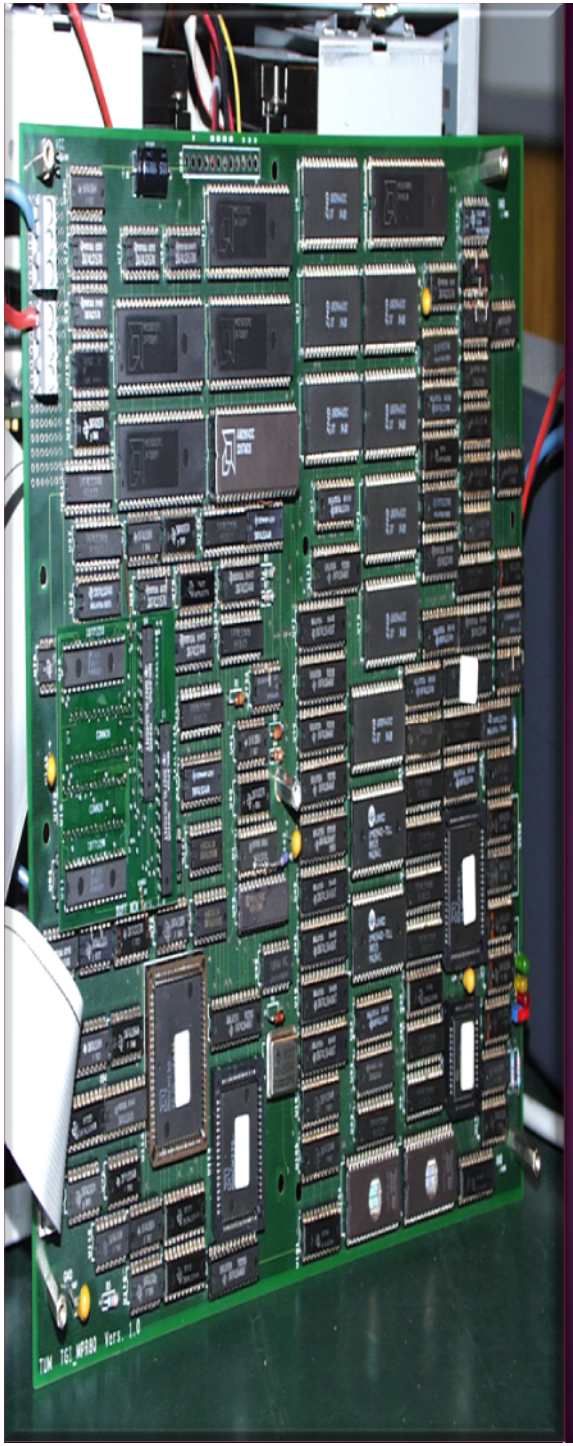

Introduction to Microprocessors

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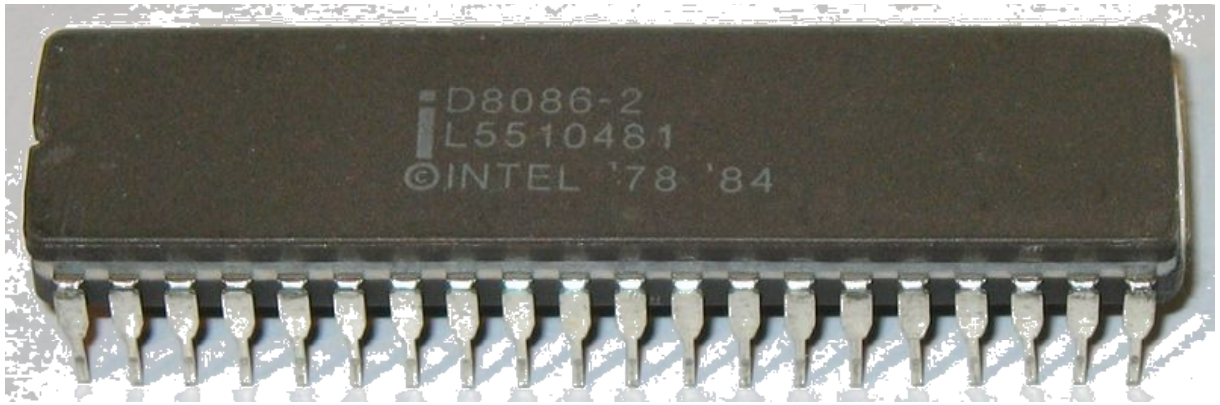
DEFINITION

- A **microprocessor** is a programmable digital electronic component that incorporates the functions of a central processing unit (CPU) on a single semiconducting integrated circuit (IC).

