

First Day's Talk

Computer Organization & Architecture

Course info

- **Course Title “Computer Organization and Architecture”**
 - Subj Code CE 420
 - Pre Requisites: Digital Logic Design (CS211)
 - **Credits 3+1**
 - Class timings
 - Mon at 0745
 - Wed at 1105
 - Lab Timings (Lab Engr: Fazalullah)
 - Tues

Few Essential topics

- **To be covered before formally starting the COA**
 - MSI-Sequential Circuits
 - Registers
 - Shift registers
 - counters
 - Memory unit

Course Contents- Linda Null

- Introduction to Computer Architecture
 - Evolution of Computers
 - Types of Computers
 - Hardware
 - Firmware and Software
 - Future trends
- Programming model of 8086 family
 - Addressing Modes.
- The Main Components of a Computer and functions
 - The Computer Level Hierarchy
 - The von Neumann & non-von Neumann Model
- Data types
 - Fixed point representation
 - Floating-Point Representation
 - Codes for Data Recording and Transmission
 - Error Detection and Correction
 - binary codes

Course Contents – D.V. Hall

- The 80X86 Microprocessor
 - Inside The 8088/8086 Microprocessor
 - Registers
 - Data / Address and Control Bus
 - Pin Configuration
 - Minimum Mode vs. Maximum Mode
 - Software model of the 8086/8088 microprocessor.
 - Segmentation of The 8088/8086 Address Space
 - Bus Activity Timings

Course Contents- Linda Null

- Instruction Set Architectures
 - Instruction Codes - Instruction Formats
 - Design Decisions for Instruction Sets
 - Little versus Big Endian
 - Internal Storage in the CPU: Stacks versus Registers
 - Number of Operands and Instruction Length
 - Expanding Opcodes
 - Computer Register
 - Register Transfer Language
 - Bus and Memory Transfer
 - Arithmetic Logic Unit
 - Addressing
 - Instruction-Level Pipelining

Contents of the course- Linda Null

- Memory Type
 - Internal Memory
 - External Memory
 - Organization and design of Memory
 - Cache Memory
 - Virtual Memory
- Interrupt
- Input/Output and Storage Systems
 - I/O Architectures
 - Magnetic Disk Technology
 - RAID
 - Ports and designing

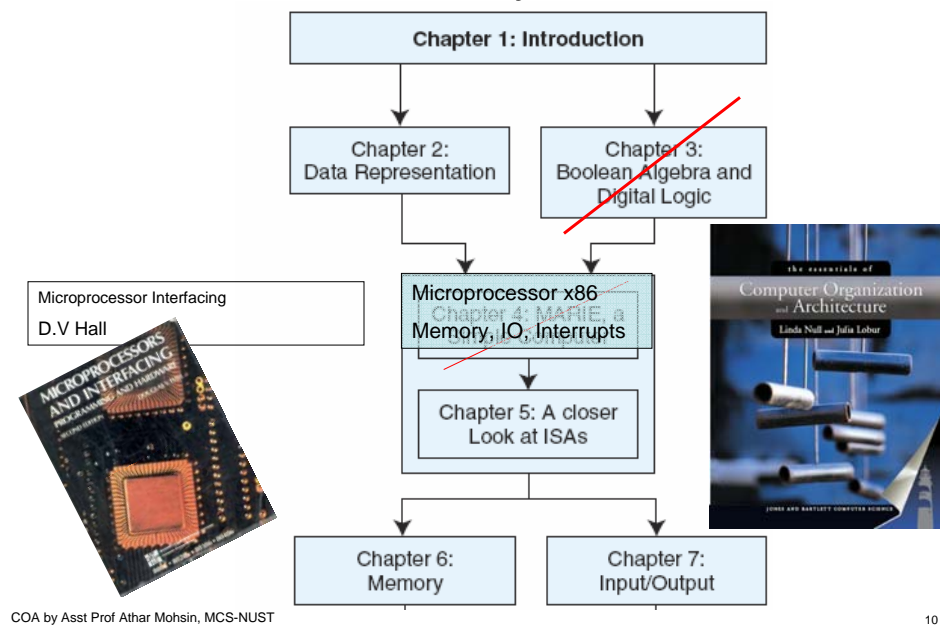
Text and Ref book

- The Essentials of Computer Organization and Architecture
 - By Linda Null (Soft & Hard copy in lib)
- Microprocessor interfacing by D.V. Hall
 - 3rd edition – for microprocessor and Assy language only
- Ref book
 - Computer Organization and Architecture
 - 6th or 7th edition – “William Stallings”

