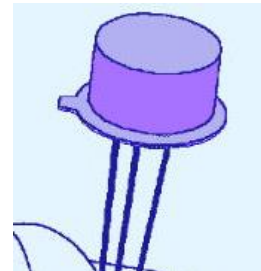


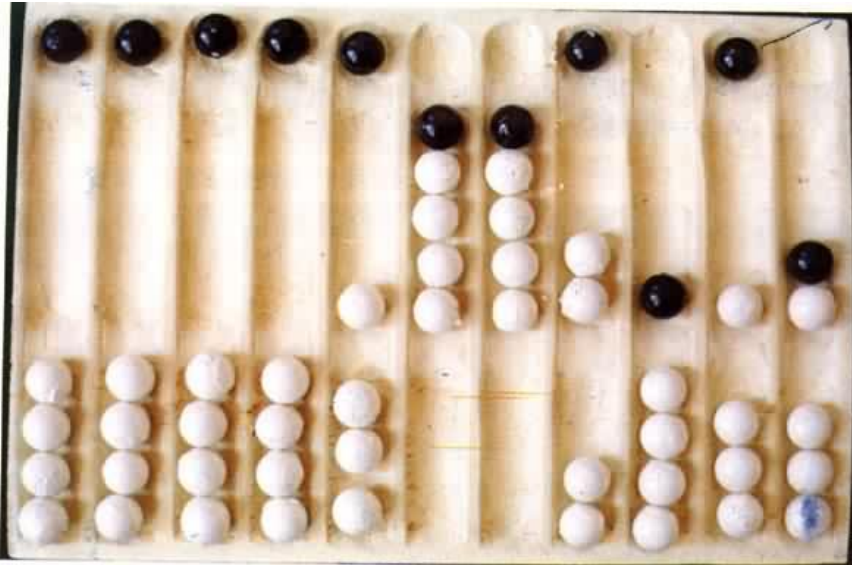
Generations

- **Zeroth Generation**
 - Mechanical (1642 - 1945)
- **First Generation**
 - Vacuum tube (1945 - 1955)
- **Second Generation**
 - Transistor (1955 - 1965)
- **Third generation**
 - Integrated Circuit (1965 -1980)
- **Fourth Generation**
 - Personal Computers and VLSI (1980 - now)



Zeroth Generation - ABACUS

Mechanical Calculating Machines



5000 BC

A very old abacus

A more modern abacus.

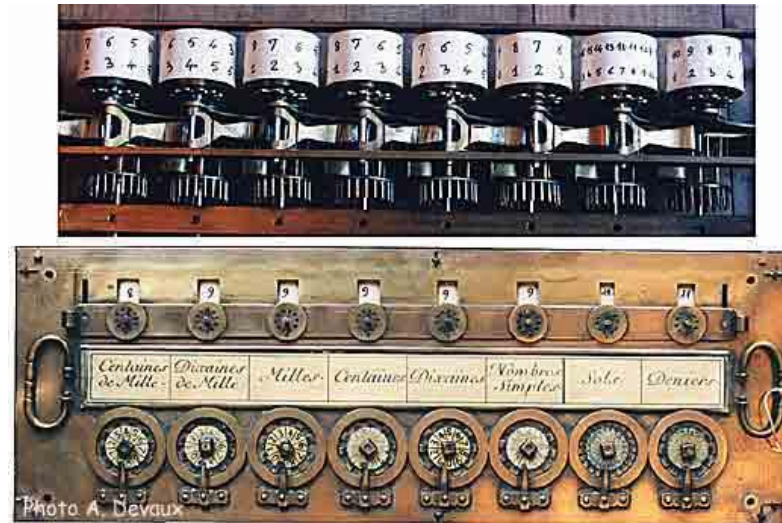


Abacus

- Early predecessor of the computers
- Able to
 - perform calculations &
 - Store data
- Widely used by
 - Merchants
 - Traders
 - Mathematicians, etc
 - In Asia, Europe & Africa

Zeroth Generation – contd.