THREE BASIC CHARACTERISTICS DIFFERENTIATE MICROPROCESSORS:

- **Instruction set**: The set of instructions that the microprocessor can execute.
- **bandwidth :** The number of bits processed in a single instruction.
- **clock speed :** Given in megahertz (MHz), the clock speed determines how many instructions per second the processor can execute.

8086 MICROPROCESSOR



- 16 bit Processor
  - 16 data lines
  - 20 address lines
- Total of 40 pins

DEFINITION : WORD LENGTH

- "word" is a term for the natural unit of data used by a particular computer design. A word is simply a fixed-sized group of bits that are handled together by the machine.

- 8086 word means two bytes

COMPANIES BEHIND

- Intel
- Motorola
- AMD
- Zilog
- National Semiconductor

- 8086 - Intel

Complete List

INTEL MICROPROCESSORS

Microprocessor	Introduction Date	Introduction Speed	Process Technology	Transistor Count	Addressable Memory	Bits
4004	Nov, 1971	108 kHz	10,000nm	2,300	640 bytes	4
8008	Apr, 1972	200 kHz	10,000nm	3,500	16 KB	8
8080	Apr, 1974	2 MHz	6,000nm	4,500	64 KB	8
8085	Mar, 1976	4.77 MHz	3,000nm	6,500	64 KB	8
8086	Jun, 1978	4.77 MHz	3,000nm	29,000	1 MB	16
80286	Feb, 1982	6 MHz	1,500nm	134,000	16 MB	16
80386	Oct, 1985	16 MHz	1,500nm	275,000	4 GB	32
80486	Apr, 1989	25 MHz	1,000nm	1.2 Million	4 GB	32
Pentium	Mar, 1993	60 MHz	800nm	3.1 Million	4 GB	32
Pentium Pro	Nov, 1995	150 MHz	600nm	5.5 Million*	64 GB~	32
Pentium II	May, 1997	233 MHz	350nm	7.5 Million*	64 GB~	32
Pentium III	Feb, 1999	450 MHz	250nm	9.5 Million*	64 GB~	32
Pentium 4	Nov, 2000	1.4 GHz	180nm	42 Million	64 GB~	32
Itanium	May, 2001	800 MHz	180nm	295 Million	18 Terabytes	64

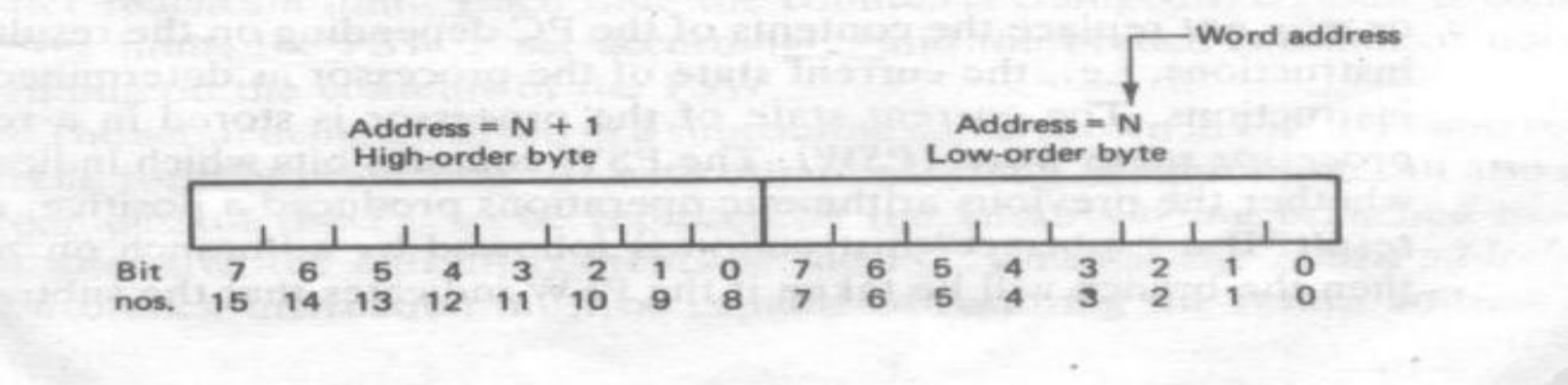
** Transistor count does not include L2 cache*

