1. Internet
   1. Infrastructure
   2. Deep Web
      1. The Silk Road – led by Dread Pirate Roberts
   3. Proxies
   4. Encryption
2. Bitcoin
3. Probability
   1. Archaic homo sapiens came about 250,000 - 400,000 years ago
   2. 95% chance we are in the middle 95% of our lifespan
4. Math
   1. <http://acko.net/blog/how-to-fold-a-julia-fractal/>
   2. Biggest primes, the twins
   3. Infinite twin primes – guy working at subway
   4. Different infinites – people driven crazy
   5. Four-Color problem – Computer aided proof in 1977, basically checks cases
   6. Bruower’s Fixed Point Theorem
   7. Fermat’s Last Theorem – Pythagorean thm untrue for anything bigger than squared
      1. Pf in 1995
   8. Godel’s Thm: there are unprovable statements
   9. Pigeonhole Principle
      1. Claim: Consider a 10 foot by 10 foot square room. Let every point on the floor of the room be colored either red or blue. Then there exists somewhere on the floor two points of the same color that are exactly one foot apart.  
           
         Proof: Consider an equilateral triangle on the floor of the room with side lengths equal to one foot.  As every point is either red or blue, two vertices of the triangle must have the same color, satisfying the claim.
      2. There must be 2 people in London with the same amount of hairs on their head
5. Bayesian statistics
6. Quantum Computing
   1. An n-bit computer has 2^n states and is in one of them with probability 1. You can think of it as having 2^n coefficients, one of which is 0 and the rest of which are 1. Operations on it are multiplying these coefficients by stochastic matrices. Only produces n bits of info.
   2. An n-qubit quantum computer is described by 2^n complex coefficients. The sum of their squares sums to 1. It’s 2^n complex coefficients must be multiplied by unitary matrices (they preserve that the sum of the squares add up to 1.)
   3. Problems: Decoherence – results from interaction with the outside world
   4. Properties:
      1. Superposition – an object is in more than one state at once
         1. Has a percentage of being in both states
      2. Entanglement – 2 particles behave exactly the opposite – instantly
   5. Fullerenes – naturally found in Precambrian rock, reasonable for storing qubits – can store
      1. Not developed, but some experiments have shown ability to store qubits for milliseconds
7. Geometry

Euclidean postulates

* 1. 1) Any two points can determine a straight line.
  2. 2) Any finite straight line can be extended in a straight line.
  3. 3) A circle can be determined from any center and any radius.
  4. 4) All right angles are equal.
  5. 5) If two straight lines in a plane are crossed by a transversal, and sum the interior angle on the same side of the transversal is less than two right angles, then the two lines extended will intersect. (never proven)
  6. Hyperbolic alternative to 5) Through a given point not on a line, there are at least two lines parallel to the given line through the given point.
  7. Riemmanian . Elliptical alternative: Through a given point not on a line, there exist no lines parallel to the line through the given point.

1. Memory
   1. the hippocampus, along with another part of the [brain](http://science.howstuffworks.com/life/inside-the-mind/human-brain/brain.htm) called the frontal cortex, is responsible for analyzing these various sensory inputs and deciding if they're worth remembering. If they are, they may become part of your long-term memory. As indicated earlier, these various bits of information are then stored in different parts of the brain. How these bits and pieces are later identified and retrieved to form a cohesive memory, however, is not yet known.
   2. As one brain cell sends signals to another, the synapse between the two gets stronger. The more signals sent between them, the stronger the connection grows
   3. three ways we store memories: first in the sensory stage; then in short-term memory; and ultimately, for some memories, in long-term memory.
2. Outliers
   1. Small advantages in the beginning become very pronounced later on
      1. Canadian professional hockey leagues
   2. 10,000 hours makes you an expert
   3. Genius that never asks for help or utilizes resources
   4. Ethnic theory of plane crashes
      1. Copilot was very passive
3. Deception
   1. The Invisible Gorilla
      1. We think we experience much more of our physical world than we do
      2. We generally only see what we’re looking for
      3. Our memory is very fake
      4. We have a belief in shortcuts to expand our brain’s abilities
         1. Things like Lumosity
4. Economics
   1. Predictably irrational

arbitrary coherence-market prices themselves that influence consumers' willing­ ness to pay. What this means is that demand is not, in fact, a completely separate force from supply.

