جامعة الملك سعود
King Saud University

# CSC 220: Computer Organization


## Unit 0
## Introduction

# Course Introduction

## Section Instructors:

## Section Instructor:


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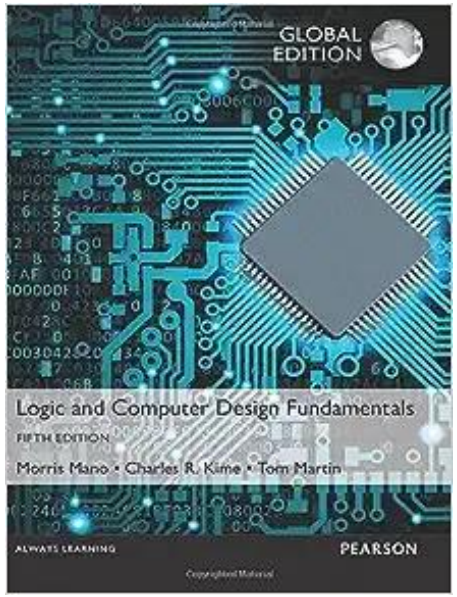
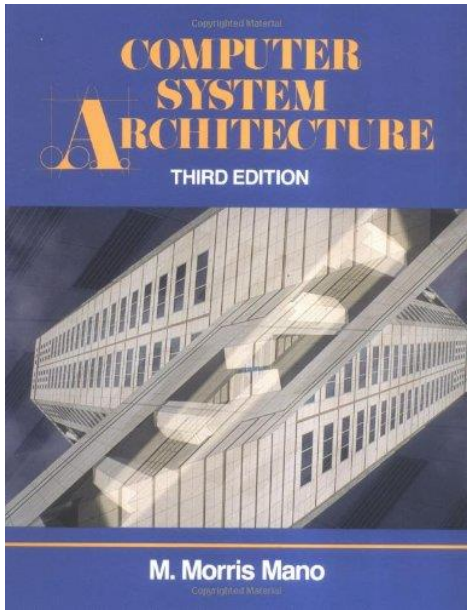
# Course Introduction

## Text Books

1. M. Morris Mano, Charles R. Kime and Tom Martin, **Logic and Computer Design Fundamentals**, 5th (Global) Edition, Pearson Education Limited, 2016. ISBN: 9781292096124

2. Morris Mano, **Computer System Architecture** - 3rd Edition, Publisher: McGraw Hill




**Class Note** based on the main text (Available at the LMS)

# Course Introduction

**CSC220 - Computer Organization (2-2-1) - Required Course**

**Pre-requisites:** MATH 151 - Discrete Mathematics

## Topics

- Data Representation: binary number systems, signed number systems, use of 1's and 2's complements in addition and subtraction
- Logic gates, Logic function, K-Map simplification
- Combinational circuits: Multiplexer, De-multiplexer, Decoder, Arithmetic circuits
- Sequential circuits: register, binary counters, and memory organization
- Arithmetic and Logic Unit design, Central Processing Unit design
- Register, Register Transfer Language, and micro-operations instruction set
- CPU design and programming

# Course Introduction

## CSC 220: Course Learning Outcomes

Upon completing CSC220, students should be able to:

1. Write a simplified logic function
2. Design combinational circuits such as Adder, Multiplexer, Decoder
3. Identify different components of a computer system (e.g. ALU, registers, RAM, Control Unit)
4. Design a basic Arithmetic and Logic Unit (ALU)
5. Recognize appropriate combinational and sequential circuits for CPU design
6. Describe instruction set architecture
7. Write simple program in register transfer language (RTL) and assembly language

# Course Introduction

## Assessment Methods:

| Assessment | Grades |
|---|---|
| Homework | 5% |
| Midterm1 | 25% |
| Quiz | 10% |
| Project + Lab Evaluation | 10% |
| Final Lab | 10% |
| Final Exam | 40% |

## Important Dates

| Exam | Date | time |
|---|---|---|
| Midterm Exam | Wednesday, February 19, 2025 | 12:00-1:30 |
| Quiz | Sunday, April 20, 2025 | 12:00-12:50 |
| Lab Exam | Monday, April 28, 2025 | 12:00-1:30 |
| Final Exam | Tuesday, May 27, 2025 | 8:00-11:00 |

