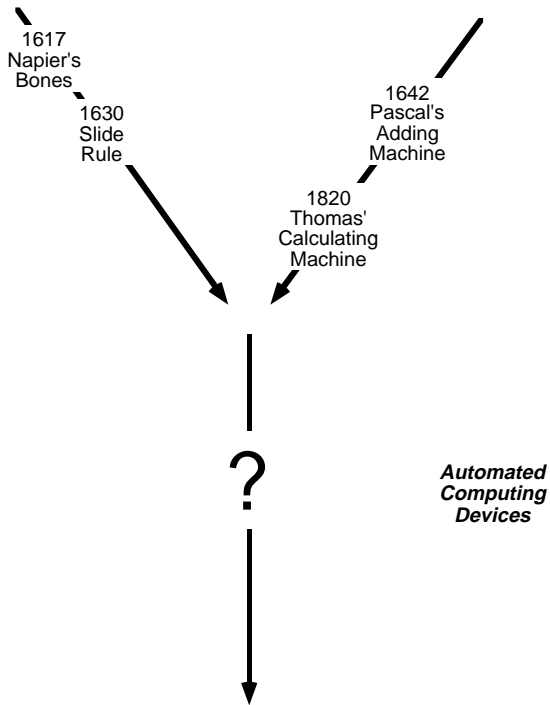


Development of Computers

*Manual Calculating Devices
(Many Arithmetic Functions,
Few Digits,
Errors Accumulate)*

*Manual Calculating Devices
(Few Arithmetic Functions,
Many Digits,
Errors Do Not Accumulate)*



1

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Babbage's Engines

■ Charles Babbage

- Born 1792 in London, died 1871
- *On the Economy of Machinery and Manufactures* (1832)
- *Passages from the Life of a Philosopher* (1864)

■ Babbage's Difference Engine (1822–1833)

- First automated computing device
- Computed tables using method of differences
- British government was interested in possible military applications
- Couldn't be built with sufficient precision for practical use

2

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Babbage's Engines (cont.)

■ Babbage's Analytical Engine (1834-1871)

- Designed to be a universal computing machine, capable of any calculation (not just tables)
- Separate "store" (storage) and "mill" (arithmetic unit)
- Control of complex operations (multiplication, division, etc.) via a microprogram represented by studs on the surface of a barrel
- User program control by punched cards based on the Jacquard loom
- Over 30 different models were designed, but not constructed
 - One trial model was being built when he died in 1871
- Microprograms were written for multiplication and division

3

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Ada Lovelace

■ In 1840, Babbage travel to Turin, Italy, to describe his Analytical Engine to a group of Italian scientists

- A military engineer, Lt. Luigi Menabrea, took notes, and after corresponding with Babbage for the next year, published a paper in French describing the Analytical Engine

■ Ada August Byron King, Countess of Lovelace

- Born 1815 in ??, died 1852
- Translated Manabrea's paper into English, adding very extensive notes of her own
- Often romanticized as "the world's first programmer", and even had a programming language (ADA) named after her

4

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Babbage & the Street Musicians

5

Fall 1998, Lecture 02

Early Computers

- Relay-based computers
 - Harvard MARK I (1944)
 - 6 multiplications / second
- Electronic (tube-based) computers (~1945-1958)
 - ENIAC (1945)
 - Developed at the Moore School of Engr., University of Pennsylvania, by Presper Eckert & John Mauchly
 - 5000 additions / second
 - Programmed by plugging wires into panels, first use of subroutines
 - Used for computing ballistic tables
 - Remington-Rand UNIVAC I (1952)
 - 360 multiplications / second
 - Bought by Census Bureau for \$159,000
 - GE bought one to work on payrolls in 1955 — first commercial application
 - IBM 701, 702, 702 (1952-1953)

6

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IBM and the Watson Family

- Thomas J. Watson, Sr.
 - Born around 1880 in Painted Post, NY, died 1956
 - First job — selling pianos, organs, and sewing machines off the back of a wagon
 - Held other jobs, selling cash registers, sewing machines, stocks, etc.
 - Later joined the National Cash Register Company (owned by John Henry Patterson) as a cash register salesman, worked there for 18 years, eventually as second-in-command

7

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IBM and the Watson Family (cont.)

