Scales, Units, and Conventions

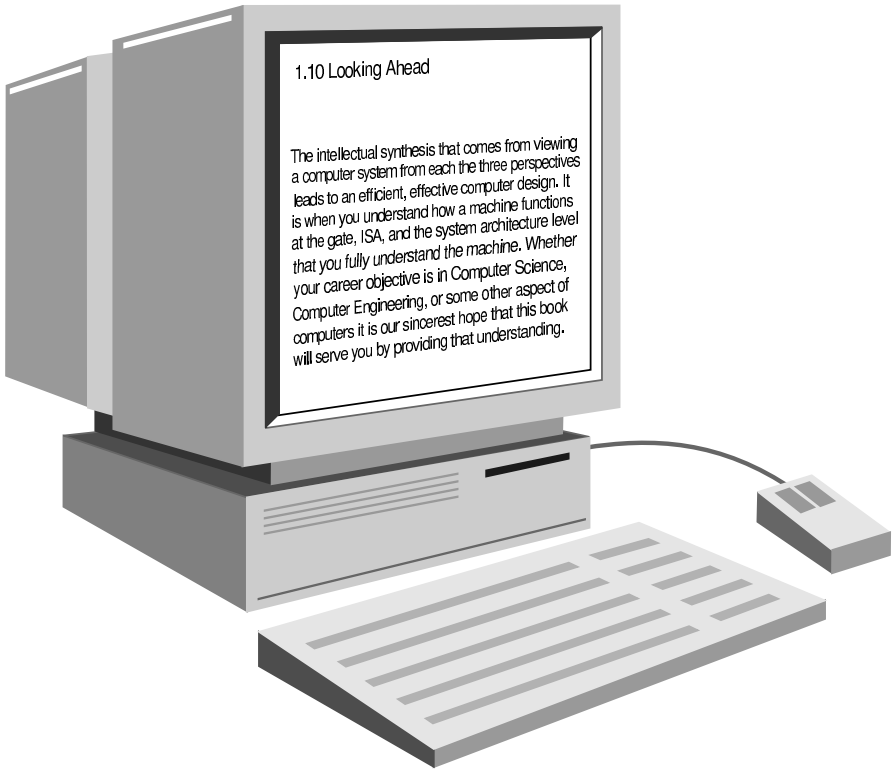
Term	Normal Usage	As a power of 2
K (kilo-)	10^3	2^{10} = 1,024
M (mega-)	10^6	2^{20} = 1,048,576
G (giga-)	10^9	2^{30} = 1,073,741,824
T (tera-)	10^{12}	2^{40} = 1,099,511,627,776

Term	Usage
m (milli-)	10^{-3}
μ (micro-)	10^{-6}
n (nano-)	10^{-9}
p (pico-)	10^{-12}

Note the differences between usages. You should commit the powers of 2 and 10 to memory.

Units: Bit (b), Byte (B), Nibble, Word (w), Double Word, Long Word, Second (s), Hertz (Hz)

Fig 1.1 The User's View of a Computer



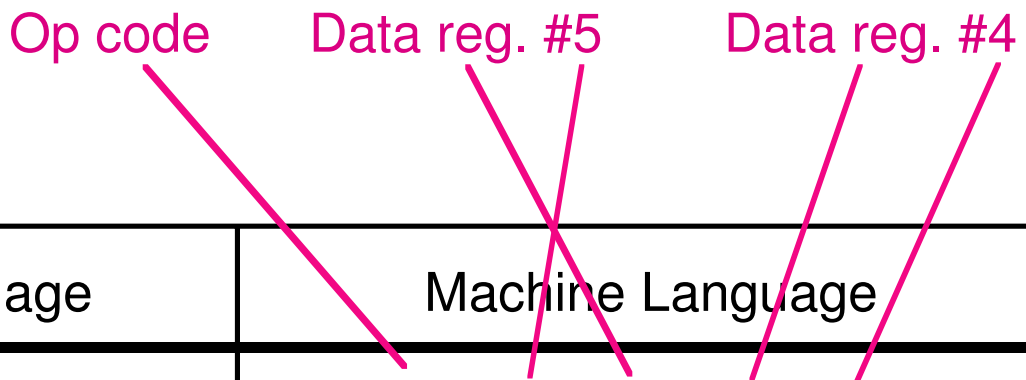
The user sees software, speed, storage capacity, and peripheral device functionality.