# Course Introduction

## Course Plan (tentative)

| Week | Date | Lecture | | Tutorial | LAB | desc |
|---|---|---|---|---|---|---|
| | | TUES | THU | | | |
| 1 | 1/5/2025 | Unit-1Number System | Unit-1Number System | Orientation+Introduction | | |
| 2 | 1/12/2025 | Unit-2 Digital Circuit Design | Unit-2 Digital Circuit Design | T1-Number System | Introduction | |
| 3 | 1/19/2025 | Unit-3 Simplification | Unit-3 Simplification | T2-Logic Circuit Design | Lab1 Logic gates | |
| 4 | 1/26/2025 | Unit-4 Signed Number Representation | Unit-4 Signed Number Representation | T3-Kmap | Lab2_Kmap | |
| 5 | 2/2/2025 | Unit-5 Combinational Circuit-1 | Unit-5 Combinational Circuit-1 | T4- Number Representation | | |
| 6 | 2/9/2025 | Unit-6 Combinational Circuit-2 | Unit-6 Combinational Circuit-2 | T5-Combinational Ckt 1-Adder | Lab3_Adder | |
| 7 | 2/16/2025 | Unit-7 Sequencial Circuit | Unit-7 Sequencial Circuit | T6-Combinational Ckt 2 MUX,Decoder | Lab4 MUX Decoder | |
| 8 | 2/23/2025 | Unit-8 Registers & RTL | Unit-8 Registers & RTL | No Tutorial due to FHD | | |
| 9 | 3/2/2025 | Unit-9 Counters & RAM | Unit-9 Counters & RAM | T7-Flip Flop /T8- Registers & RTL | Lab6 Register | |
| 10 | 3/9/2025 | Unit-9 Counters & RAM | Unit-9 Counters & RAM | T8- Registers & RTL | | |
| 11 | 3/16/2025 | | | | | |
| 12 | 3/23/2025 | | | | Eid Alfiter BREAK | |
| 13 | 3/30/2025 | | | | | |
| 14 | 4/6/2025 | Unit-10 ALU Design | Unit-10 ALU Design | T8- Registers & RTL /T9-Counter-RAM | Lab7_Counter | |
| 15 | 4/13/2025 | Unit-11 Datapath Design | Unit-11 Datapath Design | T10-ALU | Lab8 AU | |
| 16 | 4/20/2025 | Unit-12 CPU Design & Programming | Unit-12 CPU Design & Programming | T11 -Datapath Design | Lab9_ALU+Shifter | |
| 17 | 4/27/2025 | | | T12 -CPU Programming | | |
| 18 | 5/4/2025 | | | | | |
| 19 | 5/11/2025 | | | | | |
| 20 | 5/18/2025 | | | | | |
| 21 | 5/25/2025 | | | | Final EXAM 27-5-2025 | |