* + 1. Choices are always relatives
       1. Adding a comparable worse option makes the comparable option seem better
    2. Supply and demand doesn’t always work
       1. The price for black pearls was completely made up
       2. People often stay anchored to the prices they first see
    3. Social norms compete with market norms
       1. Fining parents who pick up their children late
    4. High price of ownership
       1. Students who won tickets in a lottery would sell them for much more than buy them
    5. Pepsi wins blind taste tests, coke wins shown ones
  1. “dollar auction”: <http://www.smbc-comics.com/index.php?id=3594>

1. Philosophy
   1. Solipsisim – believing that oneself is all that exists
2. Game Theory
   1. Backward Induction – start at the ends and consider the last moves for each player until the beginning is reached
   2. Dominating strategy – always gives a better payoff regardless of other player
      1. Weakly dominating strategy – always at least as good
   3. Mixed strategy – active randomization with given probabilities that determines players decision
   4. Nash equilibrium - no player can unilaterally (without the other player changing) change his strategy and get a better payoff
   5. Prisoner’s Dilllema has dominant strategy of both complying
      1. in a repeated game, this inefficiency can be fixed
   6. Quality choice game – provider and buyer can each offer high or low bandwidth
      1. Two Nash equilibria
      2. In an evolutionary game, which equilibrium is picked is based on what percentage of each the provider expects
      3. Over time, the buyer will mimic whatever the provider is providing
   7. Mixed strategies – compliance inspections
      1. The percentage of the time that the inspector should inspect is based on the incentive / penalty that the buyer will cheat
      2. It has a mixed equilibrium, based on probabilities
      3. Player’s willingness for risk and other factors are considered when determining numbers for utility
      4. Many games have first-mover advantage: such as firms determining how much of a product to produce
      5. There are games with imperfect information- ex. Deciding whether to announce or cede
   8. Bidding in auctions – one of the main uses of game theory
      1. You should bid how much you are willing to pay
      2. Winner’s curse – if you win an auction for something with common value, you probably overvalued it

Constitution

**Article 1**

Section 1: The Legislative Branch  
Section 2: The House of Represenatatives  
Section 3: The Senate  
Section 4: Organization of Congess  
Section 5: The House's Jobs.  
Section 6: Money and War-Time Jobs  
Section 7: Bills  
Section 8: Powers Granted to Congress

Elastic clause  
Section 9: Powers Forbidden to Congress  
Section 10: Powers Forbidden to the States

**Article 2: The Executive Branch**

Including, term limits, limits to become president, elections of the president, What to do if President is removed from office be it death, impeachment or other reason. Also states that the president will receive compensation for his service to the United States and is head of the Military. The president shall also give info about the state of the Uniion to Congress.

**Article 3: The Judicial Branch**

States that the supreme power in the court sysem is thesupreme court. All cases involving public officials must be presided over by the supreme court. In trials the person shall be tried in the state in which the crime was commited. Treason by a person shall only consist on them waging war on the United States. Only the person guilty of treason shall lose their life.

**Article 4: Relations of the States to Each Other**

New states

**Article 5: Amending the Constitution**

2 /3 -> 3 /4

**Article 6: National Debts, Supremacy**  
**Article 7: Ratifying the Constitution**

Amendments

1. Freedom of Religion, Speech, Press, Assembly, Petition

2. Right to bear arms.

3. Quartering Soldiers

4. Freedom from "unreasonable searches and seizures."

5. Protection from: double jeopardy, self-incrimination, private property taken without just compensation

6. Right to a lawyer and "speedy and public trial by an impartial jury."

7. Right to jury trial in civil suits.

8. Protection from excessive bail and "cruel and unusual punishments."

9. There are more rights

10. Powers not given to the United States and not prohibited to the states, are reserved to the states or to the people.

11. non-state citizens can’t sue states

12. Revises electoral college

13. Abolishes slavery. It was enacted during the Civil War

14. Makes all people who were born or naturalized in the US citizens, guarantees the right to vote to all male citizens aged twent-one. States may not deny “the equal protection of the laws."

