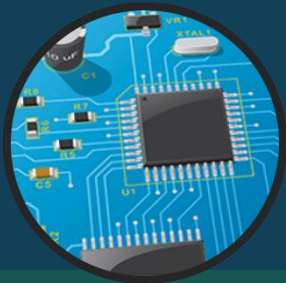


Introduction to Microprocessor



Lecture # 01

Fall 2019



Outlines

- Introduction
 - Instructor
 - Students
 - Course
 - Introduction to μ -processor



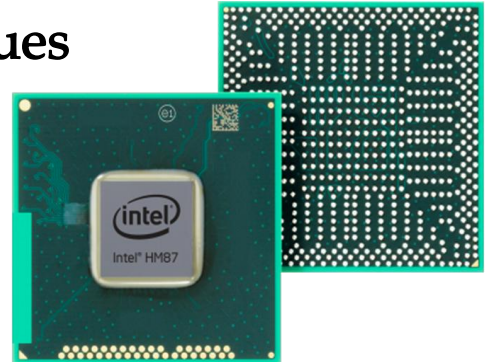
Students: Introduction





Objectives of the Course

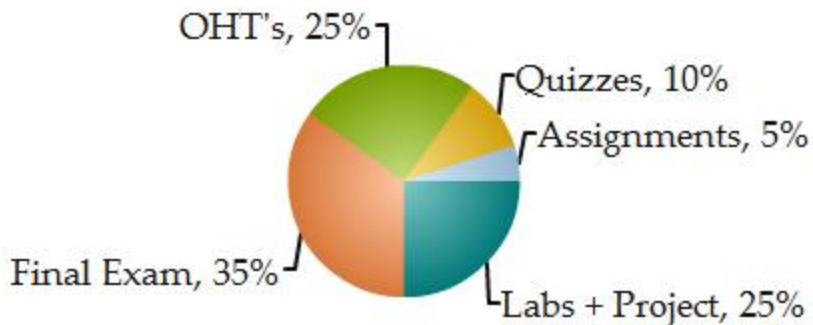
- Understanding of micro-processors
- Writing assembly language programs
- Memory/IO interfacing techniques





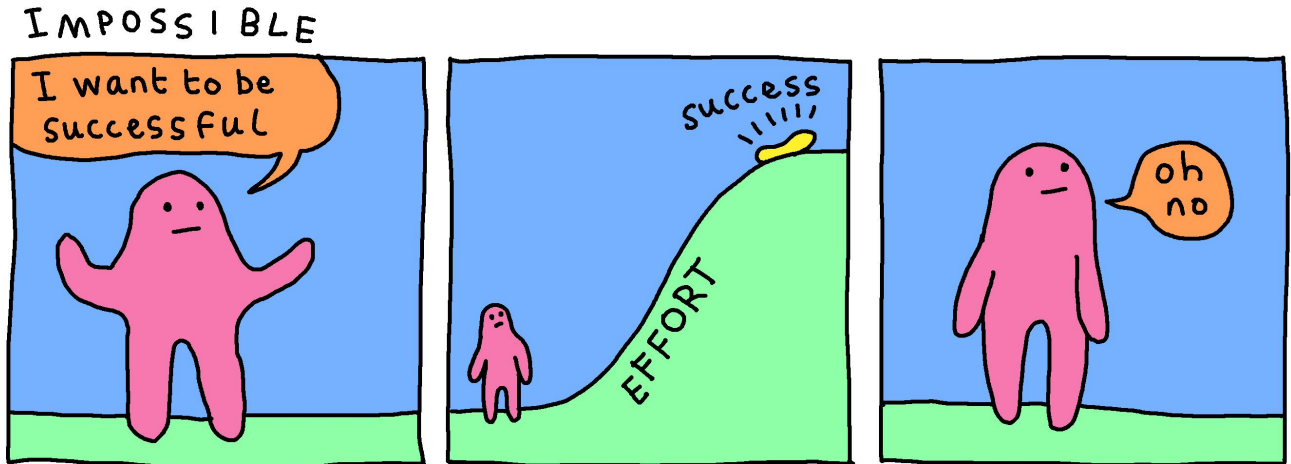
Grading Scheme (Tentative)

