Microprocessor Systems

Lecture # 1

Course Website and group

- www.uettaxila.edu.pk/cms/mps
- http://groups.yahoo.com/group/mps_08

Marks Distribution

- Final paper 40 marks
- Mid 20 marks
- Internal 40 marks
  - Quizzes
  - Assignment
  - Labs
  - Project
    - Report
    - Deliverable
    - Presentation

Books

Course Book:

- **The Intel microprocessors 8086/8088, 80186/80188 80286/80288, 80386, 80486, Pentium, Pentium Pro Processor**

  Author: Barry B. Brey

  7th Edition

Reference Books:

- **The 8051 Microcontroller and Embedded Systems by Mazidi & Mazidi, Edition 1999 or Latest, Prentice Hall**
- **The 8051 Microcontroller, Scott McKenzie, 4th Edition, Pearson Higher Education.**

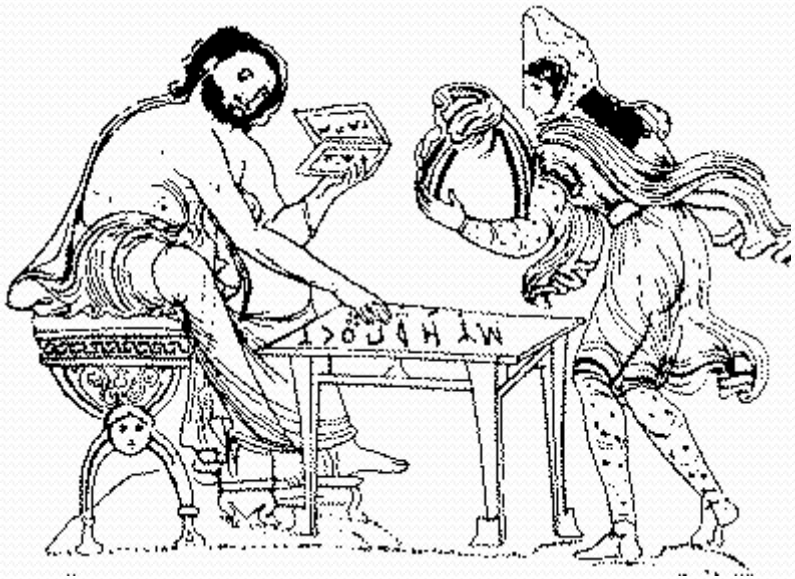
Course Contents

- Introduction to Microprocessor
- Microprocessor Programming model
- Address Modes and Assembly Language instructions
- Microprocessor Hardware Specification
- Input /Output Interfacing
- Interrupts
- Direct Memory Access (DMA controller)
- Microcontrollers and Applications
- Programming of Embedded devices
- Microprocessor Designs
- DSP Processors and Applications

Pre-requisites:

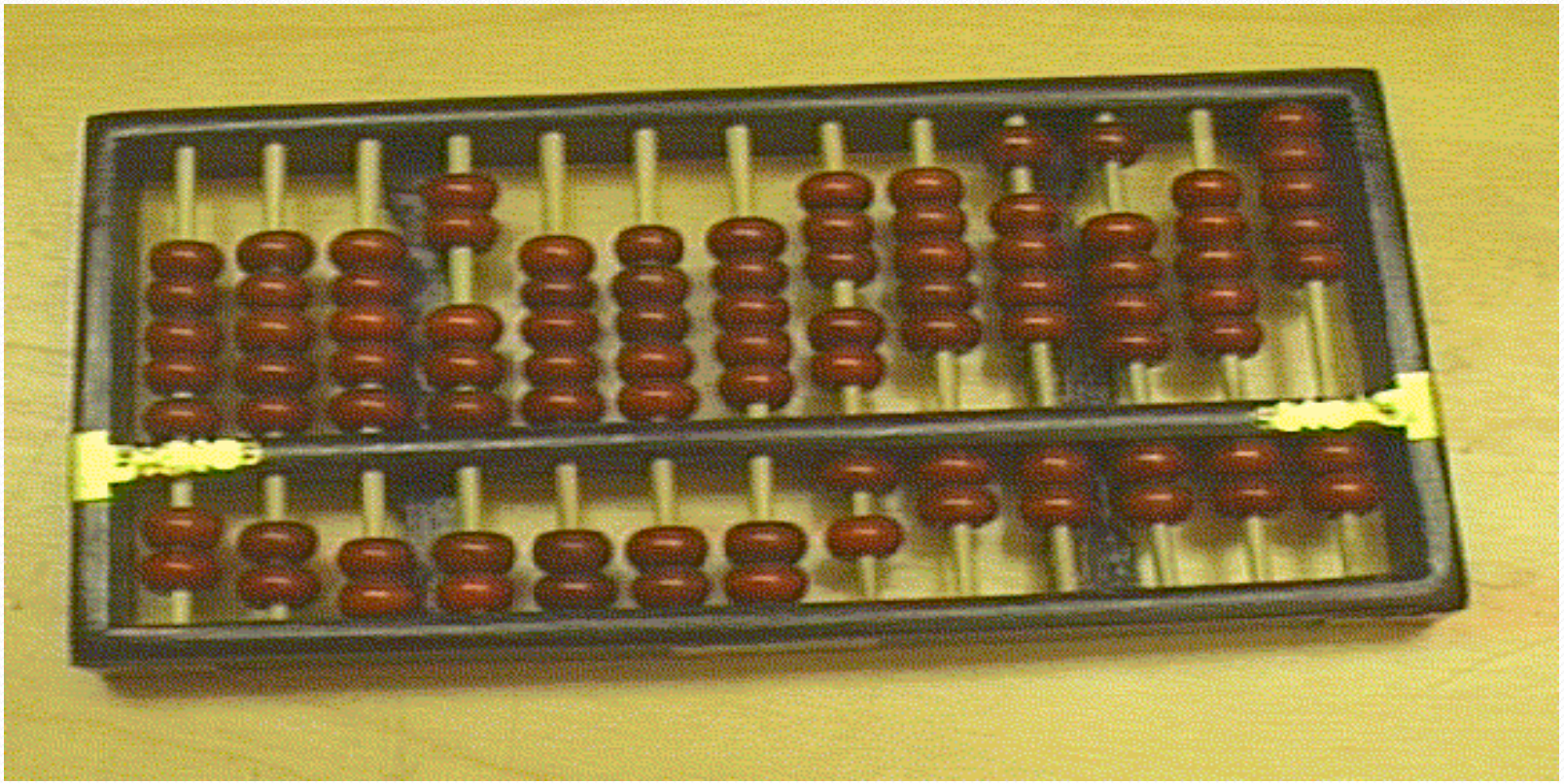
- **Computer Organization**
- **Digital Logic Design**
- **Programming Techniques**

