Computer Architecture

Dr. Bheemappa Halavar

Computer Architecture

Syllabus

1	Tour of Systems	Information as bits; Program transformation; Working of a Compiler; Processors reading instructions; Caches; Storage Devices; Technologies for Building Processors and Memory; Performance; The Power Wall;	6
2	Data Representation	Information Storage; Integer Representation; Integer Arithmetic; Floating Point	7
3	Machine Language	Data Formats; Accessing Information; Arithmetic and Logic Information; Control; Procedures; Array allocation; Heterogeneous Data Structures.	12
4	Code Optimization	Capabilities and Limitation of Compilers; Program Performance; Eliminating Loop Inefficiencies; Reducing Procedural Calls; Eliminating unneeded memory references; Understanding Modern processors; Loop unrolling; Enhancing parallelism; Memory Performance; Performance improvement techniques; Identifying and eliminating bottlenecks;	7
5	Processor Architecture,Memory hierarchy and linking:	**Processor Architecture:** Building a Datapath, A Simple Implementation Scheme, Overview of Pipelining, Pipelined Datapath **Storage techniques;** Locality; Memory Hierarchy; Cache Memories; Writing Cache-friendly code; Impact of caches on program performance; Compiler drivers; Static Linking; Object files; Relocatable Object files; Symbol and symbol tables; Symbol resolution; Relocation; Executable Object files; Loading executable object files; Dynamic linking with shared libraries; Position independent code; Tools for manipulating object files	12
6	Parallel Processing Architecture	Parallel Processing Architecture: Introduction, The Difficulty of Creating Parallel Processing Programs, SISD, MIMD, SIMD, SPMD, and Vector, Hardware Multithreading, Multicore and Other Shared Memory Multiprocessors	4

