Digital Systems: Review for Quiz 9

Session 9f for
"Digital Systems: Computers and Communications"
A Fairfield University E-Course
Powered by LearnLinc

Module: Digital Systems (in two parts)

- Texts:
  - "Computers," Capron, Benjamin Cummings, 1996, ISBN 0-8053-0662-5
  - "Telecommunications," Blyth, McGraw-Hill, 1990, ISBN 0-02-680841-2
  - "Understanding Telephone Electronics," Bigelow, Newnes, 1997, ISBN 0-7506-9944
- References:
  - Electronics Tutorial (Thanks to Alex Pounds)
  - Electronics Tutorial (Thanks to Mark Sokos)
- Part 9 – Computers
  - 5 on-line sessions plus one lab
- Part 10 – Digital Communications
  - 5 on-line sessions plus one lab
- Mastery Test part 5 follows this Module

Digital Systems: Topics

- Computer Architecture
  - Memory: ROM, RAM, Cache, Error Checking
  - CPU and Program Control
  - Secondary Storage: Floppy, Hard Drive, CD / DVD
  - I/O (Human: Video, Keyboard, & Pointer)
- Digital I/O: Serial, Parallel, IDE, USB. FireWire, SCSI

Part 9

- Serial I/O: RS232
- Modems
  - Telephone: Modulation and Data compression
  - Cable and DSL
- Telephony Digital Transmission
- Packet Transmission
- Fiber Optics: SONET

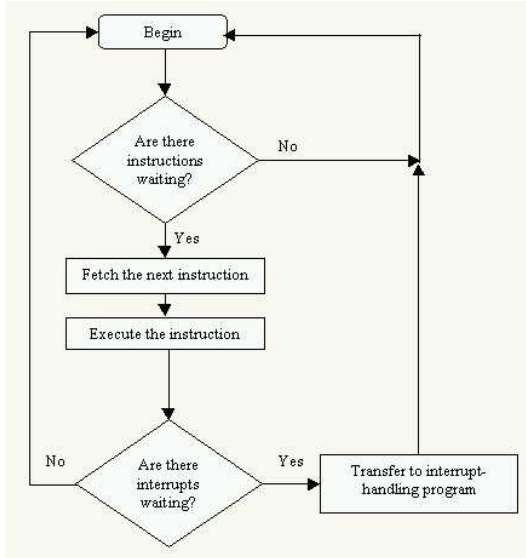
Part 10

Section 9 Schedule

Session 9a (5/26 – Holiday)	05/21	Introduction: Computer Overview	Capron: Ch 1; Notes
Session 9b	06/02	The CPU (Central Processing Unit)	Capron: Ch 2;
Session 9c	06/04	I/O	Capron: Ch 3;
Session 9d	06/09	Data Storage	Capron: Ch 4;
Session 9e (Lab-06/14, Sat. McAuliffe 113)	06/11	Digital I/O: Serial, Parallel, IDE, SCSI, USB, and Firewire	Bigelow: pp. 285-288, 301-305; Notes
Session 9f **Quiz 9 due 06/22**	**06/16**	**Review for Quiz 9**	
Session 9g (6/18 – no class)	06/23	Quiz Results	

CPU Review

- Machine Cycle
  - Fetch: Get the next instruction ("Program Counter")
  - Decode: Determine the "Op Code"
  - Execute: Perform the operation
  - Store: Save the result and increment the "Program Counter"



- Programming
  - Machine Language: 1's and 0's
  - Assembly Language: Human readable but machine dependent
  - Compiled High-Level Language: Compiled, assembled and linked into an executable machine language program (slower, e.g. "C")
  - Interpreted High-Level Language: Executed by the interpreter line by line (slowest, e.g. Java, Basic)

ALU Review (Arithmetic Logic Unit)

- Fixed Point
  - Decimal arithmetic: 18.75
  - Binary arithmetic: **0**0010010.1100 12-bit (1 sign bit)
    - Bits to the left of the "Binary Point"; Powers of 2
    - Bits to the right of the "Binary Point"; Powers of ½
    - -255 to 255 (7 significant bits for magnitudes above ± 4)
- Floating Point (scientific notation)
  - $0.1875*10^2$ decimal floating point
  - **0.**001100 * $2^{\mathbf{0}00010}$ 12-bit Binary (2 sign bits)
    $(1/8 + 1/16)*2^2$
  - 7 significant bits; $\pm 2^{-15}$ (1/32768) to $\pm 2^{+15}$ (32768)

Memory Review

- ROM-based routines (somewhat slower than RAM)
  - Power-on System Test (POST)
  - Bootstrap: Go to Disk (boot sector) to start the OS
  - Basic Input Output Sequences (BIOS)
    - Hardware specific operations
    - Used by the Operating system
      (in MSDOS used directly by application software)
- Operating System (OS): Windows, Linux, Mac (OSX) etc.
  - Provides environment for applications (API)
  - Resource Sharing: Multitasking, Virtual Memory
  - Programs stored on secondary storage

Memory Review (2)