Abacus



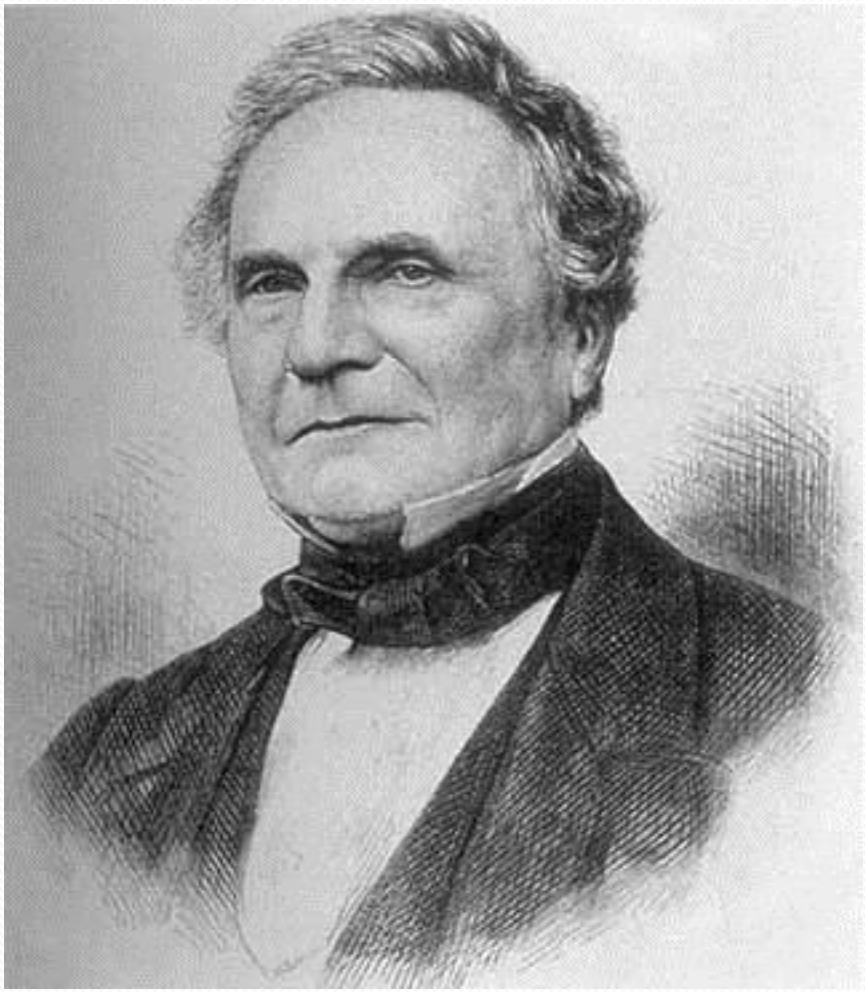
- 3000 BCE, early form of beads on wires, used in China
- Counting frame
- Primarily used in parts of Asia for performing arithmetic processes

Chinese Swan Pan



Abacus

Charles Babbage (Father of the computer)



Charles Babbage (1791-1871)