Grading Scheme





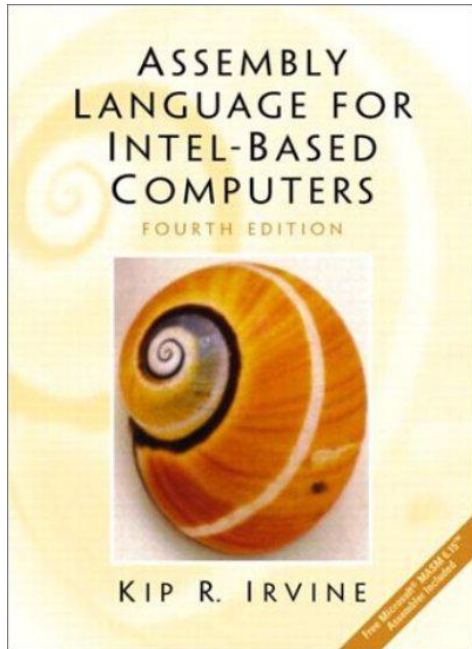
Key to Success



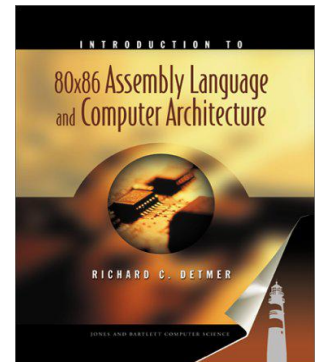
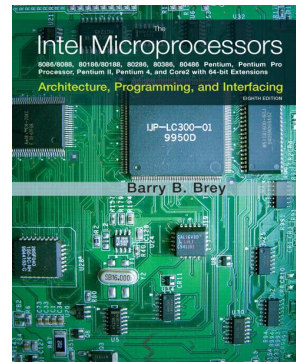
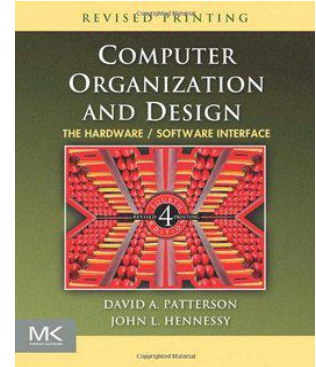
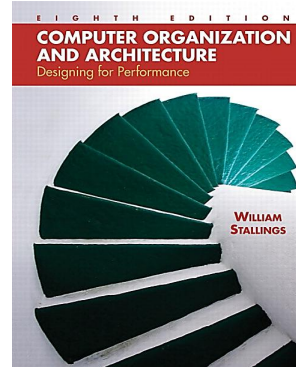


Course Books

Text Book



Reference Book





List of μ -Processor Systems

- Digital computers
- Alarm systems
- Heating systems
- Digital camera
- Digital television
- .mp3 & mp4 players
- Smart phones
- Medical equipment
- Communication equipment





Historical Background

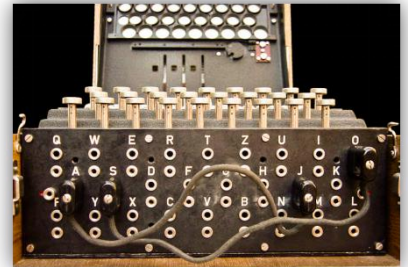
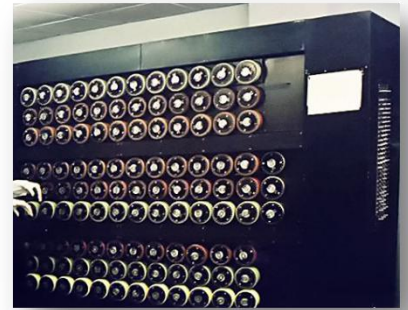
1939

