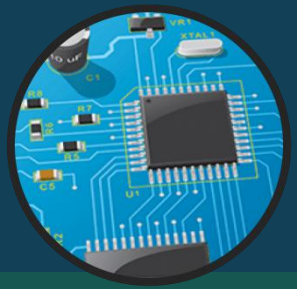
CS-235: Computer Organization & Assembly Language

Introduction to Microprocessor



Lecture # 01

Fall 2019

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Outlines

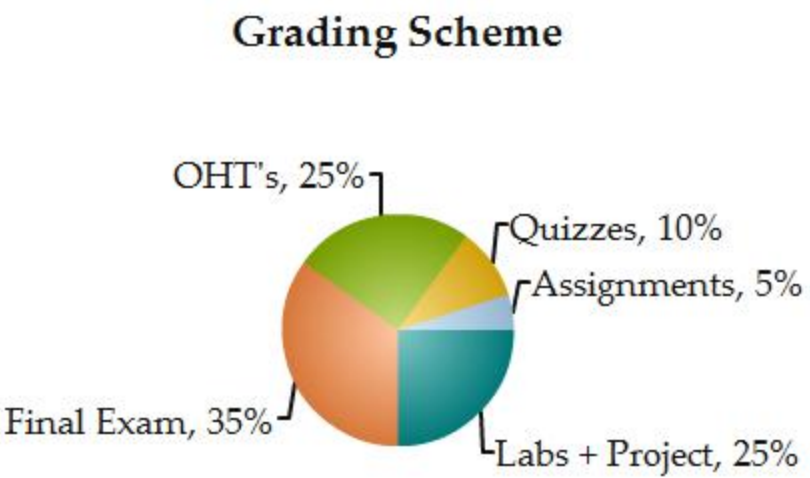
- Introduction
  - Instructor
  - Students
  - Course
  - Introduction to μ-processor

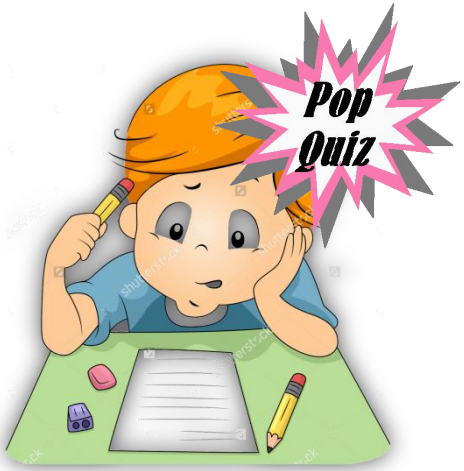
Students: Introduction

Objectives of the Course

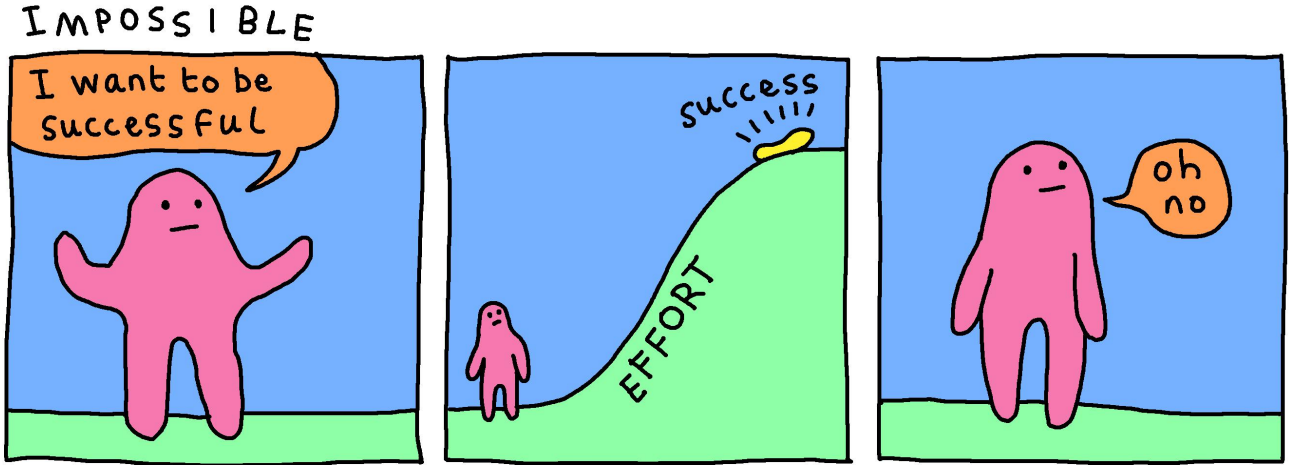
- Understanding of Intel's 80XXX series of processors
- Writing assembly language programs
- Memory interfacing techniques

