178 320 Microprocessor & Interfacing

Prerequisite: 178 220 Digital Logic Design

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Course Webpage: http://gear.kku.ac.th/~watis/courses/178320/178320.html

Course Outline

- Review of Digital & Logic Design
- Basic Concept of Microprocessors
- Microprocessor Architecture
  - * Hardware Architecture
  - * Instruction Set
- Microprocessor System Design
  - * Memory & Interfacing
  - * Input & Output Interfacing
- Advanced Microprocessor Interfacing Techniques
  - * Direct Memory Access
  - * Bus & Data Communications
  - * Analog Interfacing & Data Conversion

Grading

- Midterm Exam	**20%**
- Final Exam	**30%**
- Homework	**20%**
- Term Project	**30%**

* Proposal	5%
* Implementation	15%
* Presentation	10%

*** 178 321 should be taken at the same semester

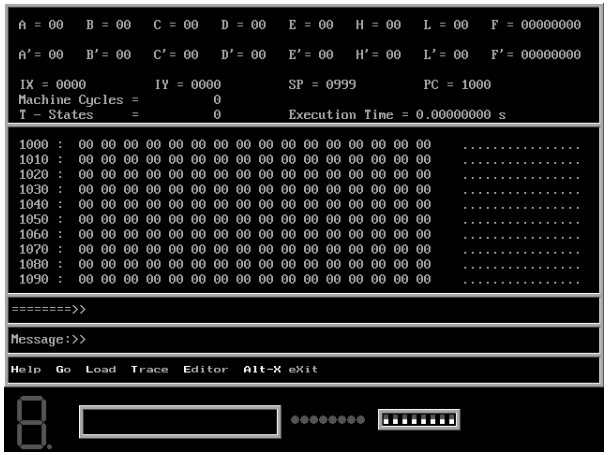
Text Books & References

- **Book manuscript by Dr. Daranee Hormdee (Thai) d/l**
- **Z80 Data sheet (REQUIRED) d/l**
- **Z80 User manual (REQUIRED) d/l**
- **Z80 Family Peripherals (REQUIRED) d/l**
- **Leventhal, L. A., *Z80 Assembly Language Programming*, Osborne/McGraw-Hill *****
- **Gaonkar, R., *The Z80 Microprocessor: Architecture, Interfacing, Programming and Design*, Merrill Publishing Company**
- **Any Z80 related books you preferred**

Computer Tools

Z80 Simulator (CoE Senior Project 1997)

- * Written in C Language for DOS
- * No GUI, menu-based commands
- * Absolutely free of charge
- * Features cover almost Z80 programming required for this course



What are we going to learn in this course?

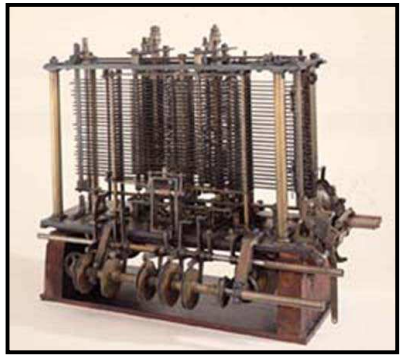
Course Philosophy

- To make clearly understanding of CPU fundamentals
- Understanding how CPUs work is not easy without choosing one *good* CPU and learn from it.
- Why the idea work?
  Answer The major concepts of CPU are alike
- A classic CPU namely "**Z80**" from Zilog Corp.
  - It's simple, powerful, inexpensive CPU
  - Lots of materials, boards and developing tools
  - It's classic!!