15. Gives citizens the right to vote regardless of "race, color, or previous condition of servitude."

16. Gives the national government the right to establish an income tax.

17. Direct election of senators.

18. Establishes prohibition-the sale and consumption of virtually all alcoholic beverages are outlawed.

19. Gives women the right to vote.

20. Changes the day of the beginning of the president's term and Congress's term.

21. Abolishes prohibition.

22. Prohibits any person from being elected president more than twice (the two-term limit)

23. Gives three electoral votes to Washington, D.C. Before this amendment, the citizens of Washington, D.C. could not vote for president.

24. Outlaws the poll tax.

25. Changes presidential succession; disability and vice president.

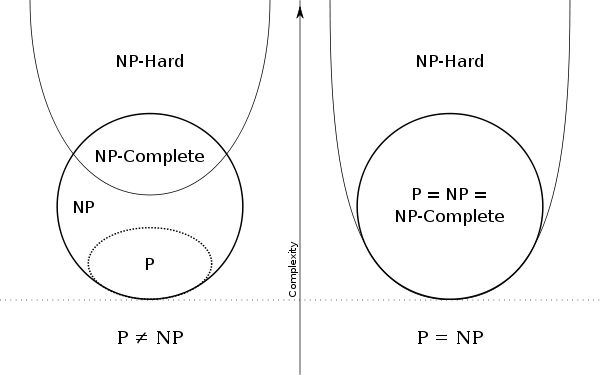
26. Gives the vote to all citizens 18 years old or older.

