

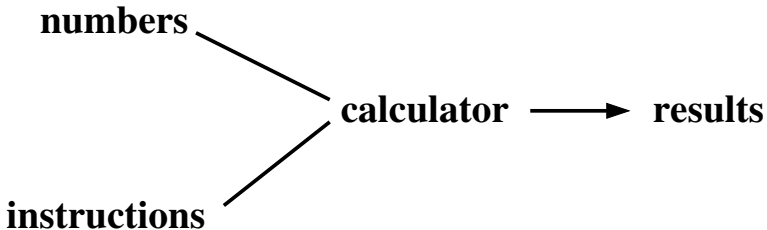
Computer Science 1400: Part #2:

Getting Here: The First Computers (1940–1950)

THE FIRST ELECTRONIC COMPUTERS

THE FIRST COMPUTER COMPANIES

What is a Computer? (Take II)



Overall speed of calculation can only increase if input, calculation, and output operations **all** undergo **same** increase in speed.

Computing in the 1930's: The State of the Art

- Human computers (business / scientific / government)
- IBM tabulators (business / government)
- Differential analyzer (scientific)

New Frontiers in Computing: Mechanical



Howard Aiken
(1900-1973)



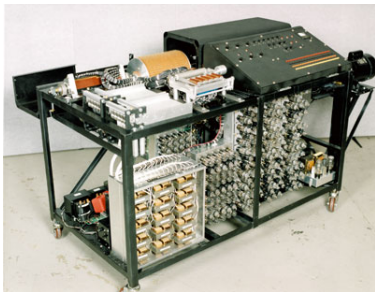
Harvard Mark I
(1944)

- Inspired by nonlinear equations in Aiken's PhD thesis.
- Done in collaboration with IBM starting in 1938.

New Frontiers in Computing: Electronic



John Atanasoff
(1904-1995)



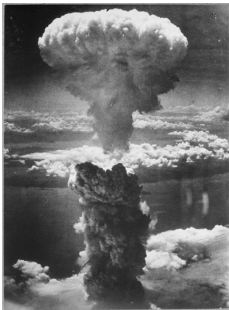
Atanasoff-Berry Computer
(1941)

- Inspired by statistical analyses at Iowa State U.
- Done with Clifford Berry starting in 1939.

The Driving Forces Behind Electronic Computers



Adolf Hitler
(1889–1945)



Atomic Bomb
(August 6, 1945)



Joseph Stalin
(1878–1953)

Computing During World War II: Applications

- Weapons design and use:
 - Artillery tables
 - Automated firing control
 - Atomic bomb design
- Decrypting encoded military messages

Computing During World War II: Machines



Harvard Mark I
(1943
Mechanical
Artillery Tables)



Bombe
(1940
Electromechanical
Codebreaking
(Enigma Cipher))



Colossus
(1944
Electromechanical
Codebreaking
(Lorentz Cipher))

Electronic Computing During World War II

Presper Eckert (1919-1995) and John Mauchley (1907-1980)



- Started collaborating in 1942 at Moore School of Electrical Engineering, U. Penn, on ENIAC (Electronic Numerical Integrator and Computer).
- Focused on electronic implementation of computer.

Electronic Computing During World War II (Cont'd)



Herman Goldstine
(1913-2004)



John von Neumann
(1903-1957)

- Started working together in 1944 after meeting on train; collaborated with Eckert and Mauchley on ENIAC.
- Focused on logical organization of computer.

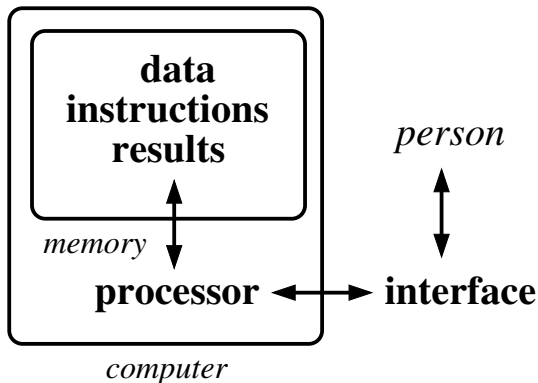
Electronic Computing During World War II (Cont'd)



ENIAC (1945)

- Performs 5000 calculations / sec; programmed by wiring.

What *is* a Computer? (Take III)



- Proposed by von Neumann and collaborators in 1945's *EDVAC Report* as the stored program computer.

Computing After World War II: Applications

- Weapons design and use:
 - Atomic and hydrogen bomb design
 - Bomber defense / offense systems
 - Missile guidance systems
- Government (recordkeeping / planning)
- Business (recordkeeping / planning)
- Science (numerical calculation)

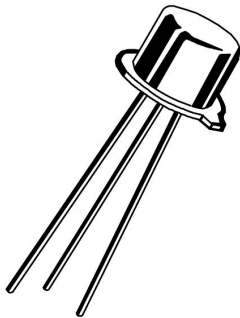
Computing After World War II: Overview

- ENIAC team splits up in 1946 – work continues at Moore School on EDVAC (Electronic Discrete-Variable Automatic Computer), von Neumann and Goldstine develop their own stored-program computer in collaboration with RCA at Princeton, and Eckert and Mauchley form Electronic Control Corporation (ECC) to commercialize UNIVAC (Universal Automatic Computer).
- In wake of Aiken's error at Mark I (IBM Sequence Controlled Calculator) ceremony in 1944, Watson Sr. steered IBM R&D to create Selective Sequence Electronic Calculator (SSEC) and Card Programmed Calculator (CPC) (“evolution, not revolution”).

Computing Technology: Processor



Vacuum tube
(1904)



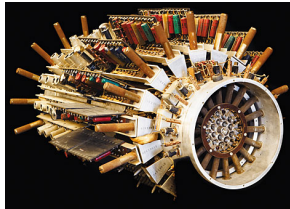
Transistor
(1947)

- Transistor invented by William Shockley (1910–1989).

Computing Technology: Memory



Punch card / tape
(1940s)



Mercury delay line
(1940s)



CRT display
(1940s)

Computing Technology: I/O Interface



Punch card / tape
(1940s)



Teletype
(1940s)



CRT Display
(1940s)

British Computing After World War II



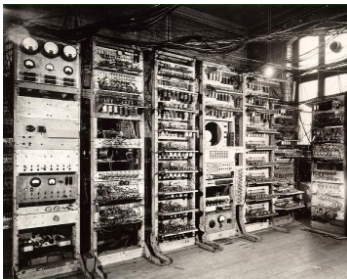
Leslie Comrie
(1893-1950)



Maurice Wilkes
(1913-2010)

- Comrie spread *EDVAC Report* in England; Wilkes built EDSAC (Electronic Delay Storage Automatic Calculator).

British Computing After World War II (Cont'd)



SSEM ("Baby")
(1948, U. Manchester)



EDSAC
(1949, U. Cambridge)

- SSEM and EDSAC were world's first operational stored-program electronic computers.
- EDSAC developed into commercial computer by Ferranti.

Human Computing After World War II

- Towards end of WWII, human computing groups dominated by women (“kilogirl” = 1000 human-computing hours); several speed and accuracy comparisons also run between human computing groups and prototype electromechanical and electronic computers.
- After WWII, many human computer groups dismantled and formation of new ones discouraged by electronic computing groups. Human computing survived in niches (Blanch’s Institute for Numerical Analysis at UCLA).
- Some women computers become computer programmers (particularly under John Mauchly on the UNIVAC).