Motivation & Introduction

History of CPU

- Scientific & engineering need for computational machine
- Attempt have been made to invent "computer"

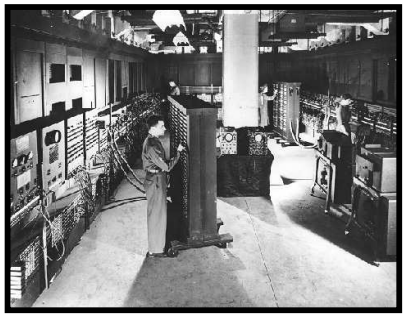


- Charles Babbage

- Analytical Engine
- Started in 1834
- Never finished

Motivation & Introduction

History of CPU



ENIAC

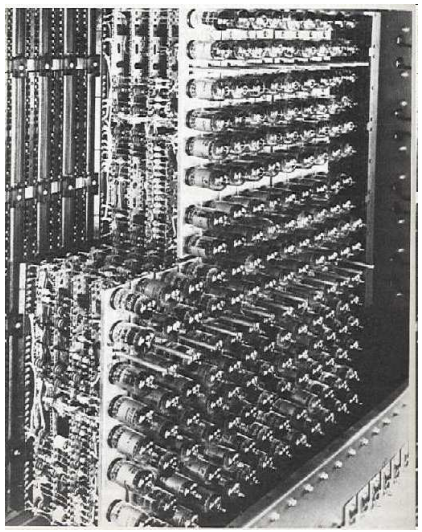
Eckert and Mauchly

- 1st working electronic computer (1946)
- 18,000 Vacuum tubes
- 1,800 instructions/sec
- 3,000 ft^3

Motivation & Introduction

History of CPU

Vacuum Tube

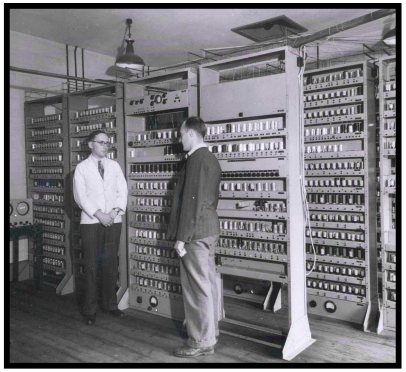


Memory Unit

Vacuum Tube
Hi-Fi Amplifier

Motivation & Introduction

History of CPU



EDSAC 1 (1949)

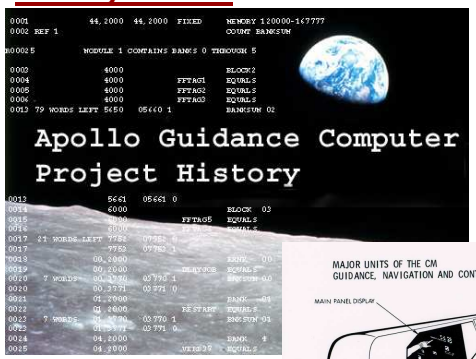
http://www.cl.cam.ac.uk/UoCCL/misc/EDSAC99/