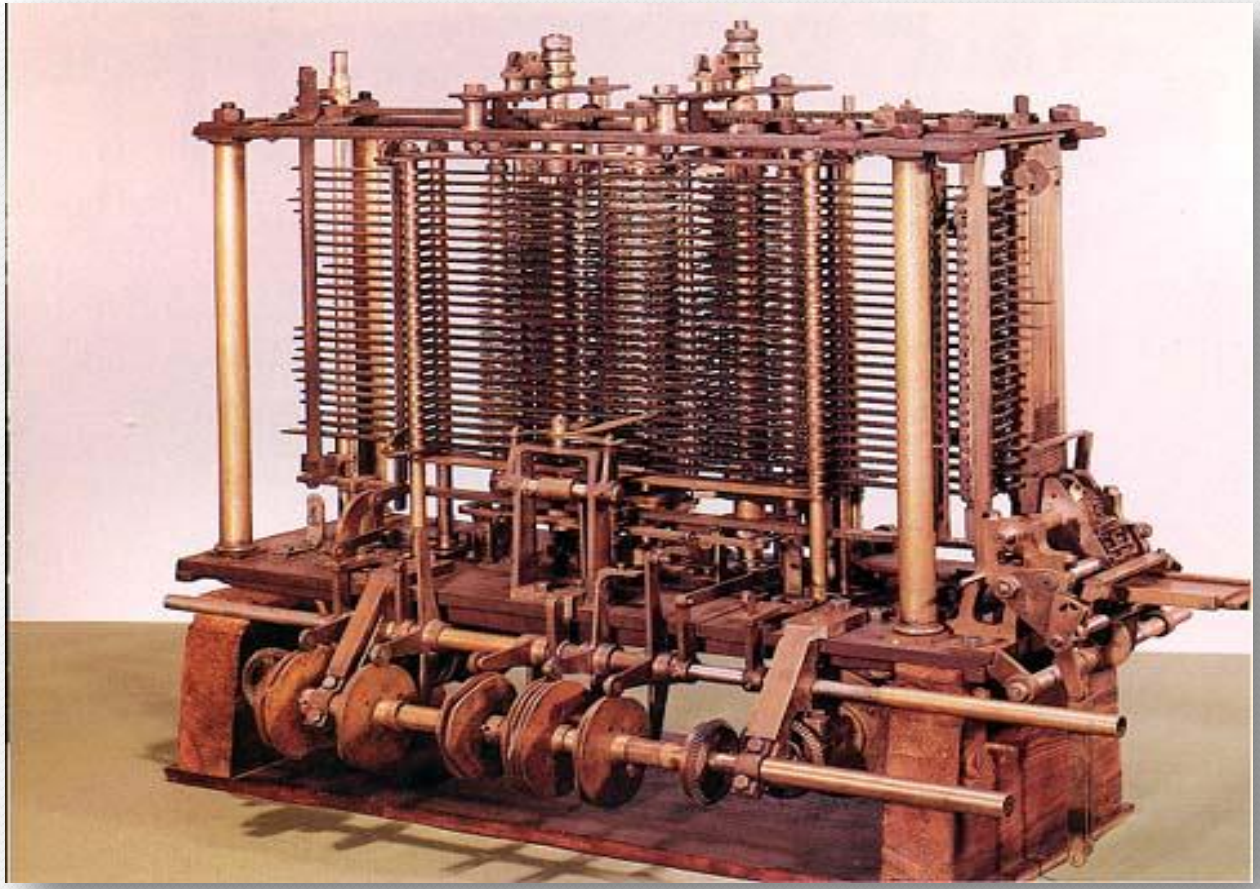
- 26 December 1791 – 18 October 1871
- English mathematician, philosopher, inventor, and mechanical engineer who originated the concept of a programmable computer
- Babbage is credited with inventing the first mechanical computer
- Formed the Analytical Society in 1812, with Herschel, and Peacock
- He was the top mathematician at Peterhouse, but did not graduate with honours. He instead received an honorary degree without examination in 1814
- Babbage sought a method by which mathematical tables could be calculated mechanically, removing the high rate of human error

Design of computers

Part of Babbage's difference engine, assembled after his death by Babbage's son, using parts found in his laboratory

The London Science Museum's Difference Engine #2, built from Babbage's design.

Analytical Engine



Ada Lovelace

- First computer programmer.
- She wrote the programs for the analytical engine

Analytical Engine

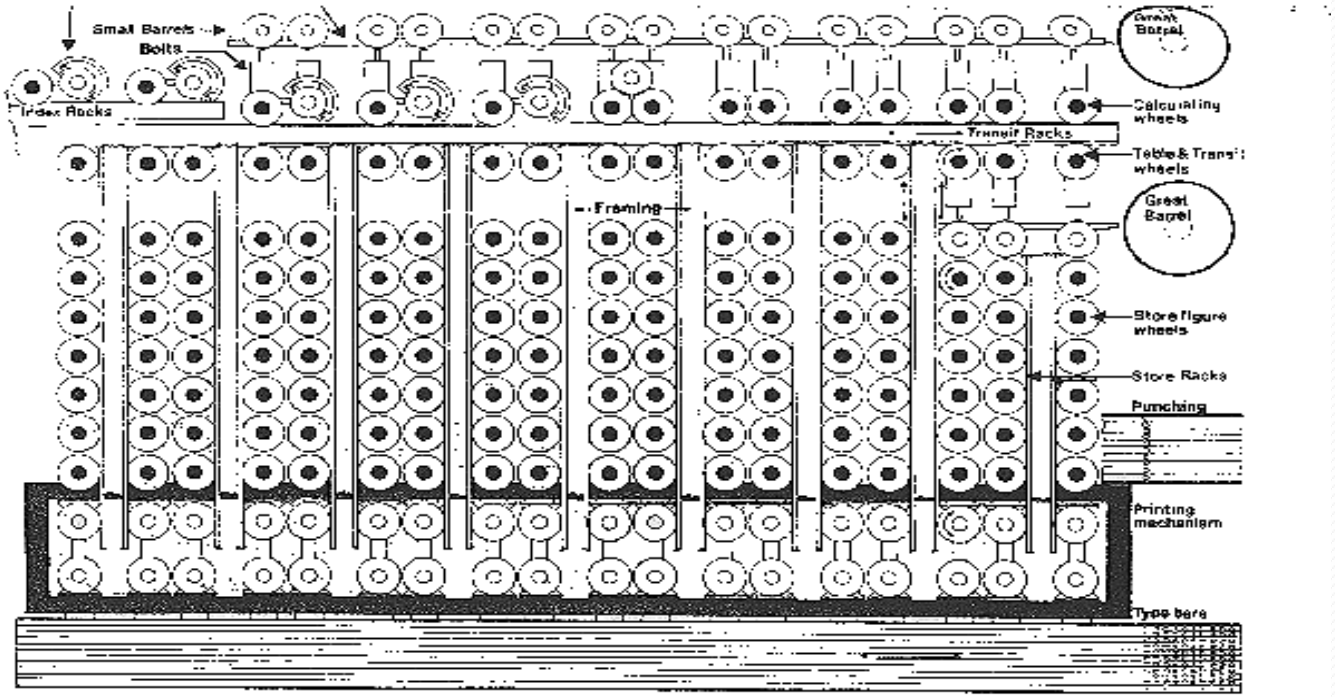
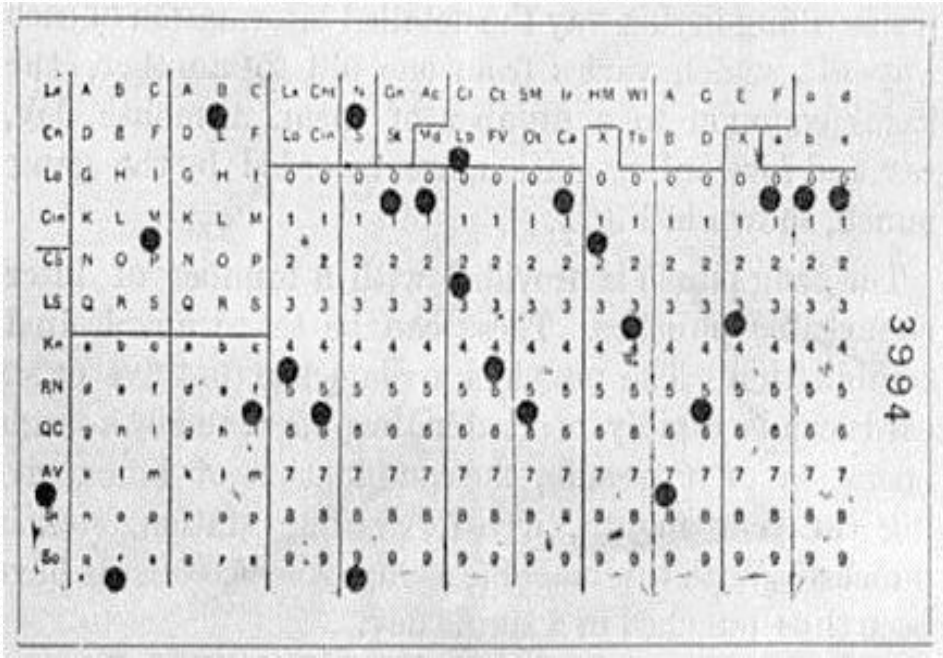


