Faculty of Computers and Artificial Intelligence

Benha University

Course Description

The architecture and organization of a simple computer system are studied. Topics covered include information representation and transfer, instruction and data access methods, the control unit: hardwired and microprogrammed, memory organization, I/O systems, channels, interrupts, DMA, Von Neumann SISD organization, RISC and CISC machines. Pipelined machines, interleaved memory system, caches.

Course Syllabus

- **Introduction to Computer Architecture - From Zero to One**
  - The Game Plan
  - The Art of Managing Complexity
  - The Digital Abstraction
  - Number Systems
  - Logic Gates
  - Beneath the Digital Abstraction
  - CMOS Transistors
  - Power Consumption
- **Combinational Logic Design**
  - Boolean Equations
  - Boolean Algebra
  - From Logic to Gates
  - Multilevel Combinational Logic
  - X's and Z's, Oh My
  - Karnaugh Maps
  - Combinational Building Blocks
  - Timing
- **Sequential Logic Design**
  - Latches and Flip-Flops
  - Synchronous Logic Design
  - Finite State Machines
  - Timing of Sequential Logic
  - Parallelism
- **Hardware Description Language – Verilog**
  - Combinational Logic
  - Structural Modeling
  - Sequential Logic
  - More Combinational Logic
  - Finite State Machines
  - Data Types
  - Parameterized Modules

- Testbenches
- **Digital Building Blocks**
  - Arithmetic Circuits
  - Number Systems
  - Sequential Building Blocks
  - Memory Arrays
  - Logic Arrays
- **Architecture**
  - Assembly Language
  - Machine Language
  - Programming
  - Addressing Modes
  - Compiling, Assembling, and Loading
  - Odds and Ends
  - Real-World Perspective: x86 Architecture Types of Operation
- **Microarchitecture**
  - Performance Analysis
  - Single-Cycle Processor
  - Multicycle Processor
  - Pipelined Processor
  - HDL Representation
  - Exceptions
  - Advanced Microarchitecture
  - Real-World Perspective: x86 Microarchitecture
- **Memory and I/O Systems**
  - Introduction
  - Memory System Performance Analysis
  - Caches
  - Virtual Memory