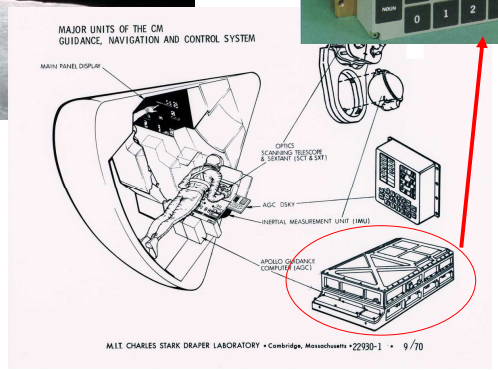
- Maurice Wilkes

1st store program computer
650 instructions/sec
1,400 ft^3

Motivation & Introduction

History of CPU

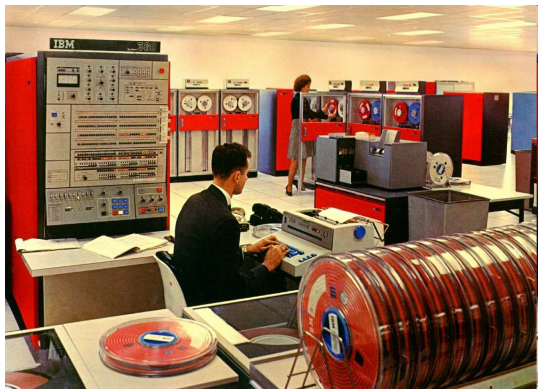




Motivation & Introduction

History of CPU

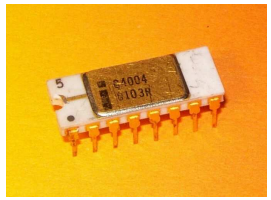
IBM System/360 general-purpose computer

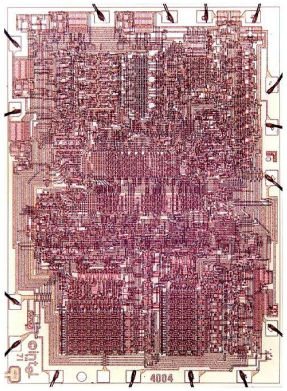


History of CPUs

1971: 4004 Microprocessor

- Intel's first microprocessor.
- Used in the Busicom calculator
- Max frequency **0.108** MHz.

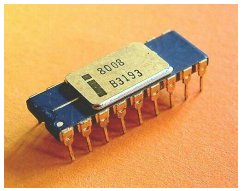


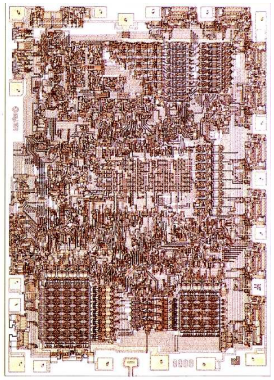


History of CPUs

1972: 8008 Microprocessor

Used in Mark-8, which is known as one of the first computers for the home

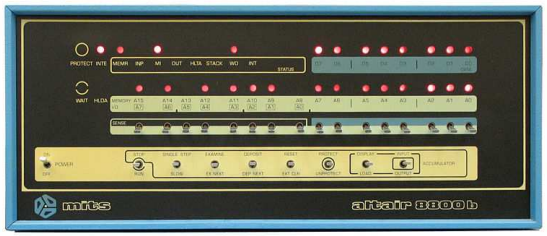


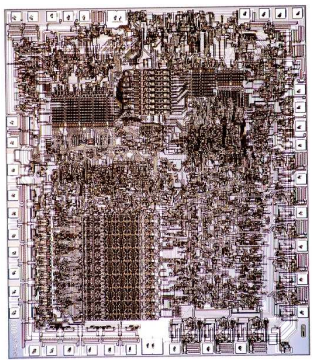


History of CPUs

1974: 8080 Microprocessor

Used in the first personal computer--the Altair





Z80 history & overview

ZiLOG

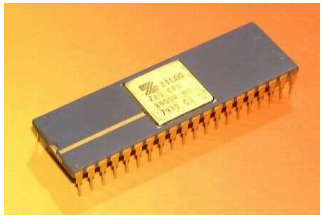
- Founded
  - 1974
  - Federico Faggin
- Ex-employees of Intel

Z80 history & overview

Federico Faggin

- Physicist and electrical engineer
- Considered one of inventors of microprocessor
- Intel
  - 4004
  - 8008

Z80 history & overview



- designed to be binary compatible with the Intel 8080
- one of the most popular 8-bit CPUs
- built-in DRAM refresh, and other features which allowed systems to be built with fewer support chips.

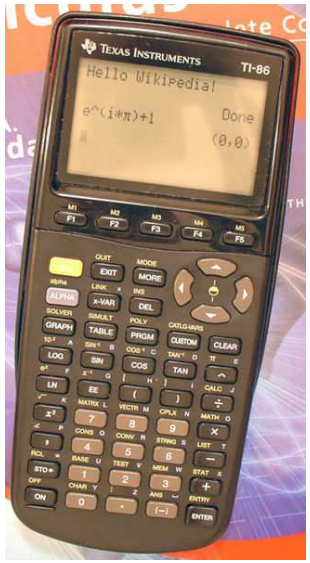
Z80 history & overview

Sinclare ZX Spectrum

- A home computer released in the United Kingdom in 1982 by Sinclair Research Ltd.
- Based on a Zilog Z80A CPU running at 3.5 MHz, 16 KB of ROM and either 16 KB or 48 KB of RAM.
- RF modulator output to TV
- Text mode: 32 cols, 24 rows
- Graphic mode: 256x192
- 8 colors, 2 shades
- Software medium: casette tape

Z80 never die!!