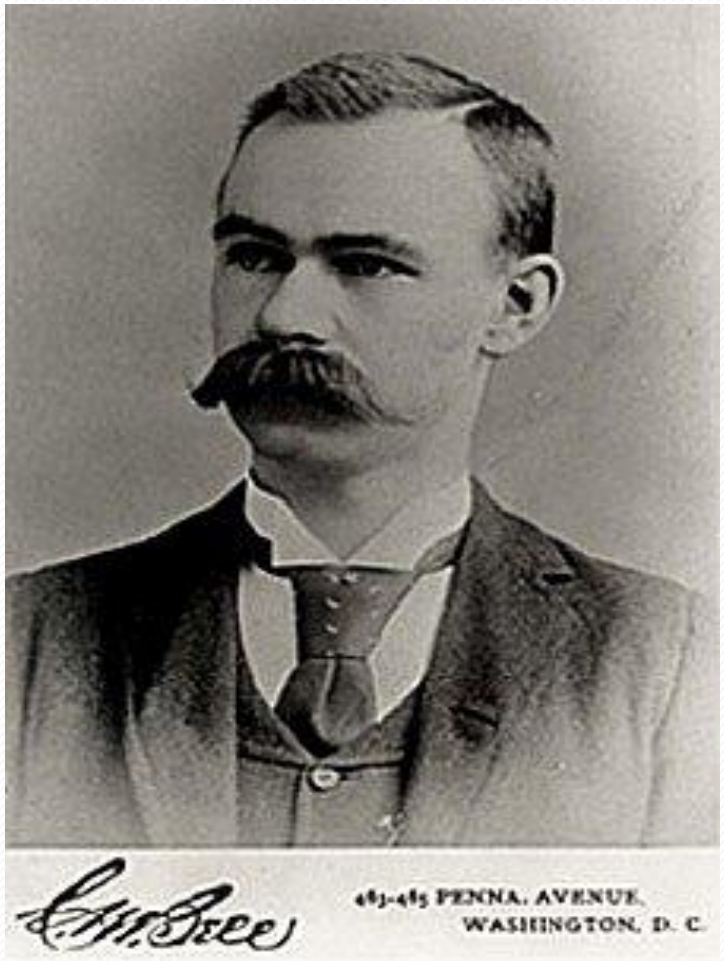
Fig. 2. Plan of Analytical Engine with grid layout, 1858 Redrawn

Analytical Engine

Herman Hollerith (1860-1929)