# Course Introduction

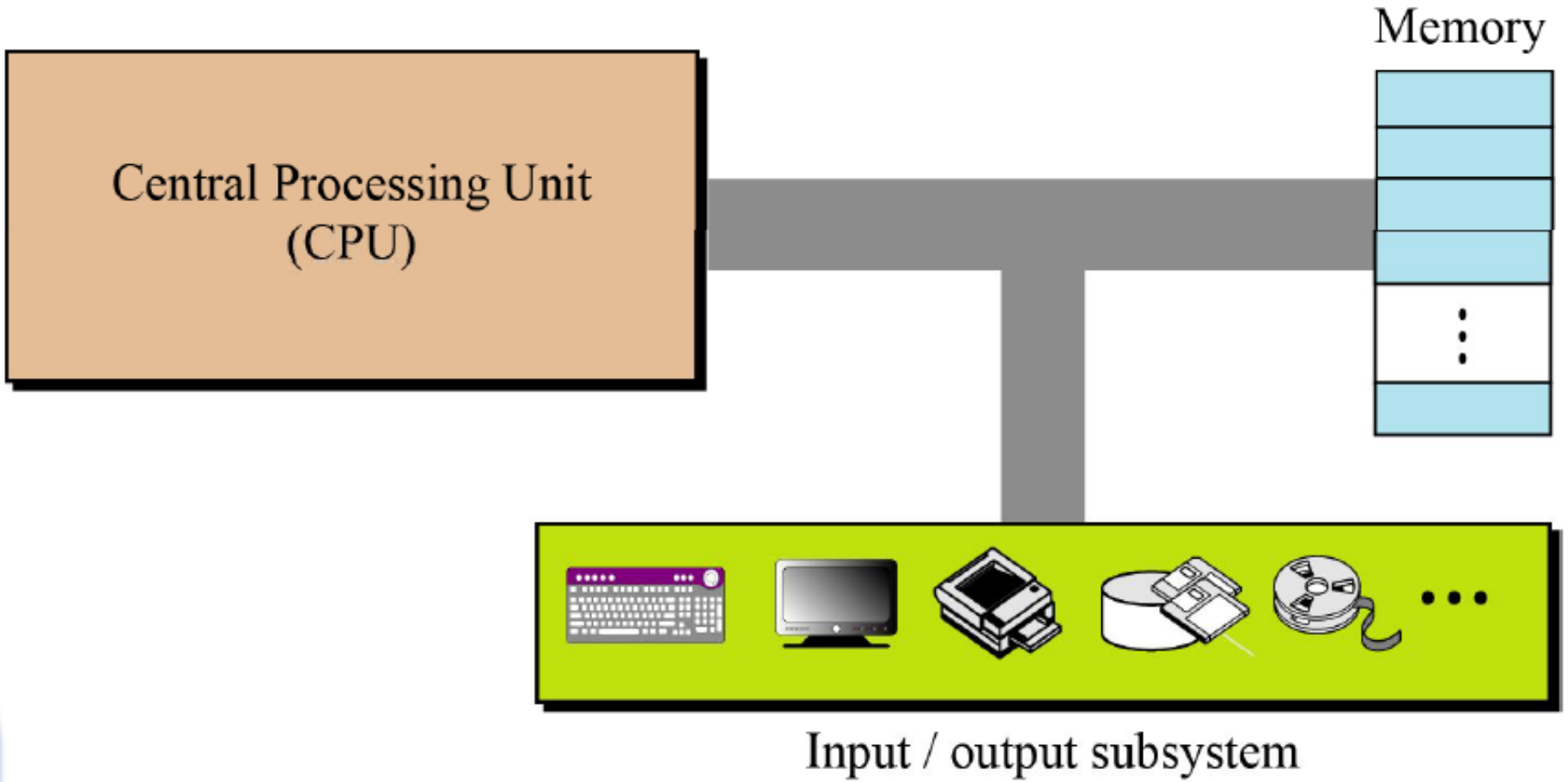
| Assessment | Grades | due-date | |
|---|---|---|---|
| | | date | time |
| HW1 | 2% | Thursday, 13 February 2025 | 11:59 PM |
| HW2 | 3% | Thursday, April 17, 2025 | 11:59 PM |
| Midterm1 | 25% | **Wednesday, February 19, 2025** | 12:00-1:30 |
| Quiz | 10% | **Sunday, April 20, 2025** | 12:00-1:00 |
| Project | 5% | Thursday, April 24, 2025 | 11:59 PM |
| Lab EXAM | 10% | Monday, April 28, 2025 | 10:00-11:30 |
| Final Exam | 40% | **Tuesday, May 27, 2025** | 8:00-11:00 |
| Weekly Evaluation | 5% | Every Week starting from second week | |

