mailto:olga.zamaraeva@gmail.com))

## A Brave New World

- Course information on web
  - <http://courses.cs.washington.edu/BraveNewWorld>
- Class mailing list:  
[honors220a\\_au13@uw.edu](mailto:honors220a_au13@uw.edu)

## We will wet our toes by doing a bit of fun programming!

- Not necessary to do significant programming for conceptual understanding
- Gives us more time for a broader coverage of computer science, inside and outside.
- No advantage to those who have prior programming experience

Some labs/lectures use "pseudocode"

## Grading

- Labs and homework: 40%
- Participation (in class, on blog): 35%
- Project: 25 %
- Attendance at lectures is expected.
  - No book, sort of, except:
    - *Blown to Bits, Your Life, Liberty and Happiness after the Digital Explosion*, by Abelson, Ledeen, Lewis.

## Some more details

- Readings for almost every lectures. Please be sure to do them!
  - Readings for Tuesday already posted on web page.
- For most lectures, I will put students in charge of leading the discussion of the readings. This will entail:
  - Posting 2-3 questions about the reading to the blog before class.
- Occasional videos in class.
- Blog posts -- somewhat open ended.
  - At least 2 longer posts a quarter (~ 3-4 paragraphs)
  - At least 6 comments (a few sentences to a paragraph)
  - (Project in form of longer blog post: ~2000 words)
- Some guest speakers

## Project Ideas

- Explore a computational problem in the field of your choice.
- Explore a policy issue, e.g., electronic voting, privacy, etc.
- Write a book report (e.g., *The Google Story*, *Number Crunchers*, *The Singularity is Near*, *The Universal Computer: From Leibniz to Turing*, *The Code Book*)
- Read or watch a bunch of sci-fi and discuss whether what you see will be possible in 25 years or not and why.
- Discuss how technology is affecting your favorite art form.
- Anything that has anything to do with the class!
- Projects will be due on Monday of the final week of the quarter. We will discuss a few of them on the final day of classes.

## My goals for the course

- I'd like you to learn how to "think" like a computer scientist.
- I'd like you to leave the course understanding how advances in computing have changed/ are changing/ will change the world in such a deep and profound way.
- I'd like for you to leave the course understanding why you will be better off pursuing computer science further, no matter what your ultimate ambitions are.
- I'd like you to have fun!!!