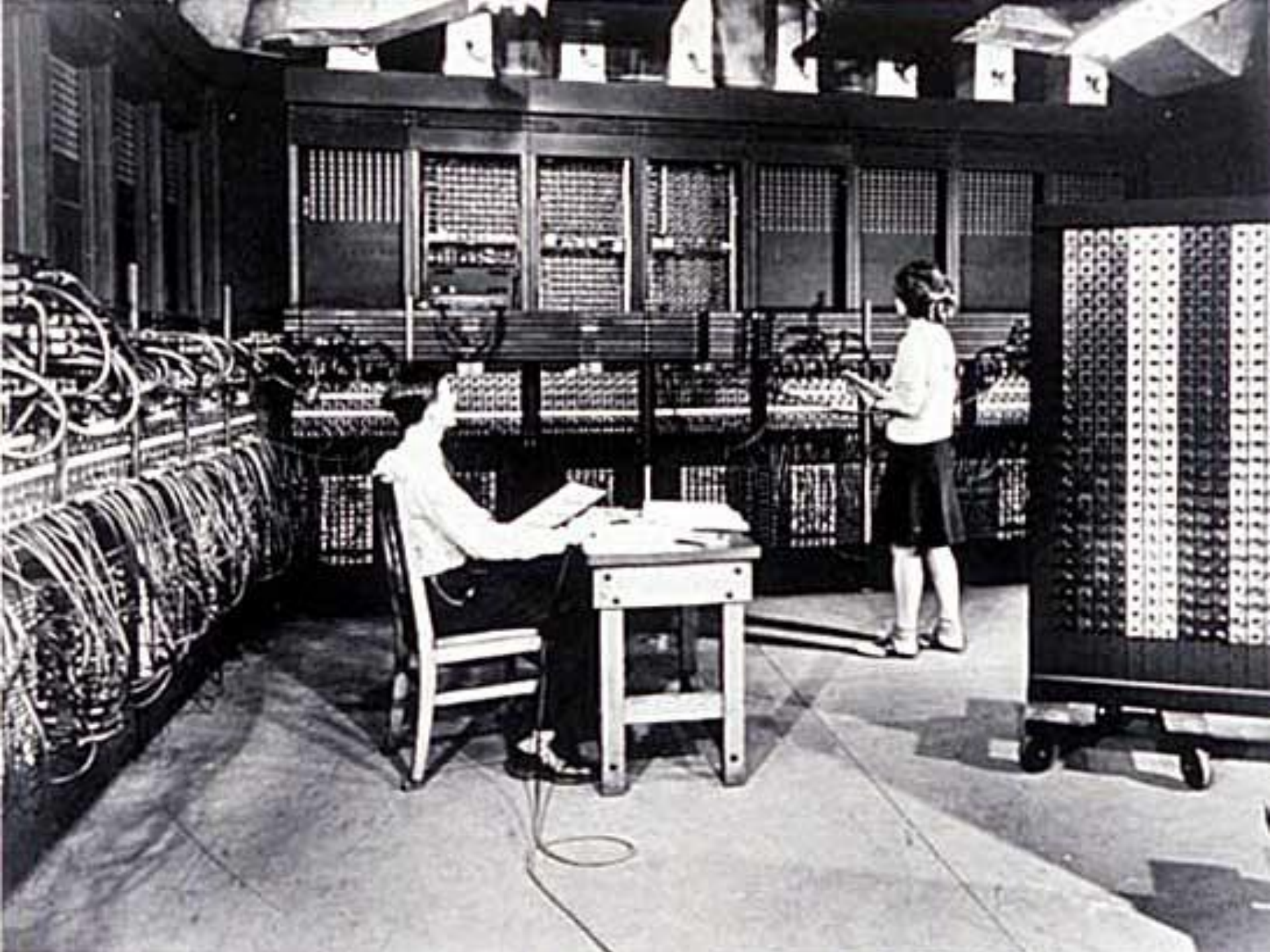
Hollerith punched card

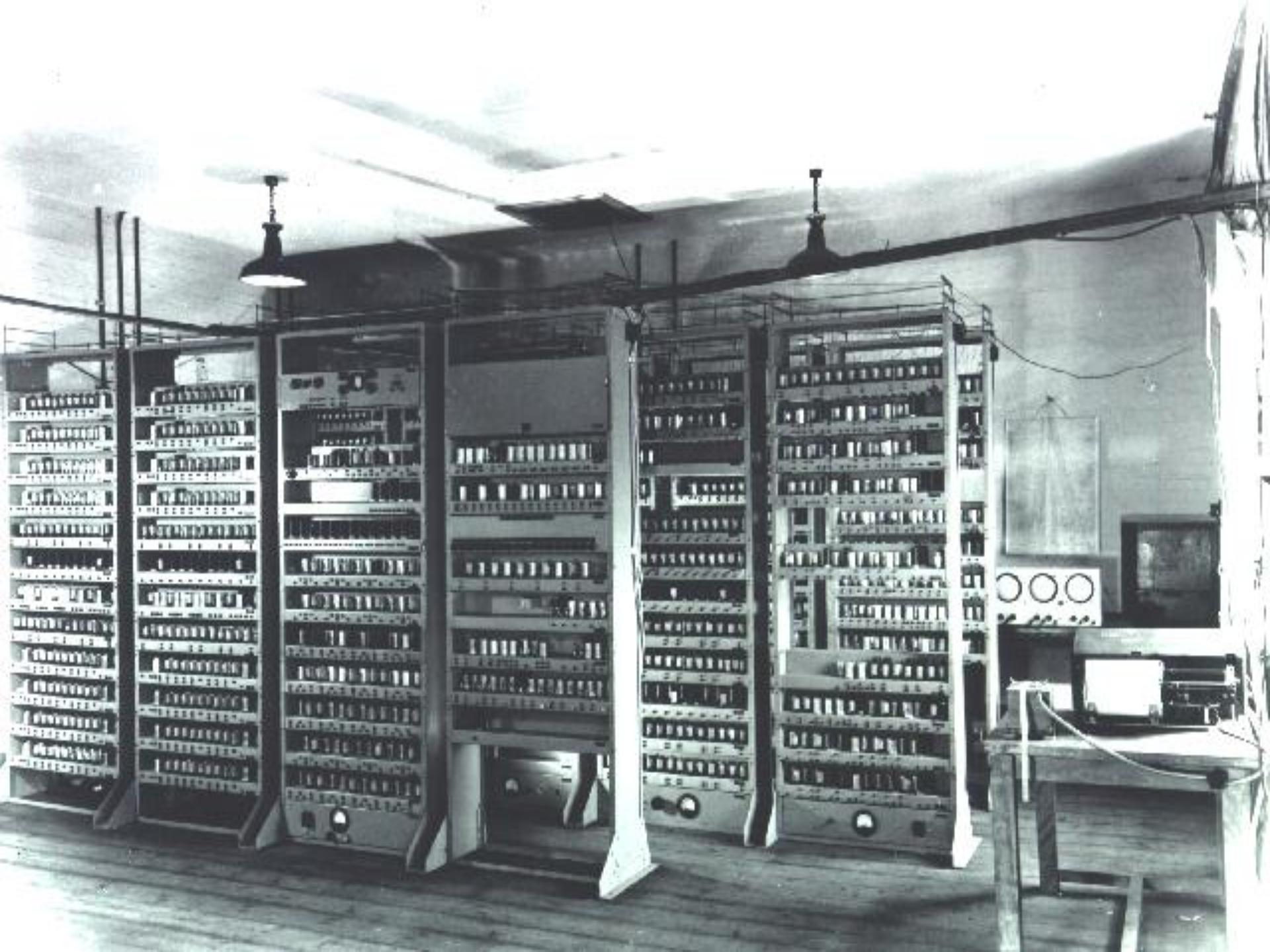