Grading Scheme (Tentative)





Key to Success



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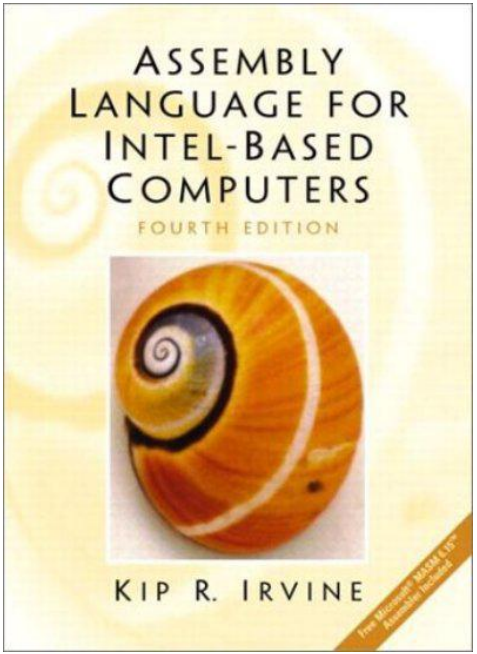
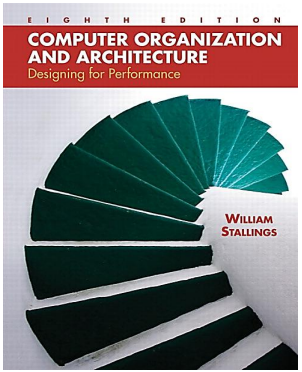
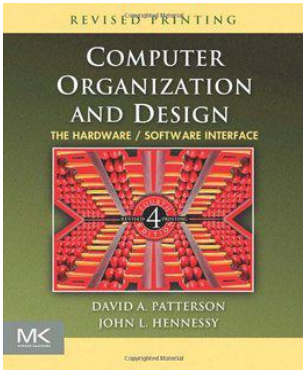
Course Books

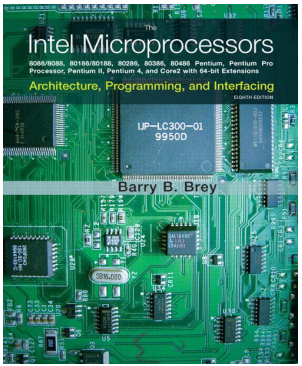
Text Book

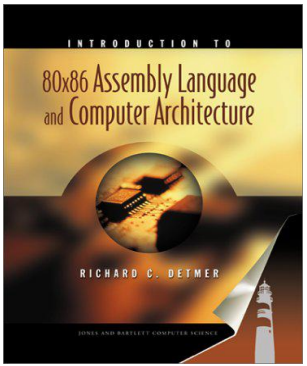


Reference Book









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List of μ-Processor Systems

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

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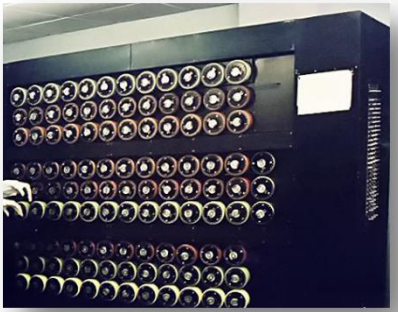
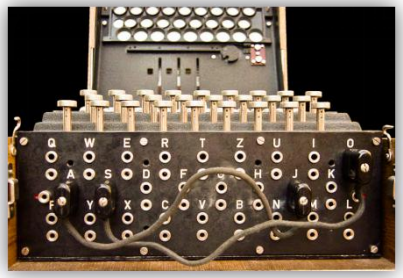
Historical Background

