

Early Computing History

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Computing in the 20th Century

- Late 19th and early 20th century
 - Mechanical, electromechanical counting machines
- · Cash registers, "business machines'
- National security demands, WW2
 - · Ballistics for artillery
 - Cryptanalysis
 - · Weapons design • Etc.
- **Coincidental trends**
 - · Emergence of electronics for switching
 - Development of computing theory
 - Adoption of binary/boolean approach
- Led to global emergence of computing devices

Atanasoff-Berry Computer

John Atanasoff (UW PhD) & Clifford Berry Iowa State 1937-1942 Featured:



- · Electronic switching
- · Solved systems of linear equations

Not fully programmable

Abandoned when Atanosoff recruited to work on other war-related activities

Zuse Z3

Konrad Zuse Germany 1943

- Featured:
 - Floating point
 - Electromechanical relays
 - No conditional branch



Not fully programmable, but close Destroyed in Allied bombing in 1943 (picture is a replica)

Colossus

Tommy Flowers Bletchley Park 1943

Featured:

- · Binary numbers
- Electronic switching
- Cryptanalysis of German codes
- · Eleven were built & used

Not fully programmable

Destroyed after WW2 to maintain secrecy • Not publicly known until 1970s

IBM ASCC/Harvard Mark I

Howard Aiken designed IBM built in 1943

Featured:

- Decimal (not binary)
- Electromechanical:
- Programmed with paper
- tape: idea of loops





shafts, clutches, gears



ENIAC

John Mauchly, Presper Eckert

Univ. of Penn. 1944-46 Featured:

- · Decimal (not binary)
- · Electrical switching
- Programmed via control panel

Not fully programmable Widely considered first electronic computer

Computing Device	Shown working	Binary	Electronic	Programmable	Universal Computin Device?
Zuse Z3 (Germany)	May 1941	Yes	No	By punched film stock	Yes
Atanasoff–Berry Computer (Iowa State)	Summer 1941	Yes	Yes	No	No
Colossus (UK)	December 1943 / January 1944	Yes	Yes	Partially, by rewiring	No
Harvard Mark I – IBM ASCC	1944	No	No	By punched paper tape	Yes
ENIAC (Penn)	1944	No	Yes	Partially, by rewiring	Yes
	1948	No	Yes	By Function Table ROM	Yes

Many early programmers were women • ENIAC: Kay McNulty, Betty Jennings, Betty Snyder, Marlyn Wescoff, Fran Bilas,

Ruth Lichterman • Harvard: Grace Hopper

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Why call it a von Neumann Machine? ENIAC 1944-1946

- Developed in secrecy. Army funded, at Univ. of Penn. Intended for ballistic tables, used for hydrogen bomb
- Designed by J. Presper Eckert and John Mauchly
- Hard-wired program -- settings of dials and switches.
- John von Neumann
 - Well-known Princeton mathematician
 - Invited to review ENIAC design documents + EDVAC follow-on in 1945
 - Wrote a report on the stored program concept, known as the First Draft
- of a Report on EDVAC · Report failed to credit designers, ironically von Neumann still gets credit The basic structure proposed in the draft became known
- as the "von Neumann machine" (or model).
 - a <u>memory</u>, containing instructions and data
 - a processing unit, for performing arithmetic and logical operations
 - a control unit, for interpreting instructions

Legal Repercussions

Mauchly&Eckert filed for a patent in 1946, granted in 1964

- Patents and copyrights established in U.S. constitution Balance rights of the inventor (exclusivity) vs. public good (limited time to expiration)
- M&E Started a company, led to UNIVAC system

• Eventually Sperry, later became Unisys (still around today) Honeywell sued Sperry to invalidate ENIAC patent

• Evidence that Mauchly exposed to Atanasoff-Berry design

- · Concepts published before patented (von Neumann report)
- · Judge ultimately invalidated patent in 1973

Opened up dynamic computing marketplace

· Minicomputers, departmental computing

- Microprocessors (Intel)
- Personal computers (Altair, Apple][, IBM PC, ...)