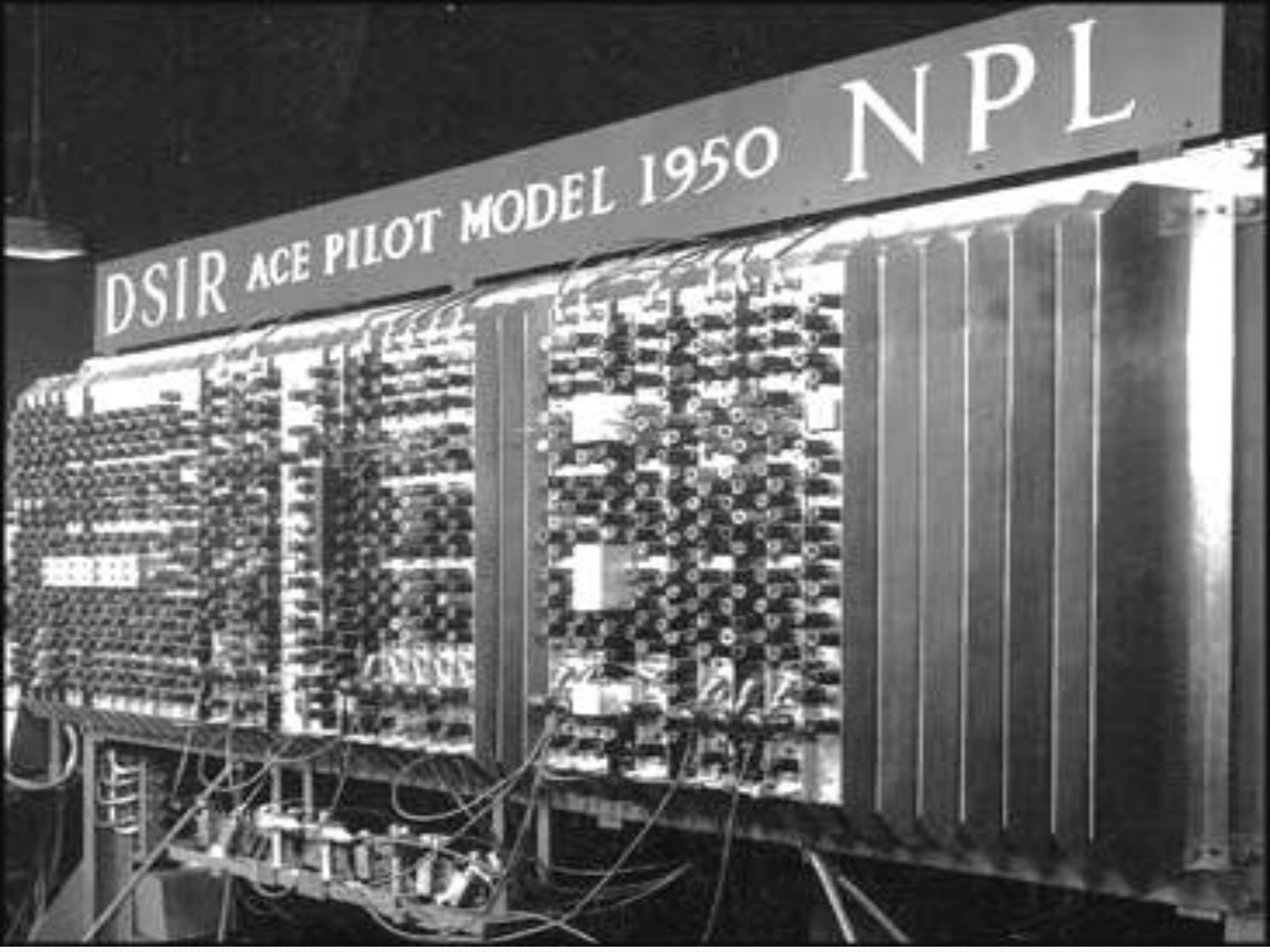
Electronic Numerical Integrator and Computer