# Course Introduction

## Attendance Rules

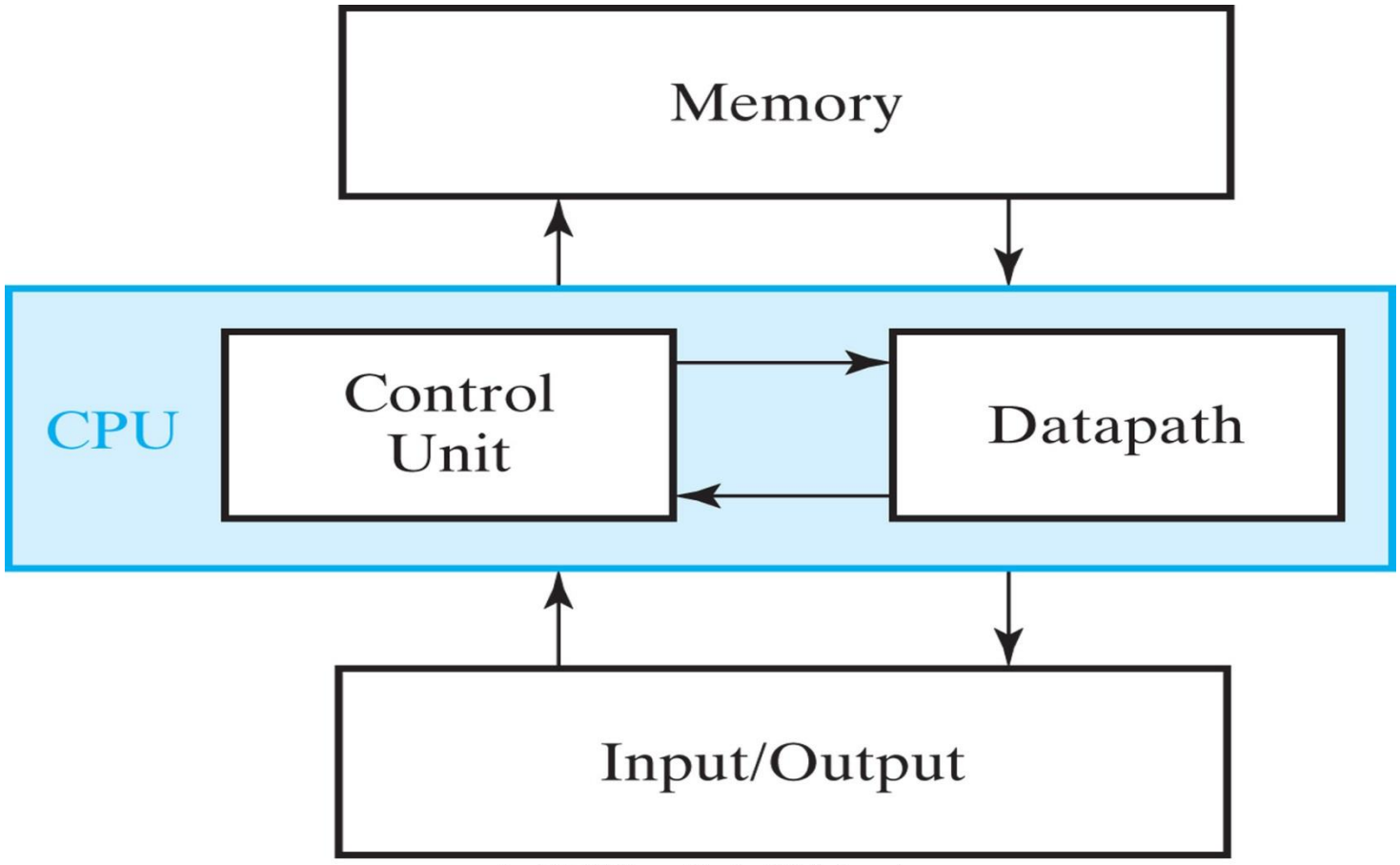
- **Student must attend 75% of lectures.**
- **Student is the responsible about counting her absence.**
- **Student must enter the lecture room BEFORE the lecture starts.**
- **If student decides to miss a lecture for personal reasons, no action needed.**
- **If a student missed the midterm or final exams, she should contact the exam committee;**
- **if a student missed a quiz, or lab evaluation no backup.**