- Blaise Pascal
- French mathematician
- Invented a Calculating Machine
- In 1642
- Unable to construct it completely



Zeroth Generation - cond.

The Differential Motor

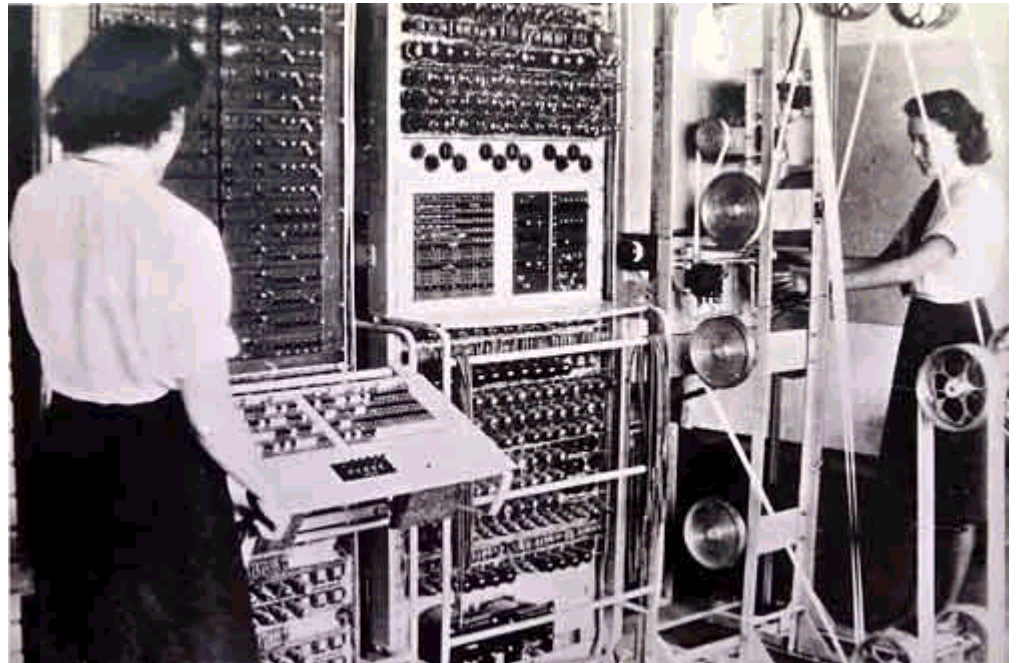
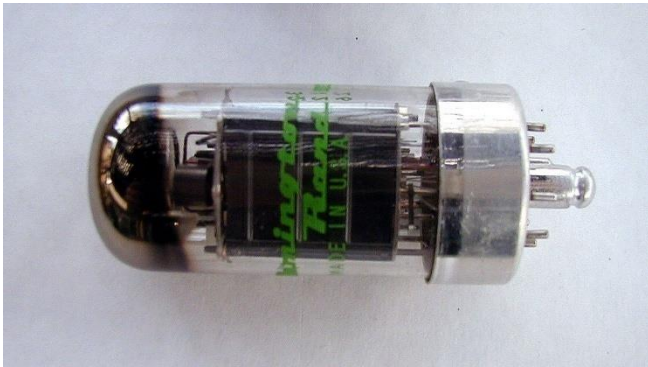


- Differential Engine/ Analytical Engine/
Difference Engine
- Charles Babbage - 1822
- steam driven calculating machine
- size of a room
- used to compute entries in navigational tables
 - *find the first 30 prime numbers in two and a half minutes*
- received government grant
 - first for the computer research