Important Information

- Examinations & Grading:
 - Sessional 50%
 - Quizzes : (5-6) graded – 10%
 - Assignments: (5-6) – 10%
 - Mid term 30%
 - Final Exam 50 %

Scheme of study- Linda Null



Accomplishment

One Semester (42 Hours)		
Chapter	Lecture Hours	Expected Level
1	3	Mastery
2	6	Mastery
3	6	Mastery
4	6	Mastery
5	3	Familiarity
6	5	Mastery
7	2	Mastery

corresponding levels of accomplishment for each chapter

The Computer Level Hierarchy

- Each abstract layer performs a specific task.
- *Instead of viewing the machine as one giant computer, we can view it as a collection of virtual machines,*
 - each level implemented on top of the next lower level, and each communicating with the machine above and below in the hierarchy via a specific set of rules.
 - This helps to close the semantic gap that exists between the digital logic level and the high-level language programming level and helps us manage the complexity of the system.
- *Each level serves as an abstract layer; its implementation is of no concern to the upper layers, and it hides the details of lower layers from upper layers.*

- circuit

Architecture & Organization

- Architecture?
 - Those attributes visible to the programmer
 - Instruction set, number of bits used for data representation, I/O mechanisms, addressing techniques.
 - e.g. Is there a multiply instruction?
- Organization?
 - How features are implemented
 - Control signals, interfaces, memory technology.
 - e.g. Is there a hardware multiply unit or is it done by repeated addition?

Architecture & Organization

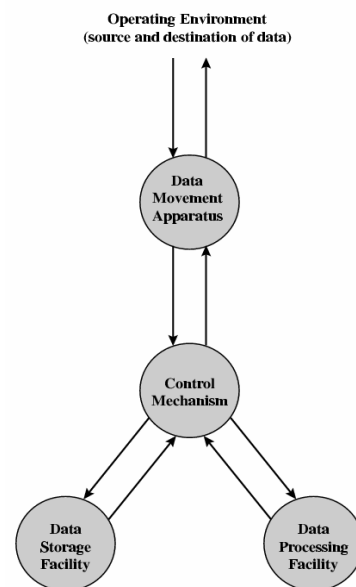
- All Intel x86 family share the same basic architecture
 - 8086, 8088, 80286, 80386, 80486, Pentium
- The IBM System/370 family share the same basic architecture
 - Initial announcement in 1964 included Models 30, 40, 50, 60, 62, and 70
 - Advantage?
 - This gives code compatibility
 - At least backwards
 - The particular functions a microprocessor performs are dictated by software (Assembly Language).
- Organization differs between different versions

Structure & Function

- A computer is a complex system contains millions of electronic components
 - The components are arranged in a hierarchal way as a set of interrelated subsystems
- The designer need to deal with a particular level of the system at any one time, and concerned with **structure** and **function** at each level
 - Structure
 - the way in which components relate to each other
 - Function
 - the operation of individual components as part of the structure

Function

- The basic functions of all computer are:
 - Data processing
 - Data storage
 - Data movement
 - Control Mechanism