■ Electro-mechanical Computer:-

- Pioneered by:-
Alan Turing
&
Harold Keen



Decrypting Nazi ENIGMA-based military communications during World War II





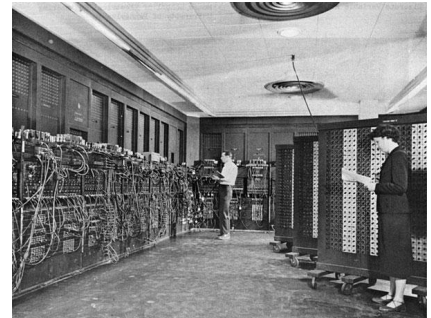
Historical Background

1946

■ ENIAC

Electronic Numerical Integrator & Calculator

- **Invented by:-** J. Presper Eckert & John Mauchly
- Occupied **1800** square feet
- **17468** vacuum tubes
- Weighed almost **50 tons**
- **200 KW** electricity
- Calculate artillery firing tables
- Cost **\$500000**



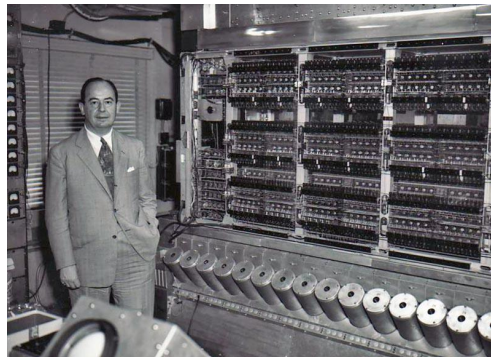
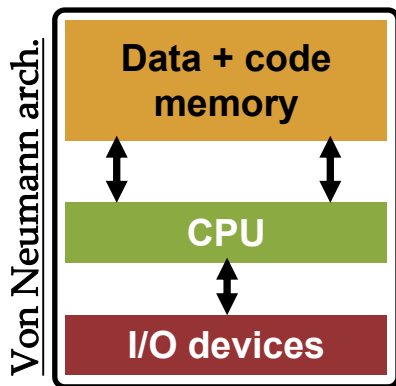
Historical Background

1951

■ IAS machine

Institute for Advanced Study (IAS)

- **Invented by:-** John von Neumann
- Based on machine language (binary)
- **General purpose registers:** Accumulator (AC)





Historical Background

1948

■ Vacuum tube replacement

Transistor vs Vacuum tube



- Low Power efficient
- Reduced size
- Increased speed
- High density
- High reliability

- High Power usage
- Impractical size
- Medium speed



Historical Background

Gen.	Dates	Technology	Speed	Time/Ops
1	1946-57	Vacuum tube	40 KHz	25 μ s
2	1958-64	Transistor	200 KHz	5 μ s
3	1965-71	Small & medium scale I.C.	1 MHz	1 μ s
4	1972-77	LSI	10 MHz	100 ns
5	1978-...	VLSI	100 MHz	10 ns



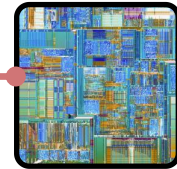
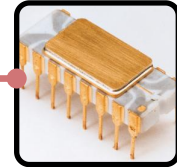
Evolution of μ -processor

4-bit μ -processor

1971

■ Intel 4004 μ – processor

- First commercially available microprocessor
- Initial transistor count: 2,300 transistors.
- Memory Address: 12 bits
- Clock speed: 740 KHz
- Uses: Calculators





Evolution of μ -processor

8-bit μ -processor

1971

■ Intel 8008 μ – processor

- Transistor count: **3500 transistors**.
- Clock speed: 0.8 MHz
- Memory address width : 14 bits (16KB)

1973

■ Intel 8080 μ – processor

- Transistor count: **6000 transistors**.
- Clock speed: 2-3 MHz
- Memory address width : 16 bits