Difference engine

First Generation 1945-1955

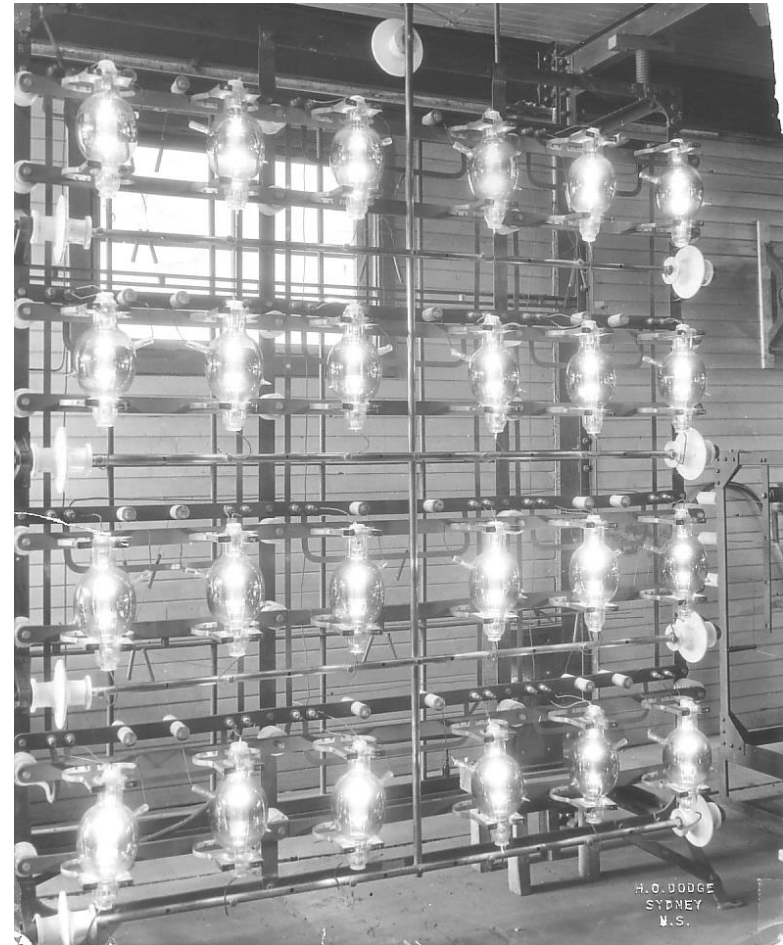
- World war II, 1939-1945
- German troops sent **encrypted** messages
- British needed to decode German messages – encrypted
- Built an electronic computer
 - vacuum tubes