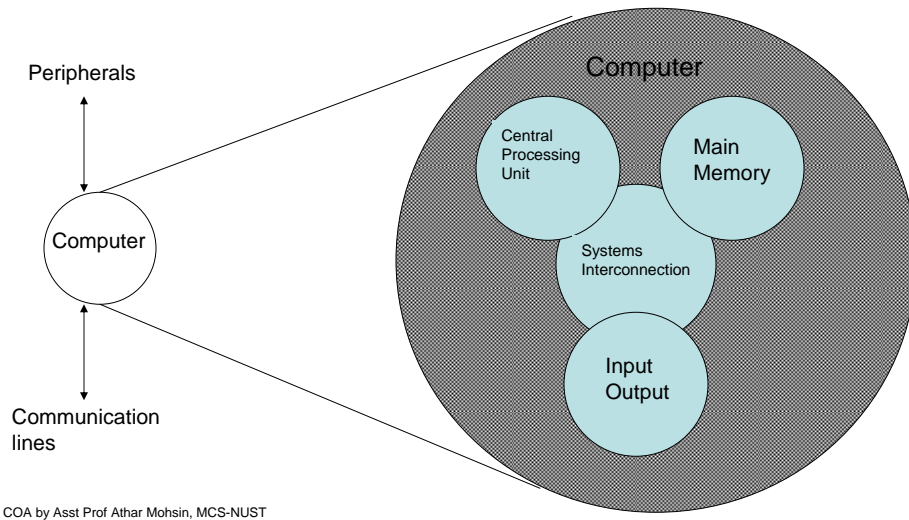
Function

- The computer must be able to **process data**, that may be in any forms and range
- The computer must also **store data**
 - Data storage may be short term or for a longer period
- Computer must be able to **move data** between in and outside the computer
 - When data are received from or delivered to a device that is directly connected to the computer, the process is known as “**input output**” (I/O)
 - When data is moved over longer distances to or from a remote device, the process is known as “**data communication**”
- There must be control of these three functions that is done through instructions

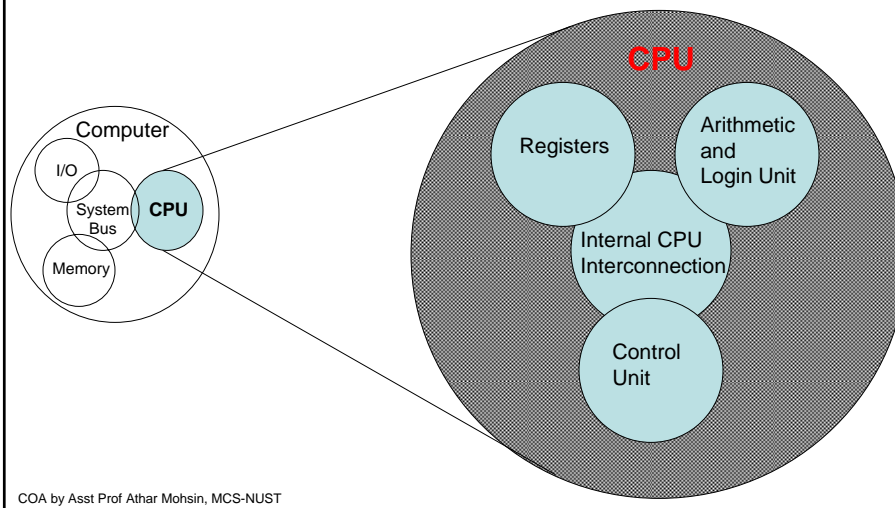
Structure

- The computer interacts in some fashion with its external environment
 - All the linkages to external environment are classified as **peripheral devices or communication lines**
- There are **four** structural components of the computer itself
 - Central Processing Unit (CPU):
 - controls the operation of the computer and performs the data processing task
 - Main Memory:
 - Store data
 - I/O:
 - Moves data between the computer and its external environment
 - System Interconnection:
 - some mechanism that provides for communication among CPU, main memory and I/O

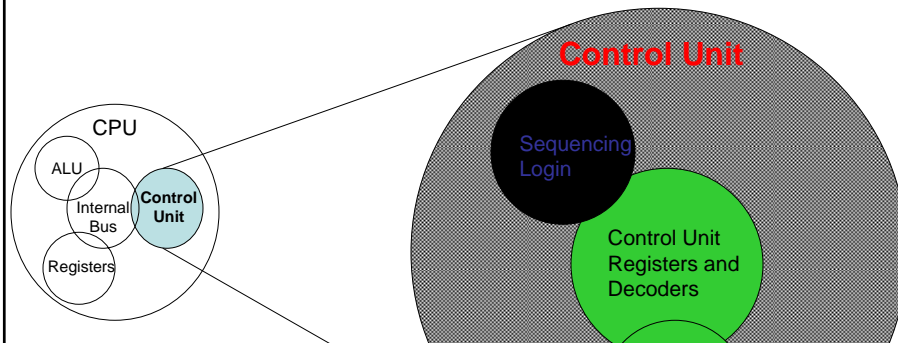
Structure - Top Level



Structure - The CPU



Structure - The Control Unit



A *control unit* decodes and executes instructions and moves data through the system.

Control units can be *microprogrammed* or *hardwired*.

- A microprogram is a program written in a low-level language that is implemented by the hardware.
- Hardwired control units consist of hardware that directly executes machine instructions.