APT 2022: Introduction to Assembly Programming

Prerequisites: APT 2020 Computer Organization

APT1030: Fundamentals of Programming Languages

3 Credit Units

Rationale

This course introduces the basics of assembly language programming for x86 processors running in real mode and the basics of CPU operation. Students learn the instruction cycle and how the CPU executes instructions. In particular, students learn how the data path and a micro programmable control units of a RISC processor are designed. It is essential that students of computer technology understand assembly language, computer arithmetic and CPU operation.

Course Description

Fundamentals of assembly language programming concepts and techniques. Topics include internal representation of data, arithmetic operations, logic statements, and general assembly language commands. Introduce low level language architecture including low level programming and debugging techniques assemblers, linkage editors, and loaders. computer architecture, input/output programming, interfacing I/O, subroutine linkage, interrupts, and memory caching. Programming assignments using C/C++ and assembly language will be used to reinforce these concepts.

Learning outcomes

This course introduces the programming, architecture and interfacing of the Intel 8086 microprocessor. On successful completion of the course, the student should be able to:

1. Recognize the main components and working principals of the Intel 8086 microprocessor
2. Program and Debug in assembly language
3. Understand the basics of computer architecture including the memory organization and memory interfacing
4. Perform input/output device programming in assembly
5. Perform the hardware and software interrupts and applications.
6. Understand the properties and interfacing of the parallel and serial ports

Course Content

Basic computer organization and introductory microprocessor architecture. Introduction to assembly language programming: basic instructions, program segments, registers and memory. Control transfer instructions; arithmetic, logic instructions; rotate instructions and bitwise operations in assembly language. Addressing Modes. Sub routines. String instructions. Basic computer architecture: pin definitions and supporting chips. Memory and memory interfacing. Basic I/O and device interfacing: I/O programming in assembly and programmable peripheral interface (PPI). Interfacing the parallel and serial ports.

Teaching Methodology

Classes for the course consist of a series of theory and practical lectures, Assigned Class Exercises, Assignments. Group Projects.

Instructional material & equipment

Textbooks, whiteboard, handouts, electronic projector, Internet access, 8086 assembly Kit, 8086 Simulator.

Methods of evaluation

Laboratory Work	20%
Project	20%
Assignments	10%
Mid-semester	20%
Final semester exams	30%
Total	**100%**

Course Text

1. Assembly Language for x86 Processors, 6th Ed. Kip R. Irvine, Prentice Hall, 2010

Recommended Reading

1. Computer Organization & Design: The Hardware/Software Interface, 4th Ed. David Patterson & John Hennessy, Morgan Kaufmann, 2008
2. Structured Computer Organization, 5-th edition, Andrew S. Tanenbaum, Prentice Hall, 2010.
3. Computer Architecture and Organization, An Integrated Approach, Milles J. Murdocca, Vincent P. Heuring, John Wiley & Sons Inc., 2007.
4. Computer Organization & Architecture, 7-th edition, William Stallings, Prentice Hall, 2006.
5. **Introduction to Assembly Language Programming, for Pentium and RISC Processors**,2nd edition, Sivarama Dandamudi, Springer, 2004. (ISBN-13: 978-0-387-20636-3, ISBN-10: 0-387-20636-1)