# Computer Hardware (Subsystems)

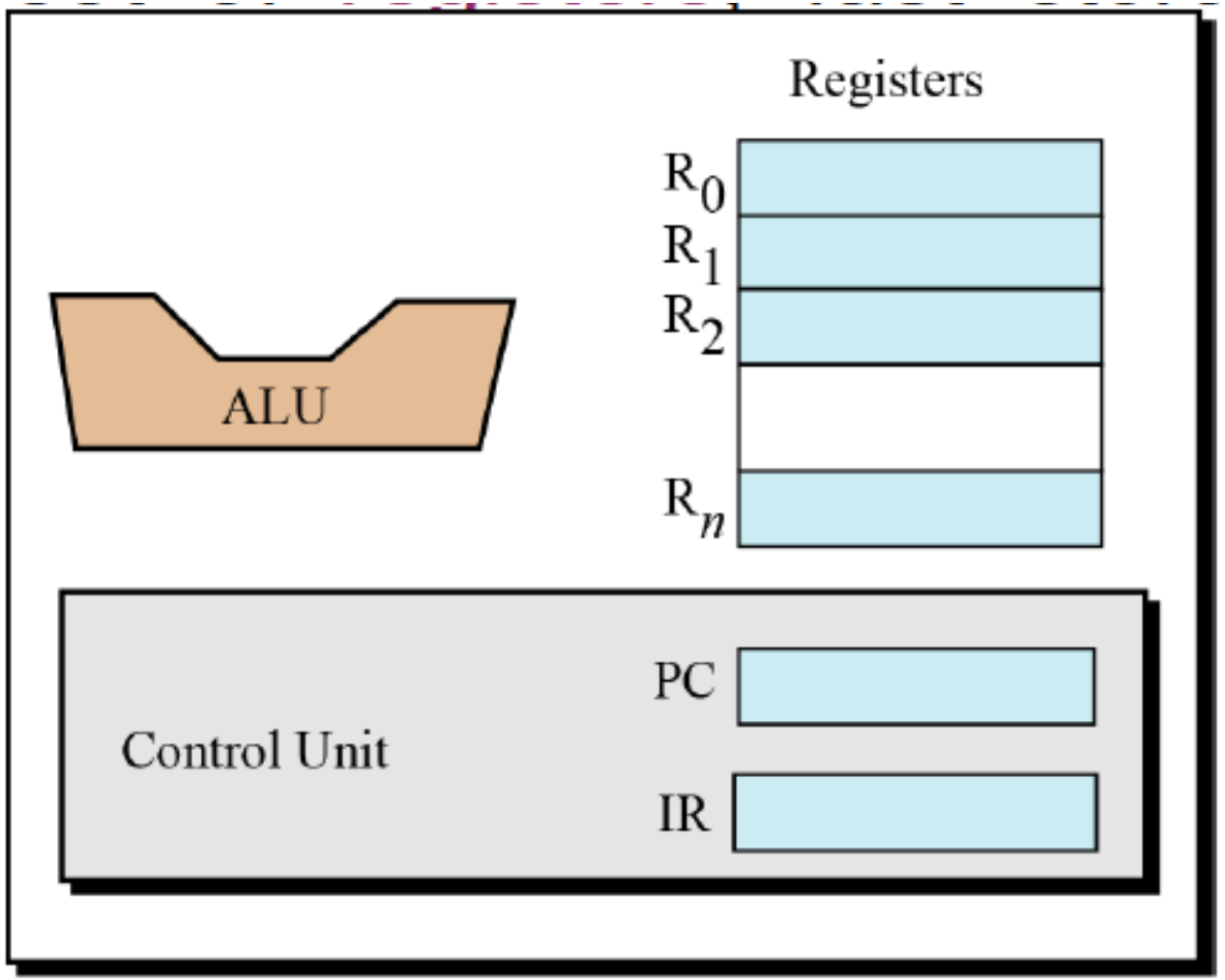


# Course Introduction

## A Digital Computer



# Central Processing Unit (CPU)



# Layers of Abstraction

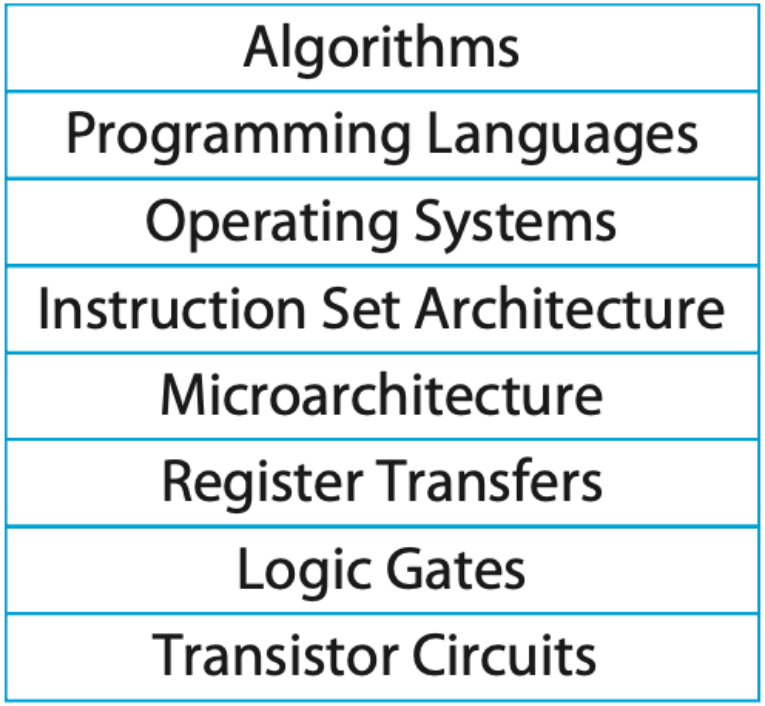



**FIGURE 1-5**
Typical Layers of Abstraction in Modern Computer Systems

