

From Turing to Fortran to the Internet



```
68 IOUTPT = 3
   IF (NQ(ITOTAL).EQ.8) GO TO 69
   LINE = 0
   ITT = 1
   CALL TEST(ITT,LINE,IOUT)
69 IF (INTERO .EQ. 0 ) GO TO 755
   WRITE (IOUT,1018)
   K = 1
   IF (ISUM - 5) 798, 799, 799
798 LINE = 2
   GO TO 800
```



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Programming Languages

- Python (1991, Guido van Rossum)
- Java (1995)
- C (1971) /C++(1983)
- Basic (1964)
- Fortran (1954)

History of PLs chart

http://www.oreilly.com/news/languageposter_0504.html

(goes up to 2004)

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Internet - World Wide Web

- In 1989, Tim Berners-Lee (CERN) created a network-based implementation of the hypertext concept.
- CERN released the technology to the public
- Berners-Lee's first webpage: <http://www.w3.org/History/19921103-hypertext/hypertext/WWW/TheProject.html>
- Researchers at NCSA at U of Illinois released Mosaic in 1993, the first graphical browser.
- Funding for Mosaic came from a program initiated by then-senator Al Gore.
- Mosaic was superseded by Netscape.

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Internet - Beginnings

- Work leading to the Internet started in the 1960's with networking research.
- Initial research was funded by DARPA (Department of Defense's Advanced Research Projects Agency)
- *"A network of such [computers], connected to one another by wide-band communication lines [which provided] the functions of present-day libraries together with anticipated advances in information storage and retrieval and [other] symbiotic functions."*

J.C.R. Licklider, Head of DARPA, 1962

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Internet - Names

- ARPANet
 - Became reality in 1969
 - Connected four locations: UCLA, UCSB, SRI, Utah
 - By 1971, 18 sites were connected; by 1980, close to 100 sites
- NSFNET
 - National Science Foundation became involved in 1984
 - Funded supercomputer centers and established NSFNET
 - Purdue was one of the five initial sites
- Internet
 - Name recognizes the similarities to interstate highway system
 - Internet Society (created in 1992) enforces standards

Related Links

- Computer History Museum (Mountain View, CA)
<http://www.computerhistory.org/>
- Internet Society
<http://www.isoc.org/internet/history/brief.shtml>
- Wikipedia pages (reasonably accurate)

When and where did PC's start?

- In 1976, Stephen Wozniak and Steven Jobs created a homemade computer board called Apple I
- Working from Jobs' parents' garage, they began to manufacture and market the Apple I to local hobbyists and electronics enthusiasts



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The first PC's

- Jobs and Wozniak found Apple
 - In April 1977 they introduced the Apple II, the world's first personal computer
- In 1981, IBM introduces its first PC
 - Uses Microsoft's MS-DOS operating system
 - Microsoft was founded in 1975
- In 1982, the Commodore 64 is introduced.
 - It sells 22 million units until discontinued in 1992.

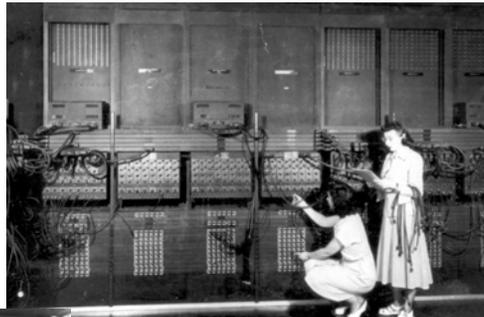
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First successful, general digital computer

- ENIAC (Electronic Numerical Integrator And Computer)
- Built in 1945 at the University of Pennsylvania
 - used 1,000 square feet
 - weighed more than 27,000 kg (60,000 lb)
 - contained more than 18,000 vacuum tubes
 - performed up to 5,000 operations per seconds
- Designed by John Mauchly and J. Presper Eckert
 - They did not get a patent on the machine
 - Main ideas came from John Atanasoff, a physicist from Iowa State College

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ENIAC achieved
5000 operations/second



Today's high end computers
achieve over 10^{12} FLOPS
(teraflops)

A high end laptop achieves
over 10^9 FLOPS (gigaflops)

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Pre-ENIAC Computing Device

- Mechanical Devices
 - Pascals's calculating machine (1642)
 - Jacquards's loom (1805)
 - Babbages's analytical engine (mid 1800's)
- Hollerith's tabulating machine (designed for the 1890 US Census)
- Computers with electromagnetic relays
 - Zuse (Germany)
 - Atanasoff (Iowa)
 - Stibitz (Bell Labs, MARK I)

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What happened first?