- Registers: directly used by CPU
- Cache: Fast, local, temporary storage
  - L1: same speed as the CPU; small size (only 16 Kbytes in old PCs)
  - L2: somewhat slower; somewhat larger (Not often present)
- Core Memory: Originally magnetic cores (toroids)
  - Dynamic silicon RAM
    - Fast Page Mode (FPM) DRAM: old – early 1980s; PC XT; 8088
      - 70 ns; 36 pin SIMM : byte-wide data or 72 pin: wider data path
    - EDO DRAM: "486" (60 ns; 72 pin SIMM or DIMM)
    - SDRAM (DDR): Pentium (10ns to 5 ns-pc3200)
- Secondary Storage: Disk (cache memory in fast disks; 1-2 Mbytes)
  - Access time (Read/Write head speed)
  - Write speed (rotation rate; 5000, 7500, 10k rpm)

Input/Output System Review

Human I/O

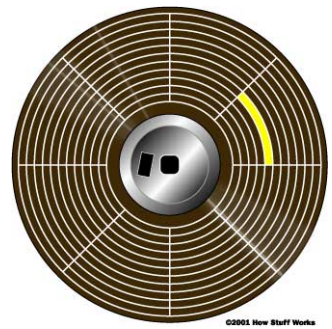
- Input
  - Keyboard
  - Mouse
  - Video
  - Audio
- Output
  - Video
  - Audio

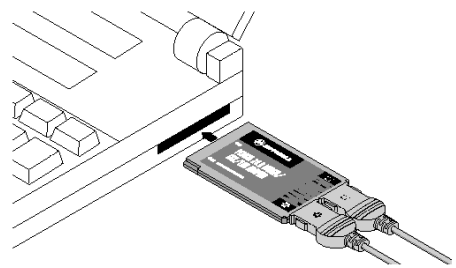
Machine I/O

- Data
  - LAN
  - Serial
  - Modems
- Printers:
  - Impact
  - Laser
  - Ink Jet
- Memory
  - Floppy
  - CD / DVD
  - Other
  - Memory Modules
- Image Scanner
- Optical Character Recognition (OCR)
- Bar Codes
- Digital Still Camera
- Digital VCR

Data Storage Review

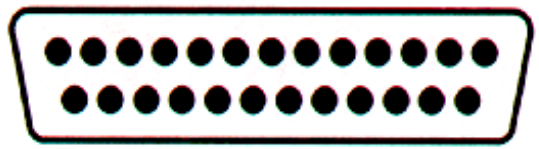
- Disk Storage: FAT, Sectors, Tracks and Heads
- Magnetic Disks: Fast, Dense storage
  - Floppies
  - Hard Disks
- Optical Disks: Dense, Inexpensive, Archival
  - CD, DVD
  - Magneto-Optical
- Flash Memory Modules: USB, PCMCIA (PC card)
- Tape: Sequential, Extreme density, Inconvenient storage
  - Reels
  - Cartridge
- Data Compression: Lossless, Lossy

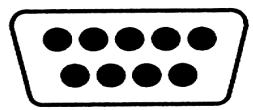




Data I/O Review

- Serial vs. parallel data
- RS232 – the PC Serial Port
  - DTE/DCE: Null Modem
  - Control Signals: RS, CS, DSR, CD, DTR, …
  - Speed: up to 115 kbits/sec (16550A UART)

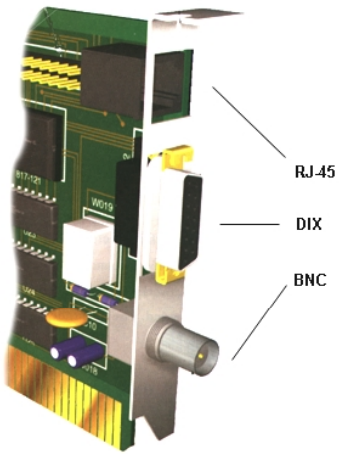




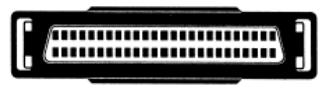
- The PC Parallel (printer) port: SPP, EPP, ECP (Bios)
  - DB25 female (Centronix at printer)
  - Speed: up to 2 Mbits/sec (Strobe to align parallel data)

Data I/O Review (2)

- PC Data Busses
  - Internal
    - Memory
    - Peripheral Card:
      - 8-bit: ISA
      - 16-bit: EISA, VESA,
      - 32-bit: PCI & AGP (Video card only)
    - IDE (ATA), serial ATA: Hard Drives
    - Floppy disk control



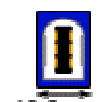
SCSI-1

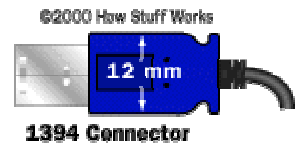


SCSI-2

SCSI-3

  - External
    - SCSI: many variants, high performance parallel data, terminate
    - USB: 12 Mbit/sec (USB2- 480 Mbit/sec), Hubs
    - FireWire (IEEE 1394): 400 Mbit/sec serial
    - LAN (Cat5-Ethernet): 10/100/1000 Mbit/sec, Hubs/switches





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