Vacuum Tubes



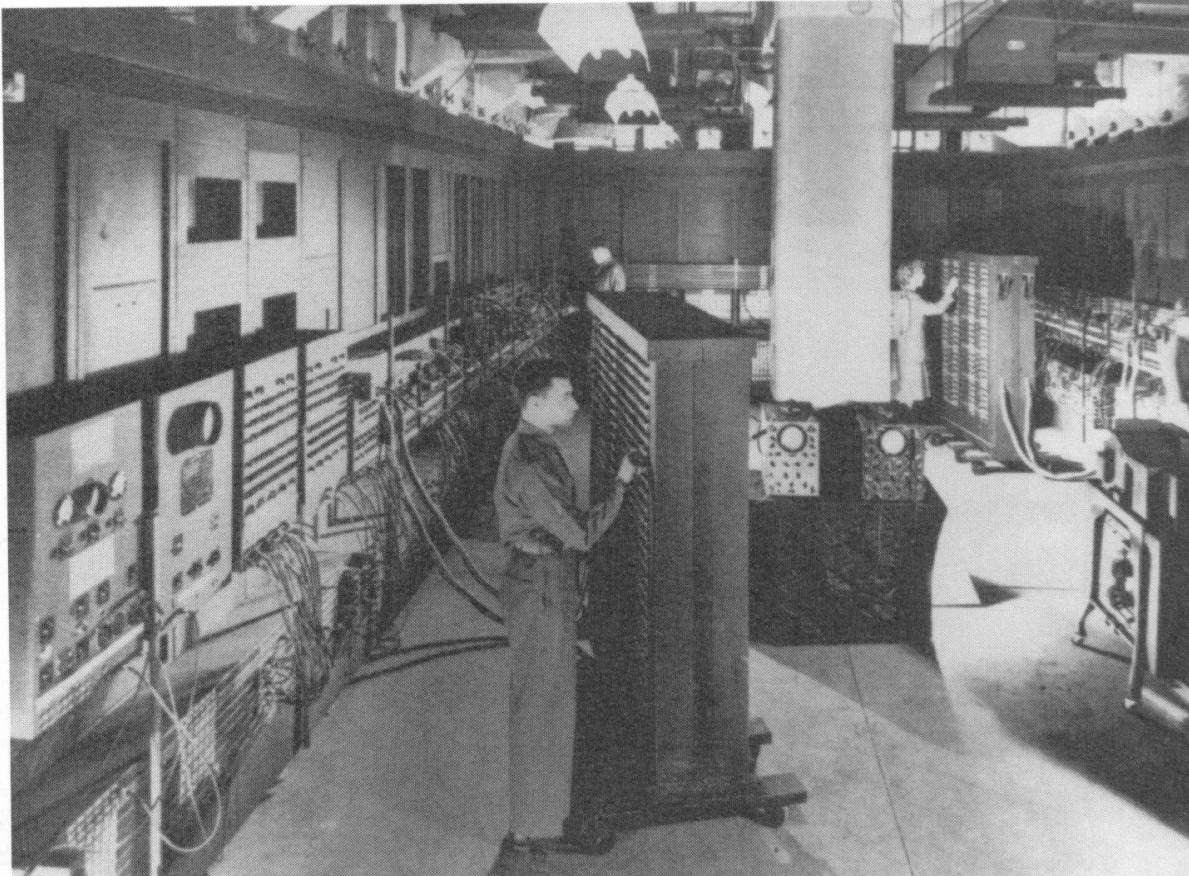
- sealed glass or metallic containers
- size of a light bulb
- evacuated to a vacuum degree
 - Vacuum – a space or container from which the air has been completely or partly removed
- directed flow of electrons



Disadvantages - vacuum tubes

- Large in size
 - 1 vacuum tube = 1 light bulb
- Slow
- High maintenance
- Produces lots of heat
- Very unreliable
- Requires bulky power supplies
- High voltages
 - Risk of electric shocks