1939

- **Electro-mechanical Computer:-**

- **Pioneered by:-**
  Alan Turing
  &
  Harold Keen





Decrypting Nazi ENIGMA-based military communications during World War II

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Historical Background

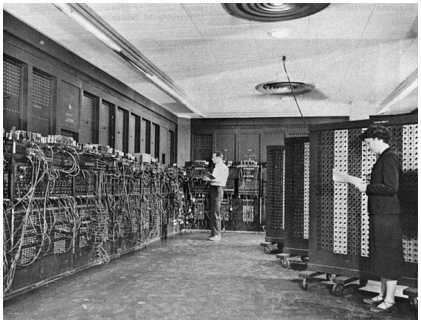
1946

- **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



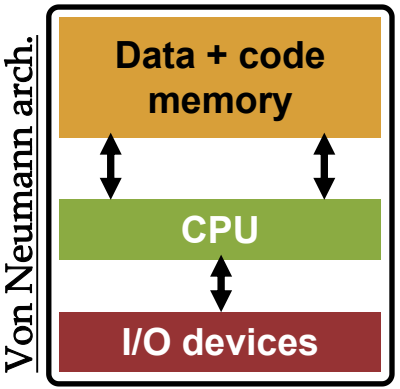
Historical Background

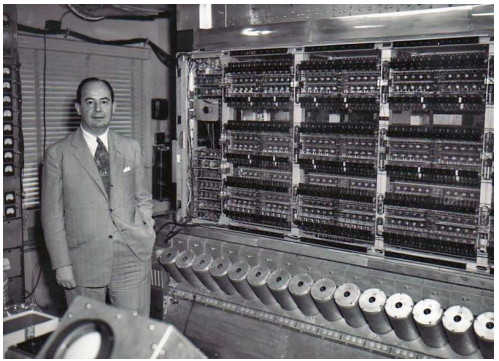
1951

- **IAS machine**

  Institute for Advanced Study (IAS)

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





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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

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Historical Background

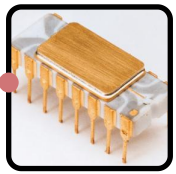
Gen.	Dates	Technology	Speed	Time/Ops
1	1946-57	Vacuum tube	40 KHz	$25\mu s$
2	1958-64	Transistor	200 KHz	$5\ \mu s$
3	1965-71	Small & medium scale I.C.	1 MHz	$1\ \mu s$
4	1972-77	LSI	10 MHz	100 ns
5	1978-…	VLSI	100 MHz	10 ns

Evolution of μ-processor

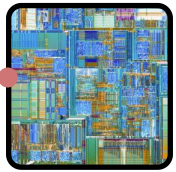
1971

4-bit μ-processor

- **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

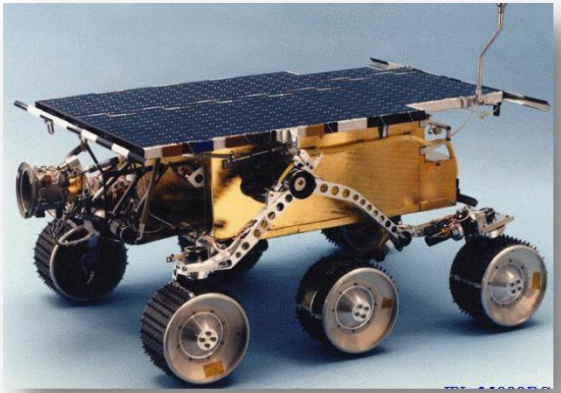
8-bit μ-processor

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



Evolution of μ-processor

16-bit μ-processor

1978 — Intel 8088, 8086 micro-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

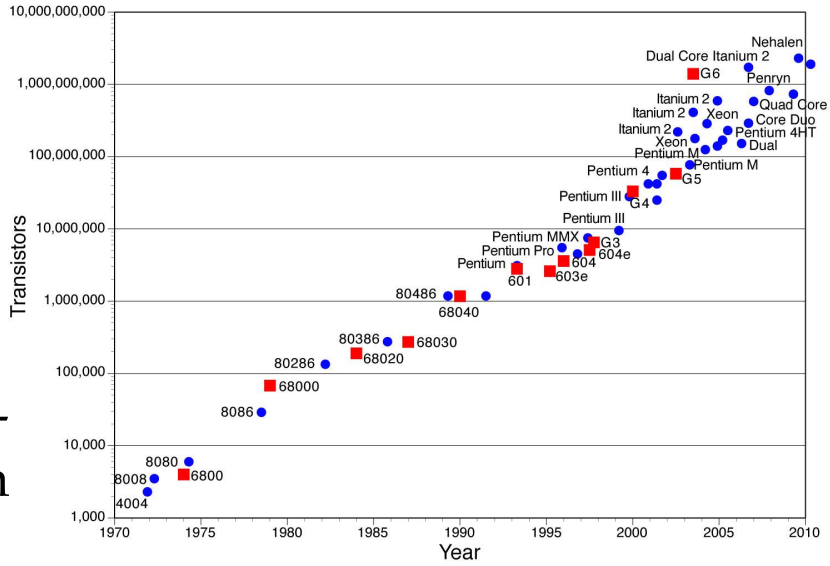
- It was the first 32-bit microprocessor that contained a 32-bit data bus and a 32-bit address bus.