Machine/Assembly Language Programmer's View

- Machine language:
  - Set of fundamental instructions the machine can execute
  - Expressed as a pattern of 1's and 0's
- Assembly language:
  - Alphanumeric equivalent of machine language
  - Mnemonics more human-oriented than 1's and 0's
- Assembler:
  - Computer program that transliterates (one-to-one mapping) assembly to machine language
  - Computer's native language is machine/assembly language
  - "Programmer," as used in this course, means machine/assembly language programmer

Machine and Assembly Language

- **The assembler converts assembly language to machine language. You must also know how to do this.**



MC68000 Assembly Language	Machine Language
MOVE.W D4, D5	0011 101 000 000 100
ADDI.W #9, D2	0000 000 010 111 100 0000 0000 0000 1001

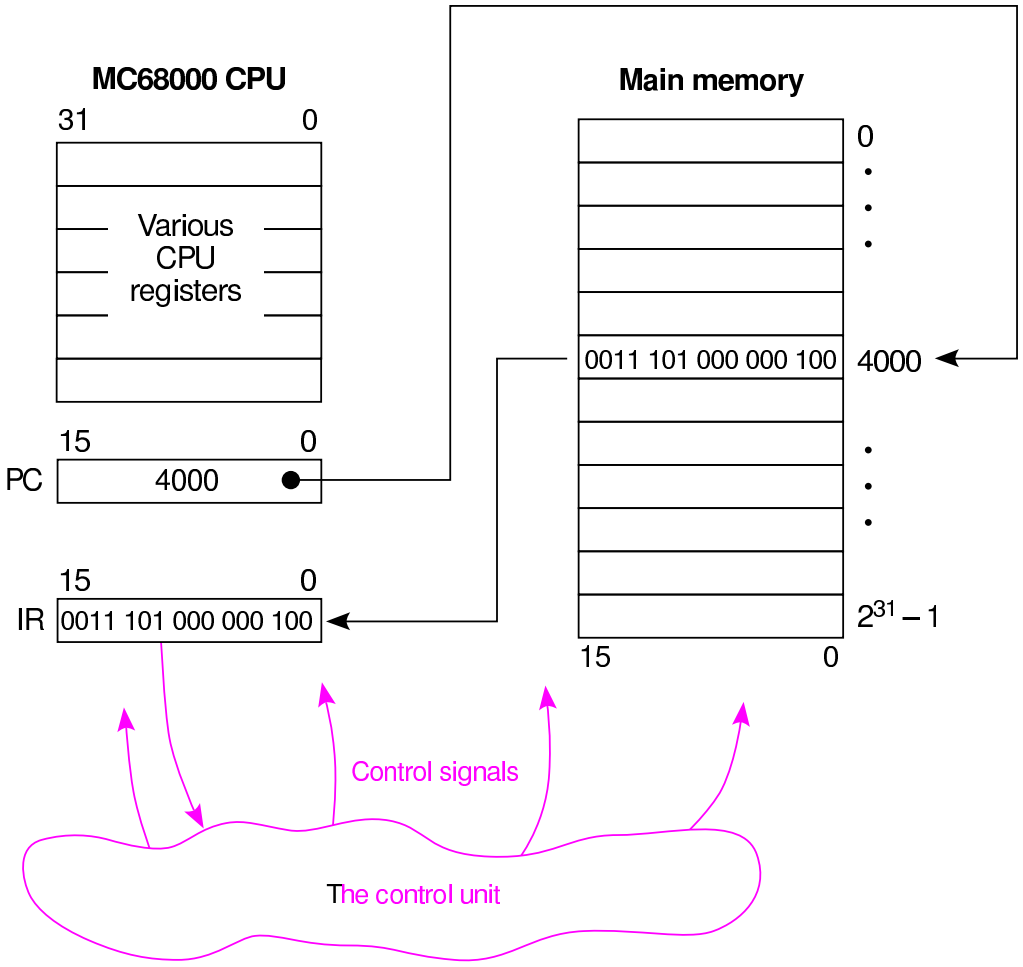
Tbl 1.2 Two Motorola MC68000 Instructions

The Stored Program Concept

The stored program concept says that the program is stored with data in the computer's memory. The computer is able to manipulate it as data—for example, to load it from disk, move it in memory, and store it back on disk.

- **It is the basic operating principle for every computer.**
- **It is so common that it is taken for granted.**
- **Without it, every instruction would have to be initiated manually.**

Fig 1.2 The Fetch-Execute Process



Programmer's Model: Instruction Set Architecture (ISA)

- Instruction set: the collection of all machine operations.
- Programmer sees set of instructions, along with the machine resources manipulated by them.
- ISA includes
  - Instruction set,
  - Memory, and
  - Programmer-accessible registers of the system.
- There may be temporary or scratch-pad memory used to implement some function is not part of ISA.
  - Not Programmer Accessible.