BU Summer Challenge
Computer Science

Introduction
Why do I find Computer Science exciting?

1. Video Games

- How do they make these awesome graphics!? (hint: algebra)
- AI
- VR
- Could there be a the perfect RPG (Reality as a video game!)?
Why do I find Computer Science exciting?  

2. Imagination

- Do computers think? Can we make ones that do?
- I, Robot! Matrix! Sci-fi
- More Drastic Changes in human life and culture coming?
Why do I find Computer Science exciting?

3. Challenge

- Theoretical challenges!
- Practical challenges! (better, faster, nicer programs)
- (more) Immediate reward. (that feel when you run your code and it works!)
That awesome moment when your program works and you feel like Zuckerberg.
Why do I find Computer Science exciting?

4. Fusion of Disciplines

- Computers + Maths + Philosophy = bae
- Biology + Computer Science = Sci-fi on earth
- Engineer + Computer Science = dancing robot puppies
- Humanities + Computer Science = culture for everybody
- Medicine + Computer Science, Law + Computer Science, Architecture + Computer Science, Psychology + Computer Science
Why do I find Computer Science exciting?

5. Cool

- Hackers are cool
- Money, money, money!
- Be the person to wear a smiley t-shirt in that boring meeting
- Vibrant community! “Why do they always travel in groups of five?”
- Impresses girls (well, not really)
Why is it called Computer “Science” anyway?
Why is it called Computer “Science” anyway?

Science: “the intellectual and practical activity encompassing the systematic study of the structure and behavior of the physical and natural world through observation and experiment.” (Google)

Scientific method: “principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses.” (Merriam Webster Online)
Why is it called Computer “Science” anyway?

- Method differs by area
  - Applications (usually) rely on experiments
  - Foundations/theory rely on mathematical proofs

- Sometimes deductive, sometimes inductive
Why is it called Computer “Science” anyway?

- Different phenomenon of interest: patterns, information, computation.
- More abstract, more concrete, or both?
Why is it called Computer “Science” anyway?

- Studies nature, affects nature, mimics nature
- Computation and information are natural phenomenons: natural computing, cognition, information theory.
- Computer Science may alter nature: DNA programming, augmented reality.
- Is Inspired by nature
  Genetic (evolutionary) algorithms, fractals, quantum computation.
Why is it called Computer “Science” anyway?

Conway’s Game of Life

- Epic YouTube Video https://www.youtube.com/watch?v=C2vgICfQawE
- Play it http://pmav.eu/stuff/javascript-game-of-life-v3.1.1/
Brave New World
Future with Computer Science

1. Sci-fi today, usual tomorrow

• Robots and AI

• Bio-tech, enhanced humans, cyborgs

• VR, augmented reality

• Control things with brain-waves?
Future with Computer Science

2. Social life

- Social media -> life!
- Algorithms for social interactions
- Personal representative
- Hologram skype?!
Future with Computer Science

3. Education

- Robots teachers
- Learning through VR
- Accelerated learning
- Revolutionize curriculum and modes of teaching
Future with Computer Science

4. Economy

- More productivity
- Shift in jobs
- Domination of Computer Science related activities?
- A new economic revolution?
Future with Computer Science
5. Policy and Law

- Robot and AI regulation
- Regulating shifting economy
- Regulating privacy and Cyber-security
- AI in the government? In policy making? In statistics and analysis?
- Cyber-crime and Cyber-bullying
Sounds like everything is Computer Science!
Areas in Computer Science
1. Theory

- Computability Theory: what can be solved? what cannot be solved? how much can it not be solved (yes, there are degrees of unsolvability)!

- Information Theory: minimal space required to express a certain information? how much can we deduce from some information? randomness?

- Complexity Theory: how fast can a problem be solved? in how much space? can we do better? what makes problems fundamentally different?

- Algorithms: systematic ways to solve a particular problem.
Areas in Computer Science

2. Programming Languages

- Design of Programming Languages: Make programming languages faster, easier to use, general purpose, or tailored to specific applications.

- Compiler Design: Translate programs between programming languages.

- Formal Verification: How do we know that a program does what we want it to? Come up with ways to “prove” that the program is correct.

- Software Engineering: Systematize the process of writing code and programs.
Areas in Computer Science

3. Systems

- Operating Systems: Make it smaller, make it faster, make it correct.

- Networking: how do computers communicate?

- Distributed Systems: what if we want to process data so large it does not fit in a room of computers?

- Systems Security: Build secure and safe to use systems.
Areas in Computer Science
4. Applications

- Cryptography: how to hide a secret in plain sight?
- Artificial Intelligence: make computers act like rational agents.
- Machine Learning: classify, predict, and analyse events by learning a model from data.
- Graphics: generate scenes, shapes, and movements.
- Data mining: learn patterns and properties from data.
Computer Science in BU

- Courses: http://www.bu.edu/cs/courses/course-web-pages/