ENIAC 1943 - 1946



ENIAC - **E**lectronic **N**umerical **I**ntegrator **A**nd **C**omputer

\$3,000,000 - cost

15 000 square feet

ENIAC

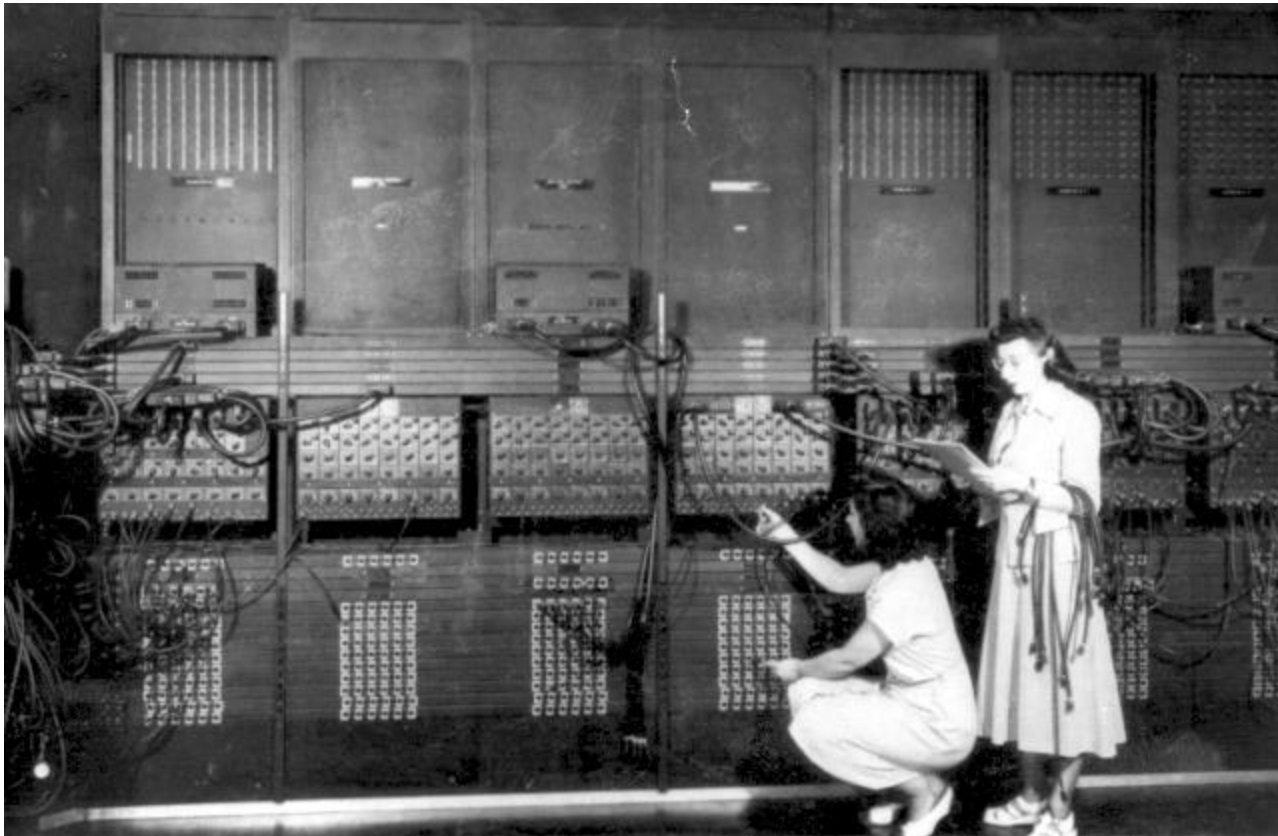
- 18,000 vacuum tubes
- weighed 30 tons
- Duration of an average run without some failure was only a few hours
- When it ran
 - the lights in Philadelphia dimmed!
- Stored twenty, 10-digit decimal numbers (max)
- Input: IBM card reader
- Output: Punched cards, lights

ENIAC - Programming



- It **took days** to change ENIAC's program

ENIAC

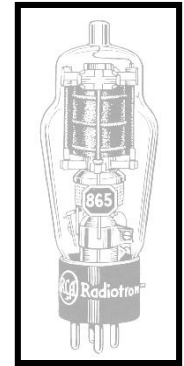


Programming required rewiring of the machine,

Major characteristics

Vacuum Tubes

Large, not very reliable, generated a lot of heat

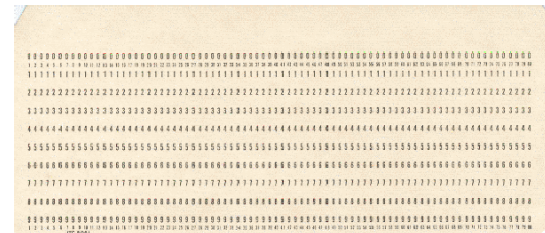
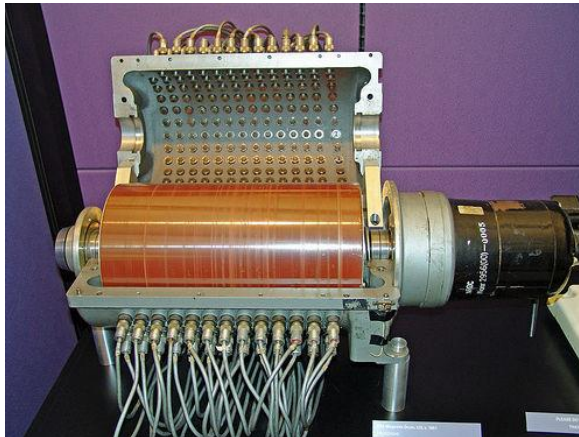