# First Generation (1951–57)

## *First Generation- Vacuum Tubes*

***ENIAC:*** Generally regarded as the first electronic computer:

Programmed by manually setting switches

full **Electronic Numerical Integrator and Computer**

vacuum tube :made of glass, size of lightbulbs

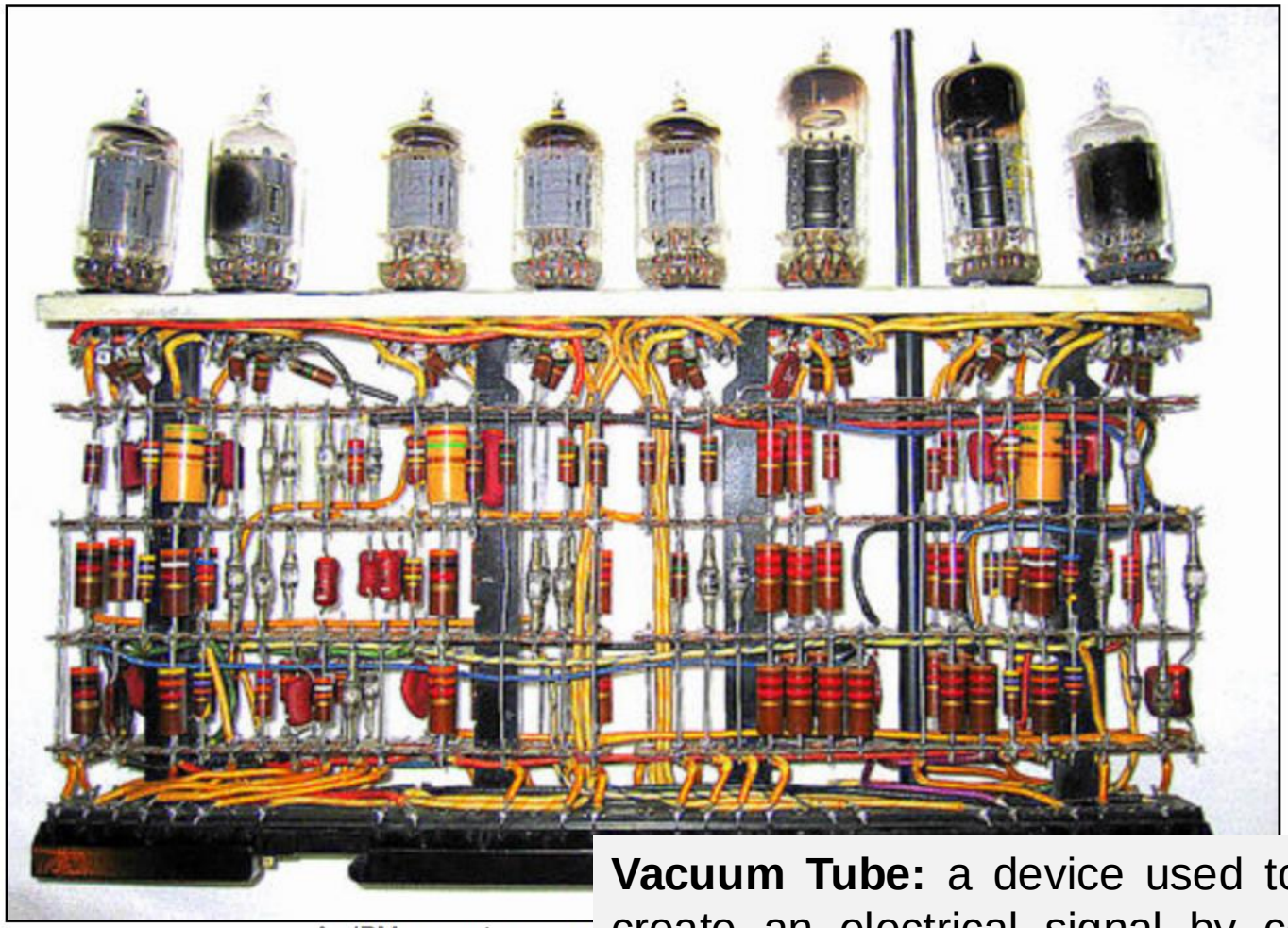
proposal was accepted in 1943, not finished until 1946