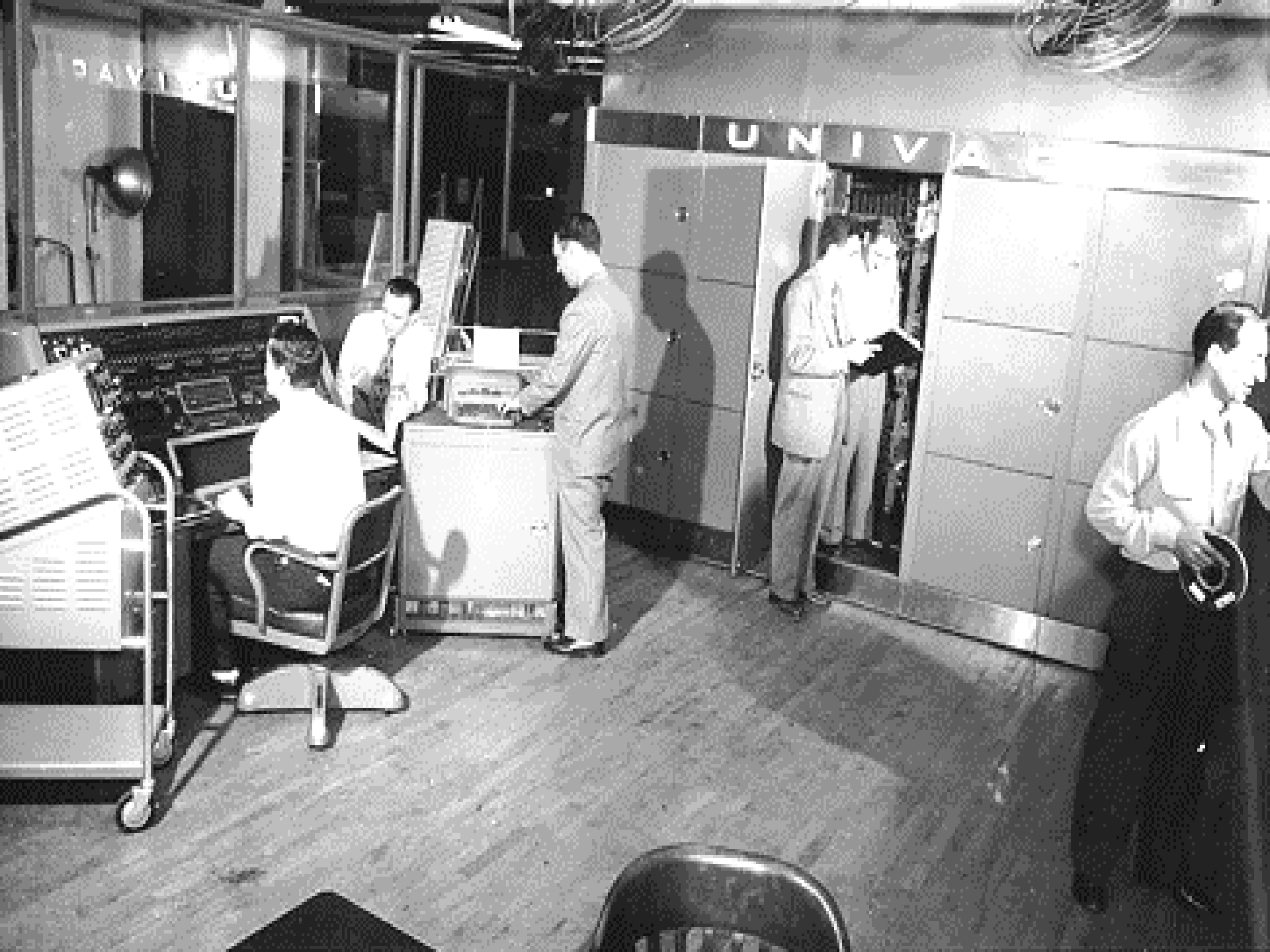
- ***1st large scale electronic digital computer***
- Designed and constructed at the *Moore School* of Electrical Engineering of the University of Pennsylvania

ENIAC at Moore School, University of Pennsylvania






DSIR ACE PILOT MODEL 1950 NPL


UNIVA

John Mauchly leaning on the UNIVersal Automatic Computer

Assabet Mills, Maynard

Microprocessors?