Magnetic Drum Storage

Memory device that rotated under a read/write head

Card Readers & Magnetic Tape Drives

Development of these sequential auxiliary storage devices

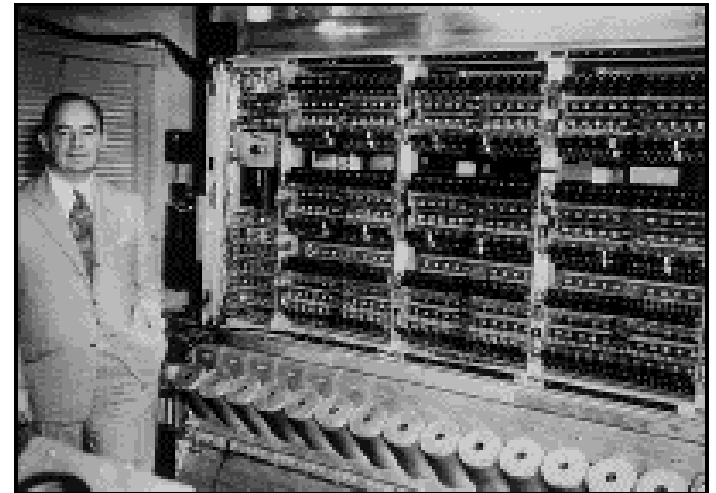


First Generation 1945-1955

- relied on **machine language** to perform operations,
- and they could only solve **one problem** at a time.

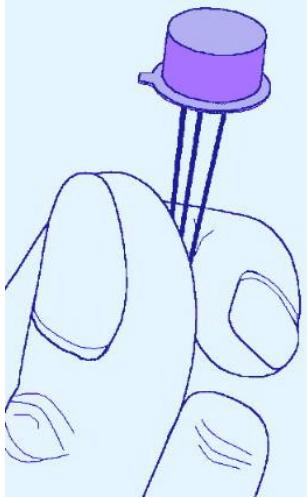
John Von Neumann

- Consultant in ENIAC project
- Proposed some improvements
 - The **stored program** concept
 - store the **program and data** in the computer's memory
 - Binary processing of data
 - use **binary arithmetic** with **0's** and **1's** for each digit
- basis for all **modern digital computers**

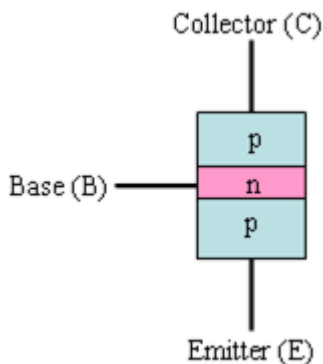


Second Generation 1955-1965

- Transistor



- Element of an integrated circuit (IC)
 - » acts like a gate and
 - » can open or close the circuit to electrical changes
- Invented at Bell Labs in 1948
 - » by John Bardeen, Walter Brattain, William Shockley



- Won the Nobel prize for physics in 1956
- revolutionized computing within 10 years
- replace vacuum tube computers

Second Generation 1955-1965

- Transistor - more
 - electronic switch
 - alternatively allows electronic signals to pass
 - alternate between “ON” and “OFF”
 - Frequency is high
 - many millions times per second
 - *binary*
 - made from semi-conducting material
 - Silicon, germanium

Transistor - more

- The **advantages** of transistors:
 - Smaller in size than vacuum tubes
 - Needed no warm-up time
 - More reliable
 - Consumes less energy
 - Faster

Second Generation 1955-1965

- **Transistorized Computers** (1954 - 1965)
 - IBM 7094 (scientific) and 1401 (business)
 - Digital Equipment Corporation (DEC) PDP-1
 - Univac 1100 and many others



CDC 6600 – University of Texas - 1964

Workstations were available to only a few.