1989

The 80486 was introduced in 1989

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

Moore's Law



In 1965, Intel co-founder Gordan Moore observed:

The **number of transistors per square inch on integrated circuits had doubled every year** since their invention

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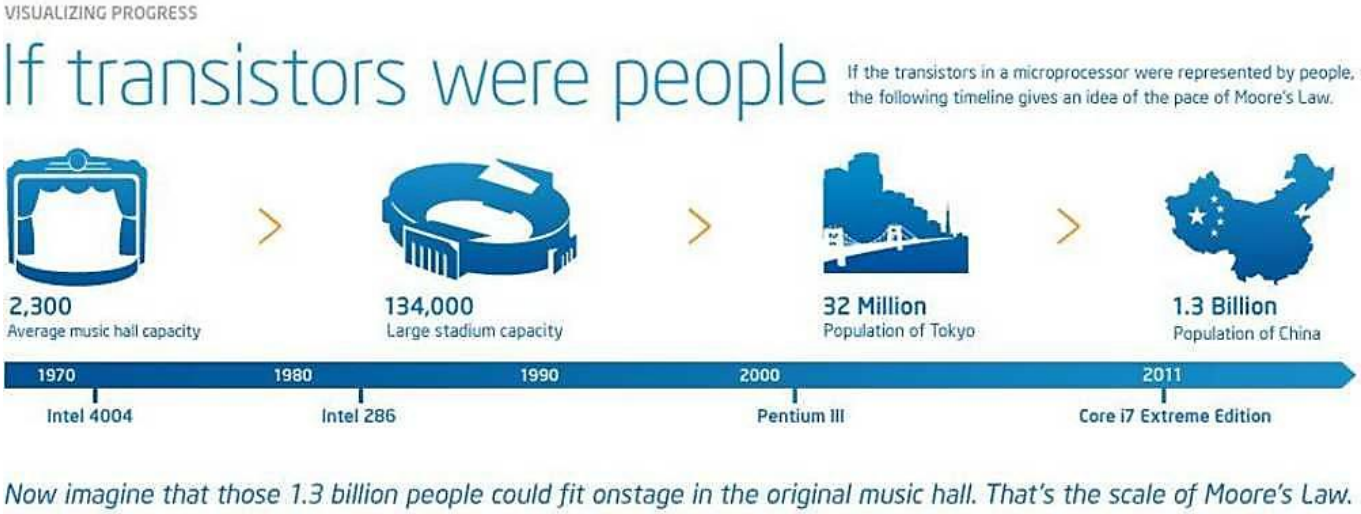
Micro-processor Revolution



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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.

http://robot.segway.com/

Example: Segway Robot

Powered by:

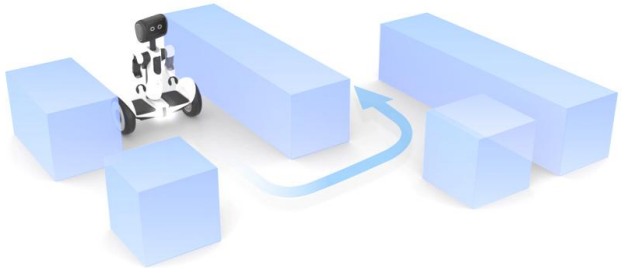
intel Atom processor

It can:-

See (depth sensing camera)

Talk interactively (AI)

Navigate autonomously



http://robot.segway.com/

Example: Boston Dynamics Robots

Advanced robotics designs

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

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Video

https://www.youtube.com/watch?v=d2D71CveQwo

Questions?

THANK YOU!