weighed 30 tons

Purpose: break a coded message, calculate range tables for aiming its heavy artillery

# First Generation (1951–57)

Vacuum Tubes from an early 1950's IBM Computer



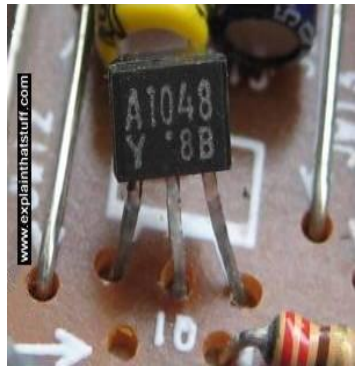
An IBM computer vacuu

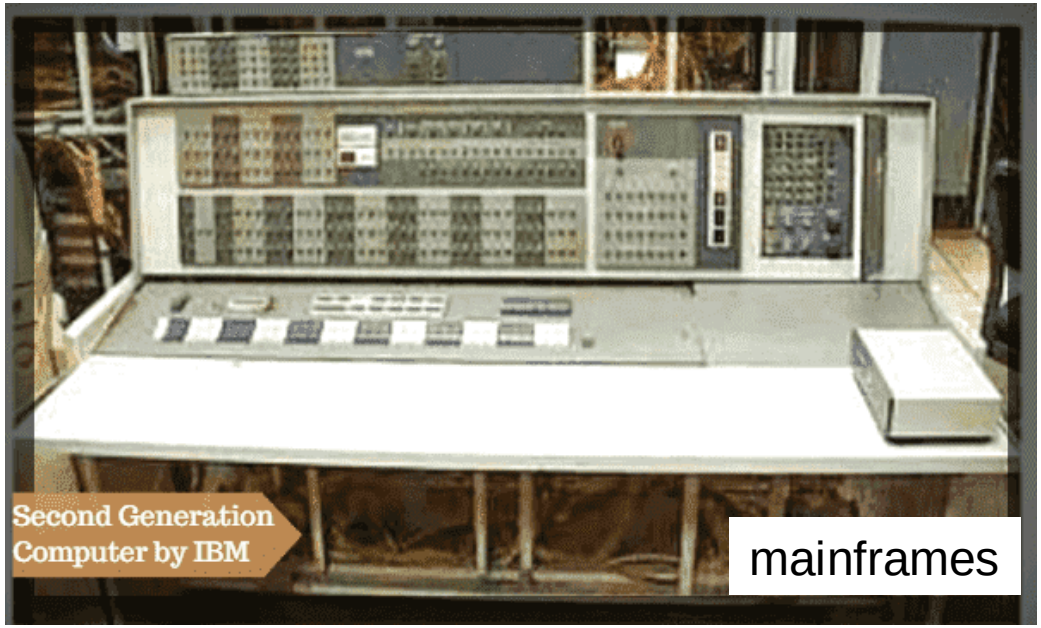
**Vacuum Tube:** a device used to amplify, switch, modify, or create an electrical signal by controlling the movement of electrons in a low-pressure (vacuum) space

# Second Generation (1958–63)

## *Second Generation- Transistors*

- Transistor was Invented 1947 at Bell Labs
  - small devices that transfer electronic signals across a resistor.
- Replaced vacuum tube
- **Advantages:**
  - Smaller
  - Cheaper
  - Less heat dissipation
  - More reliable
  - Six times faster