Most had to use punched cards handed in through a window



Characteristics

Transistor

- Replaced vacuum tube,
- fast, small, durable, cheap



Magnetic Cores

- Replaced magnetic drums,
- information available instantly
- first computers that stored their instructions in their memory

Programming Languages

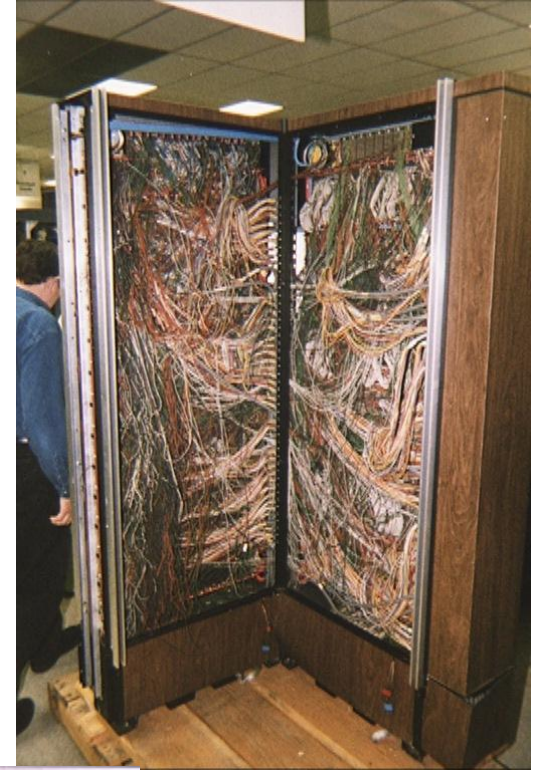
- Assembly languages & high-level programming languages
 - e.g. *FORTAN*

Mainframes



Wiring in CDC7600

150 000
transistors in
IBM-S.



Console of **IBM-Stretch** (1959)



here's the rest of
its **33 foot** length

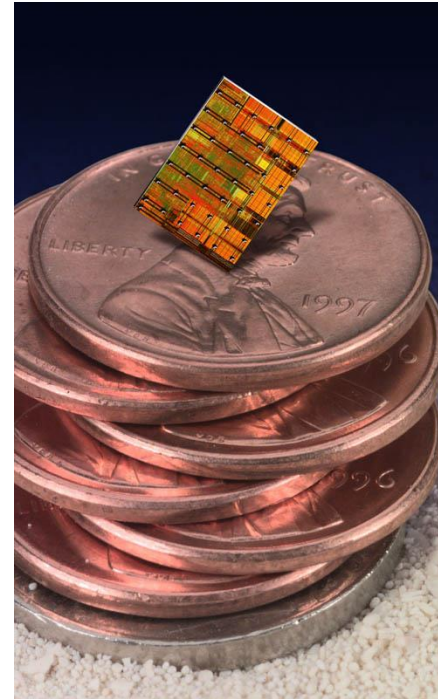
Minicomputers



Mini-computer:
PDP-12 (1969)

Third Generation 1965-1980

- Integrated Circuit
 - invented by Robert Noyce , 1958
 - many **transistors** on a single chip



Third Generation 1965-1980

- IBM 360
- DEC PDP-8 and PDP-11
- Cray-1
supercomputer
and many others.



IBM 360



Characteristics

Integrated Circuits

- Replaced circuit boards,
- smaller, cheaper, faster, more reliable.
- *Computers for the first time became accessible to a mass audience*

Operating System

- Allowed to run many different applications at one time with a program that monitored the memory.