- A. SimCity, a video game that helped launch of series of simulators is released.
- B. CBS borrows a UNIVAC to make a scientific prediction of the outcome of election (Eisenhower versus Stevenson)
- C. The MS-DOS (Microsoft Disk Operating System) is released.
- D. The first commercial FORTRAN program runs at Westinghouse.

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Which browser is no longer supported?

- A. Netscape
- B. Opera
- C. PowerBrowser
- D. SeaMonkey
- E. Firefox

Which browser is no longer supported?

- A. Netscape: version 9, last release March 2008
- B. Opera: version 9, last release Oct. 2007
- C. PowerBrowser: created by Oracle in 1996; discontinued**
- D. SeaMonkey: version 1.1.8; last release Febr. 2008
- E. Firefox: version 3; last release March 2008

A Programmable Model Establishing the Foundation of Computation and Computability

- **Turing Machine**
- Proposed by Alan Turing, who is considered the father of computer science.
- Turing's 1936 paper "On Computable Numbers" proved that one can build a machine that acts as an interpreter for another machine.
- This established that machines can be programmed.
- Means we don't have to build a new hardware every time we want to solve a new problem.

Alan Turing

- British mathematician, 1912-1954
- Ph.D. at Princeton University from 1936 to 1938
- Cryptanalyst and code breaker work during WWII
- Worked on deciphering the German Enigma code
- Worked at NPL (National Physical Laboratory)
- In 1948, he created the first design of computer with a stored program (but it was never built)

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Turing Machine

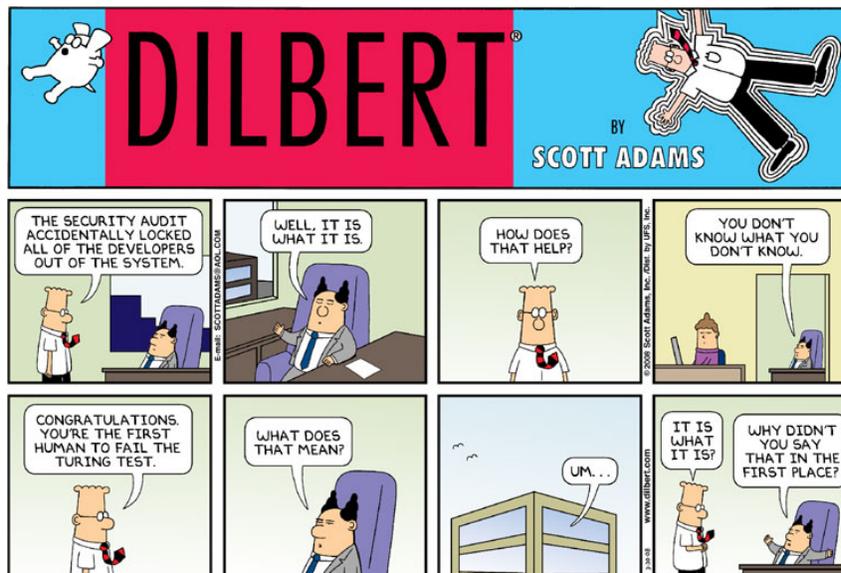
- Has a tape of infinite length consisting of cells
 - Cells hold letters of an alphabet (0's and 1's are enough)
- At any time, the machine is in one of a finite number of states
- A read/write head accesses the tape
- One step consists of:
 - read the tape cell, write to it
 - change machine state
 - move head left, right or halt

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Turing Test

- Turing investigated whether or not it is possible for machinery to show intelligent behavior
- An interrogator poses questions to one person and one machine (does not see them).
- The task is to find out which of the two is the machine.
- If the interrogator cannot make a decision within a certain time (Turing proposed five minutes), the machine is considered to be intelligent.

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Turing Award (given annually)

- 2004: Vinton Cerf and Robert Kahn
For pioneering work on internetworking, including the Internet's basic communications protocols, TCP/IP.
- 2002: Ronald Rivest, Adi Shamir and Leonard Adleman
For their ingenious contribution making public-key cryptography useful in practice.
- 1998: Jim Gray
For seminal contributions to database and transaction processing.
- <http://awards.acm.org/homepage.cfm?awd=140&srt=all>

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von Neumann Architecture

- Refers to a computer architecture that uses a processing unit and a single separate storage structure to hold both instructions and data.
- It implements a programmable Turing machine
- John von Neumann
 - Austro-Hungarian Mathematician who emigrated to the US in 1930
 - Member of the Manhattan Project and a professor of Mathematics at Princeton

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Using Turing machines we can answer the following questions:

Are there problems that have no algorithm?

Yes

Are there functions that are not computable?

Yes

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Church-Turing thesis

- Anything we naturally regard as computable is computable by a Turing machine
- For any algorithm, there exists an equivalent Turing machine

It is a thesis, not a claim about the human reasoning power, or how computers are built, or laws of physics

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