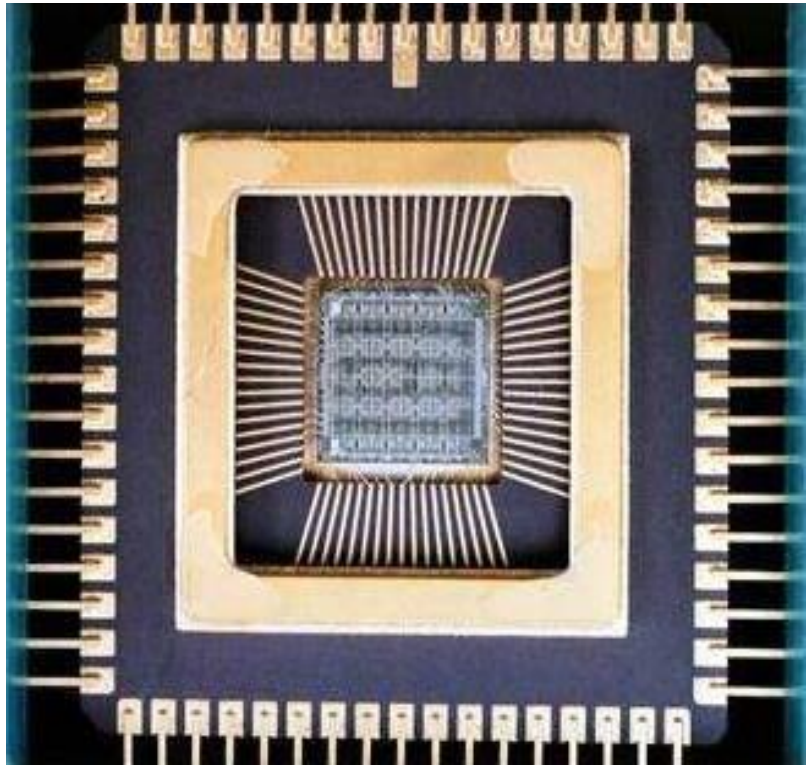


# Third Generation (1964–690

## *Third Generation-Integrated Circuits*

• Integrated Circuits (IC's): a complete electronic circuit on a small chip made of silicon, in place of transistor



- **Advantages:**
  - More reliable
  - Smaller size
  - Generate less heat
  - Faster
  - Lesser maintenance
  - Still costly
  - Consumed lesser electricity
  - Support high level language

# Fourth Generation (1970–90)

## *Fourth Generation- Very Large Scale Integration VLSI*

- Chips containing thousands of transistors on a square centimeter of silicon
- the age of the personal computer
- **Advantages:**
  - Very cheap
  - Portable and reliable
  - Very small size
  - Pipeline processing

# Fifth Generation (1991–2021 and beyond)

## *Fifth Generation: Ultra Large Scale Integration*

- Millions of transistors on a single silicon semiconductor microchip.
- Advancement in Parallel Processing
- More user friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates
- Desktop, Laptop, Notebook, Smartphones.

# Course Introduction

## Main Component

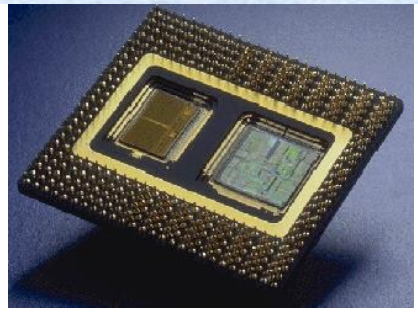
https://www.youtube.com/watch?v=yRmPTbGBqVI

### Integrated Circuit (IC) Fabrication

**https://www.youtube.com/watch?v=aWVywhzuHnQ**

**https://www.youtube.com/watch?v=qm67wbB5GmI**

# History of Intel x86 processors



- 4004: 4-bit processor; 8-bit processors 8080, 8085.
- 8086: 16-bit processors, introduced in 1979: 20-bit address bus (AB), 16-bit data bus (DB), 5/8/10 MHz.
- 80186: a faster version of the 8086. Also 20-bit AB and 16-bit DB. Never widely used in computer systems.
- 80286: introduced in 1982, It has a 24-bit AB, which implies 16MB of memory address space.
- 80386: Intel introduced its first 32-bit processor in the 1985. It has 32-bit AB and 32-bit DB. It follows their 32-bit architecture known as IA-32.
- Pentium: was introduced in 1993 (20th anniversary). it uses a 64-bit wide DB, 60/66 MHz.
- Itanium: 64-bit processor, released in 2001; formerly called IA-64, the Itanium uses a 64-bit AB to provide substantially larger address space. Its DB is 128 bits wide.