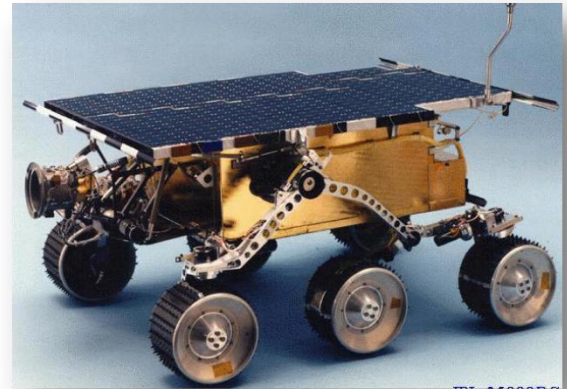
Evolution of μ -processor

1971

■ Application: NASA Sojourner Rover

Embedded on-board computer was based around

- 176 KB of flash memory solid-state storage
- 2 MHz Intel 80C85 CPU
- 512 KB of RAM



8-bit μ -processor



Evolution of μ -processor

1978

Intel 8088, 8086 micro-processor

16-bit μ -processor

Parameter	8088	8086
Clock	4-8 MHz	5-10MHz
Transistor count	29000	29000
Address bus	20	20
External Data bus	8	16
Addressable memory	1MB	1MB

- International Business Machines(IBM) decided to use the **8088 in its first ever PC** in 1981 making it very popular



Evolution of μ -processor

Intel 80x86 family

The 80286, 16-bit microprocessor

- Addresses a 16 M byte memory
- Speed @ 4 MIPs

1986

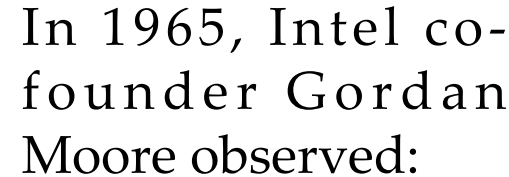
The 80386 was introduced in 1986

- It was the first 32-bit microprocessor that contained a 32-bit data bus and a 32-bit address bus.

1989

The 80486 was introduced in 1989

- It had an 8K byte cache memory in addition to being faster than the .386





Micro-processor Revolution

VISUALIZING PROGRESS

If transistors were people

If the transistors in a microprocessor were represented by people, the following timeline gives an idea of the pace of Moore's Law.



2,300

Average music hall capacity



134,000

Large stadium capacity



32 Million

Population of Tokyo



1.3 Billion

Population of China



Now imagine that those 1.3 billion people could fit onstage in the original music hall. That's the scale of Moore's Law.

https://www.thirstt.com/media/images/tbooks/5662d9083b49b3794470d5d3/uploads/044f37_1000.jpg



Intel Pentium Processor

- **Intel Pentium Microprocessors**
 - Introduced in 1993
 - 16K byte Cache Memory
 - 4G Bytes of Memory
 - Speed @ 150 MIPs
 - Data bus width increased to 64-bit
- Later Pentium versions are up-gradations of above specifications in terms of **Speed, Memory(levels of caches) and more complex instruction set.**



Example: Segway Robot

Powered by:

intel Atom processor

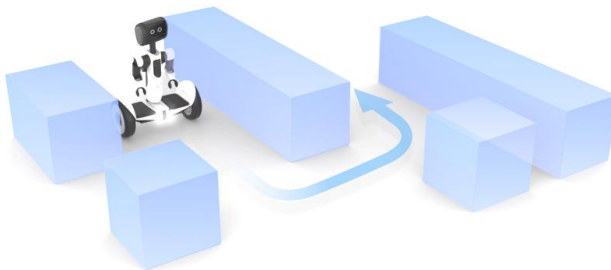


It can:-

See (depth sensing camera)

Talk interactively (AI)

Navigate autonomously



<http://robot.segway.com/>

[22]



Example: Boston Dynamics Robots

Advanced robotics designs

- List of robots
 - **Atlas** (The Agile Anthropomorphic Robot)
 - **Cheetah** (Fastest Legged Robot)
 - **Spotmini**
 - **BigDog**

Video



<https://www.youtube.com/watch?v=4o0FZalxIYw>

Questions?

THANK YOU!