27. Provides that no congressional pay raise may take effect until one congressional election shall have intervened.

1. Theoretical Computer Science
   1. Turing Machine – 1936
      1. 1. A limited set of states
      2. 2. An infinite tape with 1s, 0s, and spaces with a read / write device
      3. 3. A transition function
      4. All it does is transform the string of 1s and 0s (it starts somewhere and does something based on the tape and its state) – all modern computers do what this does
   2. Turing Test – 1950
      1. Goal is for computer to convince human that it is human using only text
      2. Laplace had the view that knowing the positions and velocities of all particles in the universe, all of future could be predicted; it is possibly so with the discrete state machines that computers are – they can only known so many outcomes
      3. Godel’s Theorem – in any powerful logic system there are statements that can be neither proven nor disproven within the system – could mean that computers are unable to correctly answer some questions
      4. Computers might be unable to answers questions about themselves or similar computers.
         1. These limitations might also exist in humans
      5. Things a computer can’t do: Be kind, resourceful, beautiful, friendly, have initiative, have a sense of humour, tell right from wrong, make mistakes, fall in love, enjoy strawberries and cream, make some one fall in love with it, learn from experience, use words properly, be the subject of its own thought, have as much diversity of behaviour as a man, do something really new.
      6. Reply: “No support is usually offered for these statements. I believe they are mostly founded on the principle of scientific induction. A man has seen thousands of machines in his lifetime. From what he sees of them he draws a number of general conclusions. They are ugly, each is designed for a very limited purpose, when required for a minutely different purpose they are useless, the variety of behaviour of any one of them is very small, etc., etc. Naturally he concludes that these are necessary properties of machines in general. Many of these limitations are associated with the very small storage capacity of most machines. (I am assuming that the idea of storage capacity is extended in some way to cover machines other than discrete-state machines. The exact definition does not matter as no mathematical accuracy is claimed in the present discussion,) A few years ago, when very little had been heard of digital computers, it was possible to elicit much incredulity concerning them, if one mentioned their properties without describing their construction. That was presumably due to a similar application of the principle of scientific induction. These applications of the principle are of course largely unconscious. When a burnt child fears the fire and shows that he fears it by avoiding it, f should say that he was applying scientific induction. (I could of course also describe his behaviour in many other ways.) The works and customs of mankind do not seem to be very suitable material to which to apply scientific induction. A very large part of space-time must be investigated, if reliable results are to be obtained. Otherwise we may (as most English 'Children do) decide that everybody speaks English, and that it is silly to learn French.”
      7. Nervous system is continuous while discrete systems are not
      8. It could be hard to define a complete set of rules (ex. What if you see a red and a green light simultaneously? A human would probably stop, but then go)
      9. Turing believed in telepathy…
      10. He describes early machine learning
          1. They should probably have random elements
      11. Some claim the test was passed by a bot named Eugene in 2014, but it was a 5-minutes test and the English judges might have been thrown of by the Russian bot
      12. *Last question* – the computer tries to find the answer to the question “How can we decrease the entropy of the universe.” It continues to say INSUFFICIENT DATA FOR MEANINGFUL ANSWER until eventually it becomes god and responds “Let There Be Light”.
      13. *All The Troubles of The World* – the computer has been given the task of analyzing the data of the world and provide solutions to problems; knowing who to arrest before they commit crimes. In the end, however, it tries to destroy itself saying “I want to die.”
      14. *Holy Quarrel –* smart computer develops sense of God, warns of attack, ignored
2. [Foundationalism](http://en.wikipedia.org/wiki/Foundationalism) - where the chain of justifications eventually relies on [basic beliefs](http://en.wikipedia.org/wiki/Basic_beliefs) or [axioms](http://en.wikipedia.org/wiki/Axiom) that are left unproven
   1. Plato’s Republic
3. Programming
   1. Djikstra – visit each node based on its distance
   2. Dynamic programming
      1. Overlapping subproblems – Fibonacci vs. factorial
4. Julia
   1. [http://arstechnica.com/science/2014/05/scientific-computings-future-can-any-coding-language-top-a-1950s-behemoth/](http://arstechnica.com/science/201)
   2. <http://graydon2.dreamwidth.org/3186.html>
   3. <http://graydon2.dreamwidth.org/189377.html>
   4. <http://www.paulgraham.com/articles.html>
   5. There is a fundamental tradeoff between abstraction and computing speed. However, the design of the new language Julia seems to have potential for reaching speeds near Fortran, the ancient pure-speed language without compromising abstraction. However, there must be a way to rewrite the abstraction in such a way that there is no speed loss. Java was well known for not having the speed of its predecessors, but its abstraction makes it very easy to pick up and build objects. However, with its new JIT (just-in-time compiler), it has the ability to reach the speeds of some other scientific computing languages. Julia could be a good compromise between the two types of languages and could also be fairly easy to pick up (this could allow it to replace languages such as Matlab which have steep prices.)
5. Fourier Analysis
   1. Fourier Series – a way to represent a wave-like function as the sum of simple sine waves
      1. e^(ix) = cos(x) + i \* sin(x)
   2. Fourier Transform – decomposes a signal into the frequencies that make it up
      1. Like how a chord can be decomposed into its notes
      2. It returns a complex-valued function of frequency (which is the phase offset of the sinusoid in that fre
      3. Fast Fourier transform is an algorithm to compute the discrete Fourier Transform and its inverse
6. Pi
7. Biology
   1. <http://www.wired.com/2015/01/grawk-proteins-making-proteins/>
   2. There are proteins that can edit other proteins; cells aren’t then just following instructions from DNA
8. Some Cool Applications: http://www.reddit.com/r/InternetIsBeautiful/

* <http://mrdoob.com/#/148/aaronetrope>
* Weebly: allows normal people to design websites as if they were professionals – eventually most of computer science should be able to be done this way. At least software development, if it is successful enough, should be able to create software to supplant itself.
* Multeor has a well-designed web interface which allows users to quickly join in a multiplayer web game. Its setup is the simplest of its kind and it is likely that the future of game development (especially in apps) will draw from this kind of design in order to be successful. <http://multeor.com/>
* Monster Milktruck uses the Google Earth API to simulate driving in real life. It adds in a clever gravity engine which allows the user to experience the game in full. This clever use of the API allows for the design to be interesting and appeal to everyday users and let them use the API in a new way. <http://earth-api-samples.googlecode.com/svn/trunk/demos/milktruck/index.html>
* The basics of cloud computing: <http://www.techradar.com/us/news/internet/cloud-computing-explained-1105688>
  + If there is no security risk, cloud computing could drastically improve the performance of computers
  + It could also make things more easily accessible for everyday users
  + Things that sync by themselves are awesome
* With the big changes and nice-looking interface this model draws in the viewer and brings out underlying comparisons. <http://hereistoday.com/>
* These clever animations render a 3D interactive environment which has almost no lag, even through an internet browser. This 3D rendering goes hand-in-hand with the filming of the newest Taylor Swift video, which was filmed in 3-dimensions. In fact, an app was released which allows users to experience 360 degree views of the castle in which the video was filmed. This is the first time this has been done for a music video and could be due to the relative ease of 3D rendering with modern technology. Regardless, making this technology fast and easily usable would greatly extend its functionality and could even become the baseline for how we view media. <http://www.jeanhelfenstein.com/>
* This simple API lets people easily look up a type of crime and see a history of that from public databases on a map. This design allows people to elegantly gain access to records, which could otherwise be cumbersome to look through. <http://crimetimeline.io/>
* <https://sliderdown.herokuapp.com/>