- Thomas J. Watson, Sr.
 - Joined the Computing-Tabulating-Recording Company (CTR) (conglomerate assembled by Charles R. Flint) as president (?) in 1914
 - CTR became International Business Machines (IBM) in 1924
 - Sold off scales and meat slicers in 1930s, concentrating on tabulating machines
 - Brought his son into the business in 1939

8

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IBM and the Watson Family

- Thomas J. Watson, Jr.
 - Born 1914 in ??, still alive?
 - Almost a given that he'd follow in his father's footsteps at IBM
 - Got in trouble when young, eventually went to Brown, learned to fly while at Brown
 - Joined IBM in 1937 after graduating, went to IBM's sales school
 - Given one of IBM's prime territories in the financial district in Manhattan

9

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IBM and the Watson Family

- Thomas J. Watson, Jr.
 - After 3 years, left and joined the Air Force during WWII
 - Went back to IBM in 1946
 - IBM 603 (Electronic Multiplier) announced in 1946
 - IBM 604 (Electronic Calculator) announced in 1948
 - Appointed Executive Vice President in 1949, President in 1952, argued constantly with his father
 - IBM 701 (Defense Calculator) announced in 1952
 - Chief Executive Officer of IBM from 1956 (six weeks before T.J. Watson Sr. died) until 1971 (\$7.5B business)

10

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Solid State Computers

(1947 — transistor invented at Bell Labs)

(1957 — FORTRAN invented)

- Transistor-based computers (~ 1959-1963)
 - IBM 401 (1959)

(1959 — integrated circuit (IC) invented at Texas Instruments and at Fairchild (independently))

- IC-based computers (~ 1964-now)
 - IBM 360 (1964)
 - Huge commercial success
 - Many models produced using a standard architecture

11

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More Modern Developments

- Precursors to Personal Computers
 - Electronic desktop calculators (mid 1960's)
 - HP35 pocket calculator (1972)
 - \$395, one of the first pocket calculators
 - PONG (1972)
 - First video game
- Personal Computers (PCs)
 - Altair 8800 (1974)
 - \$500 assembled, \$2500 with peripherals
 - Intel 8080 processor, 256 bytes of RAM
 - First personal computer
 - IBM PC (1981)
 - First mass-market personal computer
 - Apple Macintosh (1984)
 - \$2500
 - Motorola 68000 processor, 128k RAM

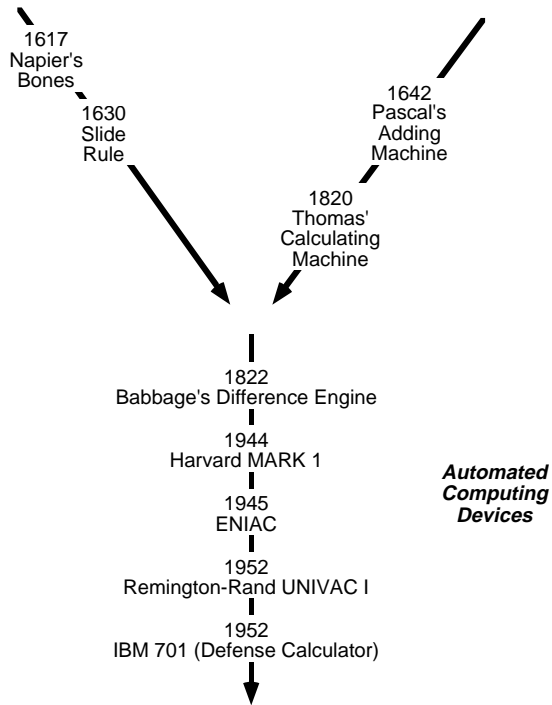
12

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Development of Computers

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Manual Calculating Devices
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Development of Computers

- Development of the slide rule and mechanical calculating machines
 - Need for fast arithmetic calculations
 - Plus need for accurate calculations
- Development of automated computing machines (Babbage's Engines, Harvard MARK 1, ENIAC, UNIVAC)
 - Need for fast, accurate, complex, mathematical tables
- Development of modern electronic computers
 - Invention of transistors and ICs
 - Plus commercial interest by large companies (IBM, etc.)
 - Led to widespread use of computers, calculators, and personal computers