- **Text Book:**
  - Davie Richard O'Hallaron, and Randal Bryant, Computer Systems: A Programmer's Perspective, 3rd Edition, Pearson, USA, ISBN:978-0134092669, 2015.[1,2,3,4,5.2]
  - David A Patterson and John L Hennessy. Computer Organization and Design – The Hardware/Software Interface. RISC-V Edition. Elsevier. 2018. ISBN:9780128122761.
  - Hamacher, Vranesic, Zaky. Computer Organization. 5e. Tata McGraw Hill. 2011. ISBN:9780072320862.
- **Reference books:**
  - William Stallings, Computer organization and architecture - Designing for performance, 10th Ed. Pearson Ed. 2016 ISBN: 978-0134997193.
  - David M. Harris and Sarah L. Harris, Digital Design and Computer Architecture. 2e. Elsevier. 2013. ISBN 9780123944245.
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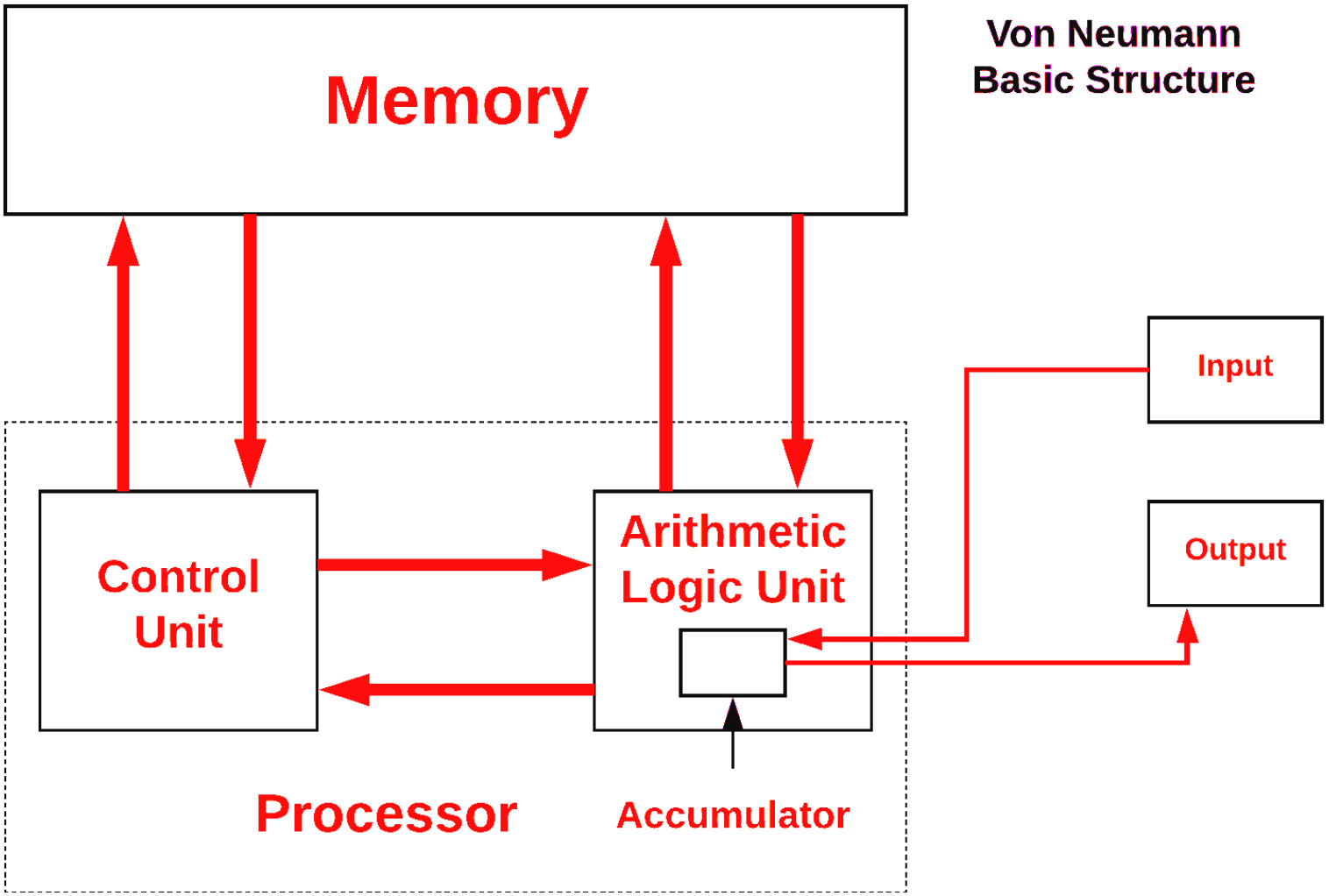
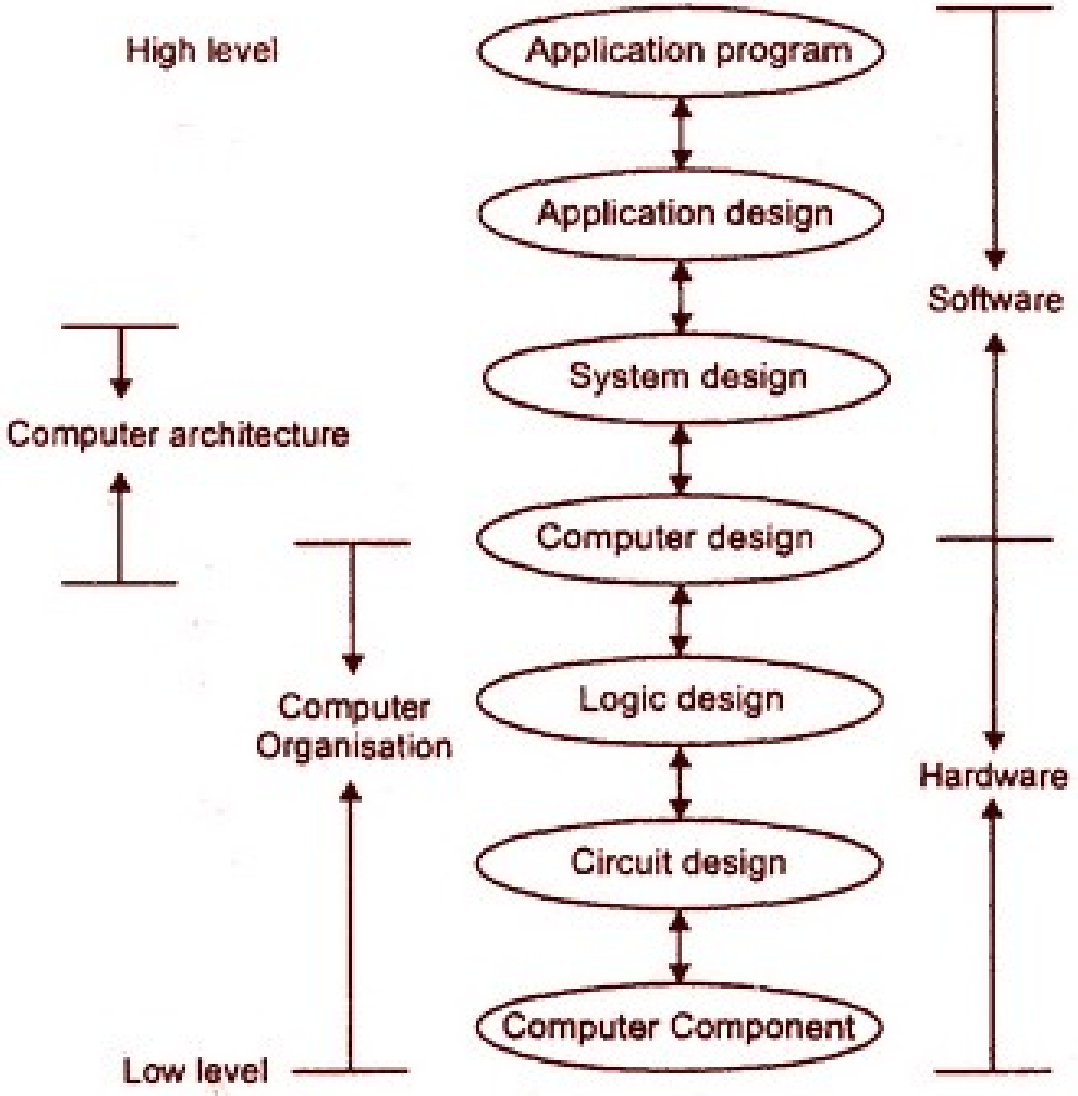

Von Neumann
Basic Structure
Memory
Input
Output
Control
Unit
Arithmetic
Logic Unit
Processor
Accumulator


High level
Application program
Application design
System design
Computer design
Logic design
Circuit design
Computer Component
Low level
Software
Hardware
Computer architecture
Computer Organisation

- **What is a Computer Program?**
- **What does gcc do for you?**