Terminal

- An input/output device with a keyboard and screen

By 1968 you could buy a 1.3 MHz CPU with half a megabyte of RAM (512 KB) and 100 MB hard drive for a mere **US\$1.6 million.**

Dumb terminals or workstations were used to tie into the mainframes:



Photo taken at Computer Science History Museum, San Jose, CA,
by Dr. Robert Walker on VLSI Trip to Silicon Valley

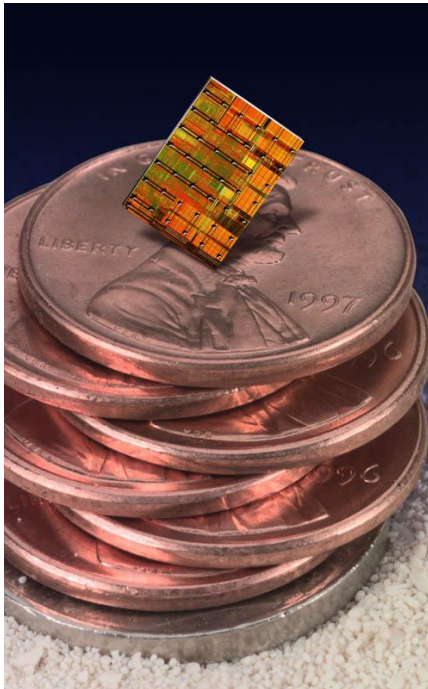
Fourth Generation 1980 – Now

- **Large-scale Integration**

- Great advances in chip technology

- **Very Large Scale Integration (VLSI)**

- 10,000's transistors on a single chip



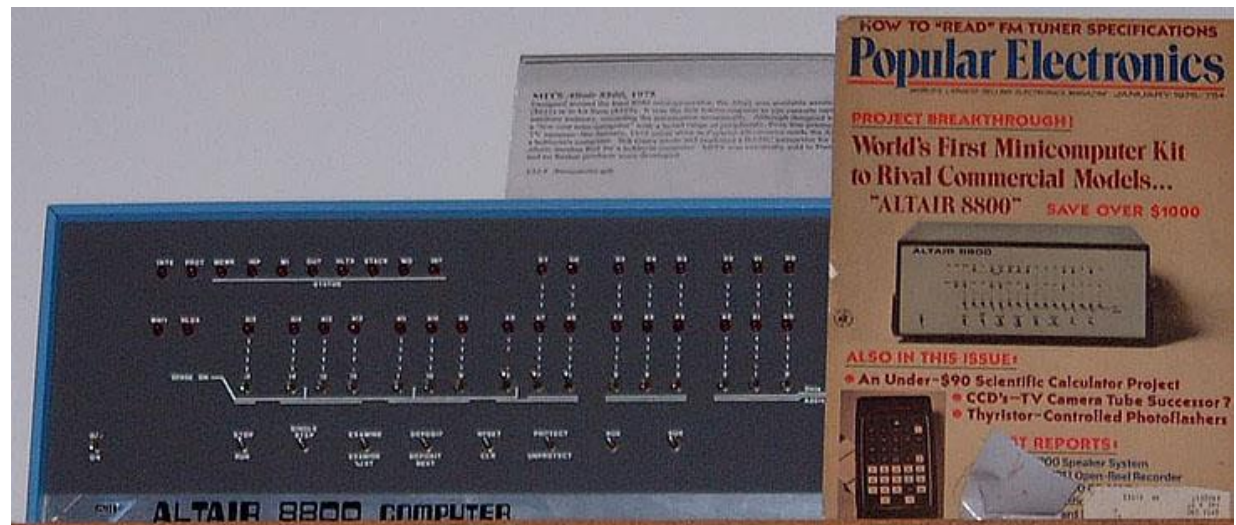
Pentium 4
contains 42
million
transistors



The Shrinking Computer

Fourth Generation 1980 – Now

- **PC Era** was born!
- First PC's were sold as **kits**
 - Intel 4004 chip, 1971
 - located all the components of the computer
 - central processing unit
 - Memory
 - input/output controls
 - » on a single chip



PCs from the 1980's



The **Apple 1** which was sold as a do-it-yourself kit (without the lovely case seen here)



Apple computer and **IBM** made the first commercial PC's

The rest is History!

Fourth Generation 1980 – Now

- **Characteristics**
 - GUIs,
 - the mouse and other handheld devices.
- these small computers became more powerful,
- they could be linked together to form **networks**,
- eventually led to the development of the **Internet**.