1. P = NP
   1. Soap-Bubbles: Steiner Tree tries to find shortest line segment connecting a set of points
      1. Putting it in soap solves it in polynomial time (polynomial putting in the pegs)
      2. Still, finding a Steiner Tree is NP-hard



General consensus is that P != NP

The first natural problem proven to be **NP**-complete was the [boolean satisfiability problem](http://en.wikipedia.org/wiki/Boolean_satisfiability_problem), from this many problems can be reduced to be NP-compete. Finding that any of them are in P would prove P = NP.

Perhaps the most famous problem in NP, for example, is finding prime factors of a large number. Verifying a solution just requires multiplication, but solving the problem seems to require systematically trying out lots of candidates.

The most famous NP-complete problem, for instance, is the so-called traveling-salesman problem: given N cities and the distances between them, can you find a route that hits all of them but is shorter than … whatever limit you choose to set?

“If **P** = **NP**, then the world would be a profoundly different place than we usually assume it to be. There would be no special value in "creative leaps," no fundamental gap between solving a problem and recognizing the solution once it's found.”

1. Psychology
   1. Freud
      1. Id – set of instinctual trends
         1. "contrary impulses exist side by side, without cancelling each other out. ... There is nothing in the id that could be compared with negation ... nothing in the id which corresponds to the idea of time."
      2. Ego – organized and realistic
      3. Super-ego – analyzes and moralizes – mediates between id and ego
2. World Problems
   1. We must look at all possible situations, and not idealize – the best of all possible worlds
   2. Scotland was largely liberal, and were ruled by the largely conservative UK
      1. Two lottery-winners donated 80% of the campaign funds for the secession campaign
      2. Despite being unsuccessful, the campaign will help Scotland be treated better by the UK
   3. Tibet – their freedom and practice of religion was largely destroyed by China
   4. Syria – their civil war continues, now without the use of chemical weapons, but with serious deaths on every side
   5. Ukraine – cultural differences and a malevolent leader led to territory being stolen militarily
   6. For-profit universities are largely exploiting the people who wish to make money through education
   7. Payloans – there are more payday loan places in America than mcdonalds
      1. Also called loan sharking
   8. Native advertising is becoming larger nowadays because traditional ads are so unnoticed by viewers
      1. Buzzfeed gets all its revenue from native advertising
   9. Uganda has serious anti-gay laws
      1. American evangelists largely led this movement
   10. The right to be forgotten – search engines must remove links to things
       1. Hong Kong - China
       2. Gaza - region of Palestine
       3. Moscow - capital of Russia
       4. Bangkok - capital of Thailand
       5. Istanbul - largest city in Turkey
       6. Abu Dhabi - capital of UAE
       7. Tel Aviv - second most populous city in Israel
       8. Beirut - capital of Lebanon
       9. Singapore - country by itself
       10. Shanghai - largest Chinese city
3. <http://colah.github.io/posts/2015-08-Backprop/->
   1. colah’s blog is very good
4. Viruses - <http://www.symantec.com/connect/articles/introduction-viruses-and-malicious-code-part-one-overview>
   1. They copy themselves
   2. Example – worm virus – eats up space on C drive

@echo off

Copy C:\Programs\virus.bat C:\Programs

# Start C:\Programs\virus.bat