The Microprocessor

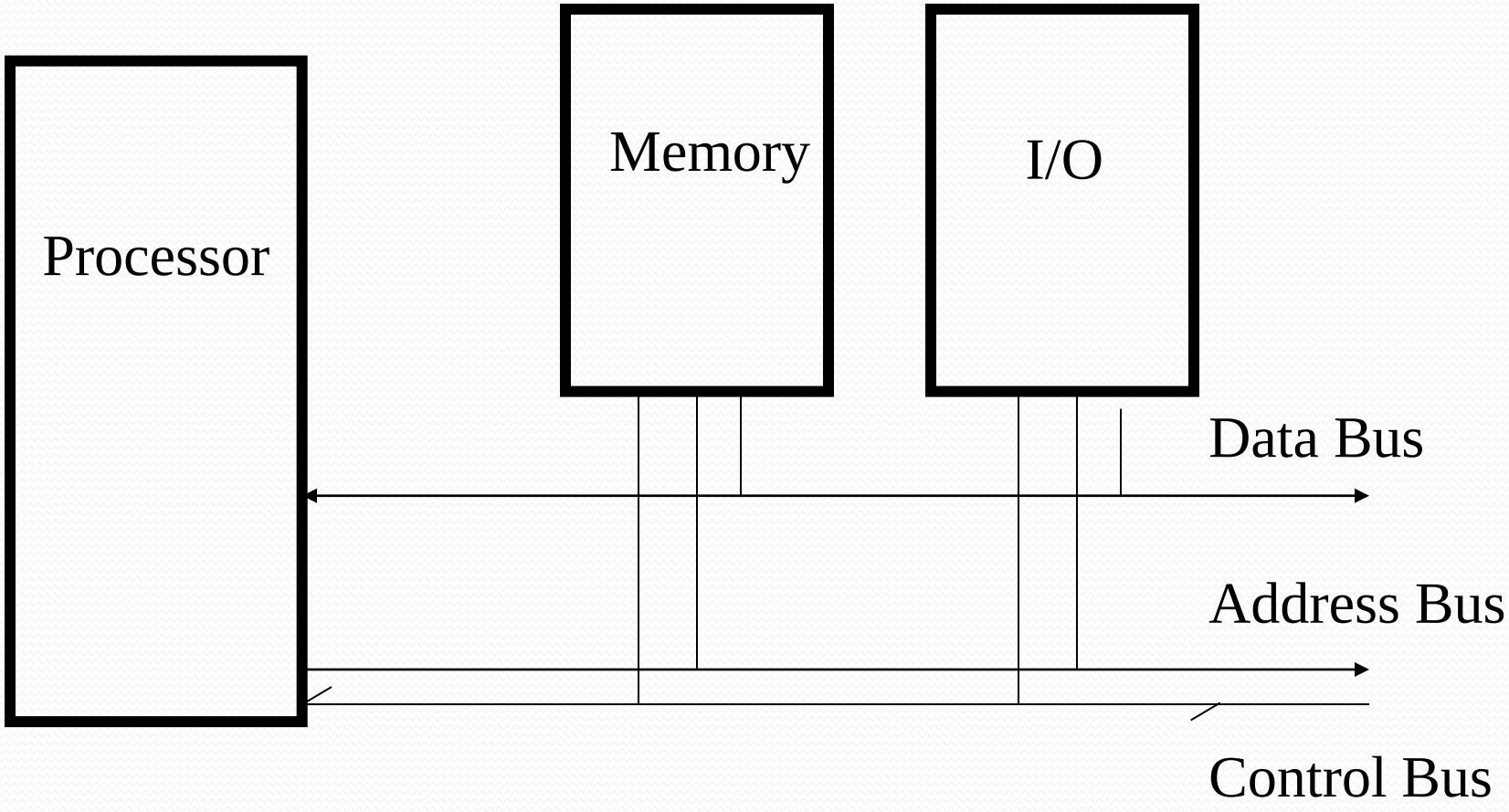
- The silicon chip that contains the CPU where most calculations take place
- Microprocessors are distinguished by 3 characteristics
  - Instruction set: the set of instructions that the microprocessor can execute
  - Bandwidth: the number of bits processed in each instruction
  - Clock speed: (MHz) It determines how many instructions/second the processor can execute

Role of The Microprocessor

- Fetch the Instruction from the memory
- Fetch the operands of the Instruction
- Decode the Instruction
- Execute the Instruction
- Output the results

- CPU continuously does the (Fetch-Decode-Execute) Cycle

What is a Computer?



Intel

- Noyce, Moore, and Andrew Grove leave Fairchild and found Intel in 1968
  - focus on random access memory (RAM) chips
- Question: if you can put transistors, capacitors, etc. on a chip, why couldn't you put a central processor on a chip?
- Ted Hoff designs the Intel 4004, the first microprocessor in 1969

The History of Intel's Microprocessors

- Intel 4004
  - 1971, 4-bit
- Intel 8008
  - 1972, 8-bit
  - Originally designed for Datapoint Corp. as a CRT display controller
- Intel 8080
  - 1974, April
  - Apple II -- Steve Jobs and Steve Wozniak 1976, Apple
  - Bill Gates and a fellow student : BASIC, 1975 --> Microsoft
- Intel 8086/8088
  - 1978, 16 bit: 8088, 1979, 8-bit external bus

The History of Intel's Microprocessors

- Intel 80286
  - 1982, 16-bit architecture
  - 24-bit addressing.
  - 16 MB of physical MEM
  - 130,000 Transistors onto a single chip
- Intel 80386
  - 1985, 32 bits
  - 3~5 MIPS (7 MIPS on the 25 MHz chip)
  - memory paging and enhanced I/O permission features
  - 4GB programming model

The History of Intel's Microprocessors

- Intel 80486
  - 1989 Spring
  - 1,200,000 Transistors
  - 386+387+8K data and instruction cache, paging and MMU
- Pentium
  - 1993
  - 110 MIPS on 66 Mhz Chip
  - 16 KB on-chip cache and 64 bit data bus
  - superscalar technology (two instructions/clock)
  - 3.1 million transistors

The History of Intel's Microprocessors

- Pentium Pro
  - 1995, Superscalar(three-way issue)
  - 5.5 million Transistors in the CPU core + 15.5 million Transistors in the secondary cache 8K data, 8K instruction cache
  - 256 KB SRAM secondary cache
  - 133 MHz
- Pentium II
  - Pentium Pro 1997
  - 233, 266, up to 450 MHz
  - 7.5 million Transistors in CPU
  - 512KB in secondary cache

The History of Intel's Microprocessors

- Pentium III
  - 1999
  - Pentium Pro Internet Streaming SIMD Instructions
  - 0.25 micron, 9.5 million Transistors
  - 600 MHz, 550 MHz,...
  - 32 K

Assignment # 1

- Arithmetic in Decimal, Binary, octal and Hexadecimal number systems
- List of Latest available microprocessors from the leading companies.
  - Memory
  - OS supported
  - Bus speed
  - Frequency