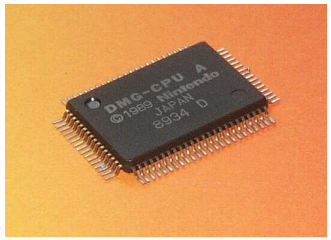
Powered by Z80



Texas Instrument TI-86

Z80 never die!!

Powered by Z80



Nintendo Game Boy & Game Boy Color

Z80 never die!!

Powered by Z80

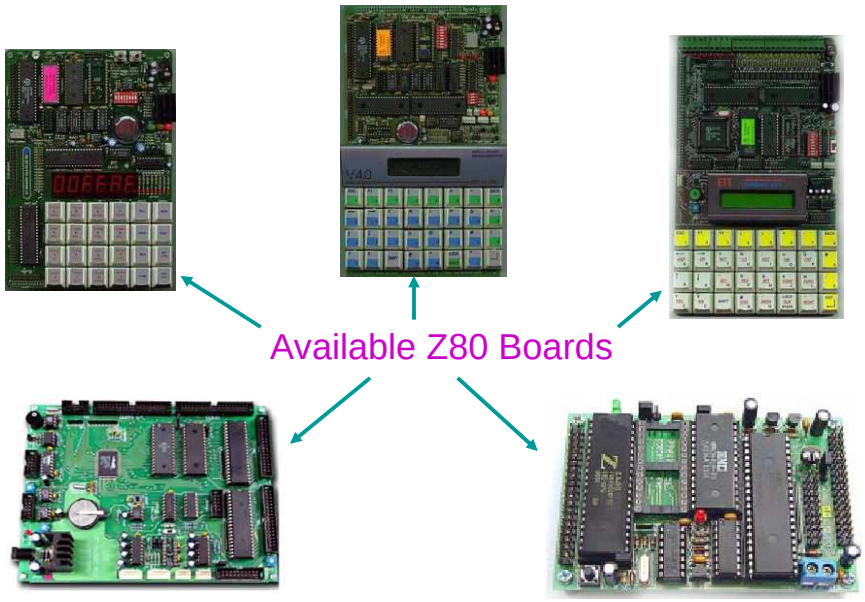
S1 MP3 Player

Z80 never die!!

Powered by Z80

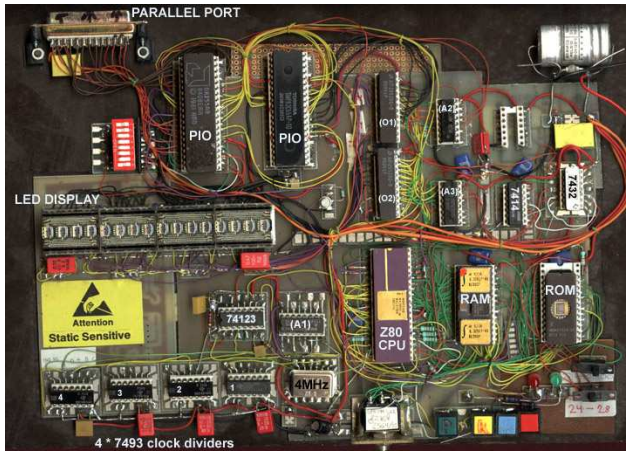
Roland Synthesizer Jupiter-8

Commercial Developing Boards



DIY Developing Board

You can make a computer by yourself



Q & A

"If you want to understand today, you have to search yesterday"

~Pearl Buck