~ 4GB standard, 64GB with Paging Address Extensions

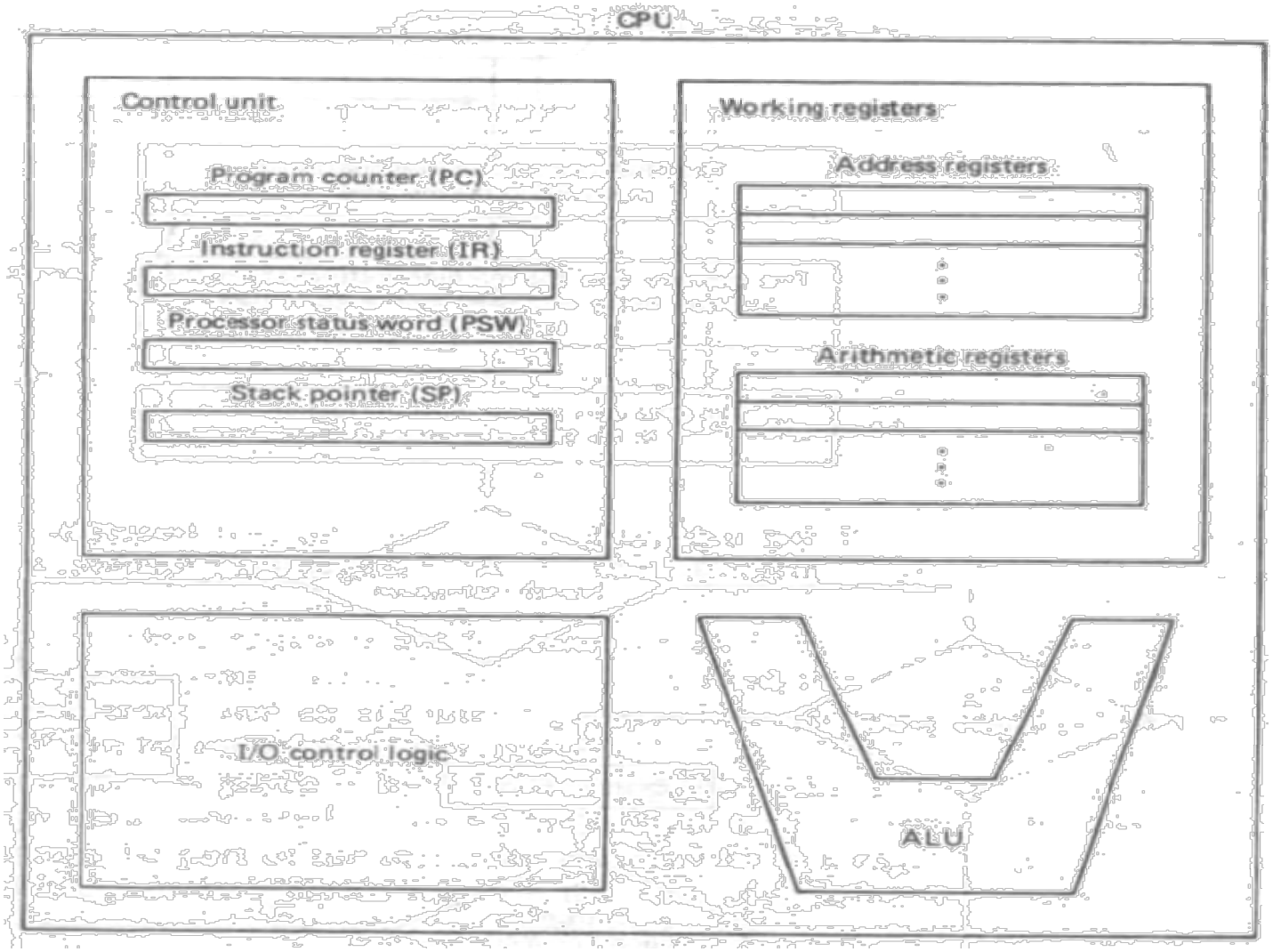
PREREQUISITE

1. Addresses Space
2. General operation of a computer

- Address space :- addresses are composed of bit combinations and the set of all possible combinations for a given situation is called an address space .
- Word: Address of a word is the address of the low order byte



General Operation



GENERAL SEQUENCE- WITH OUT BRANCH

- IR holds the current instruction
- PC holds the address of the next instruction
- After execution of one instruction
  - Address in PC placed in address bus
  - Memory places next instruction in data bus
  - CPU inputs it to IR
  - Finds its length and updates PC

SEQUENCE WITH UNCONDITIONAL BRANCH

- Permits the normal sequence to be altered by replacing the contents of the Pc , the address of the next instruction , with an address determined by the branch instruction

SEQUENCE WITH CONDITIONAL BRANCH

- Address in PC determined by the present status of the processor
- Ie.. PSW (processor status word)

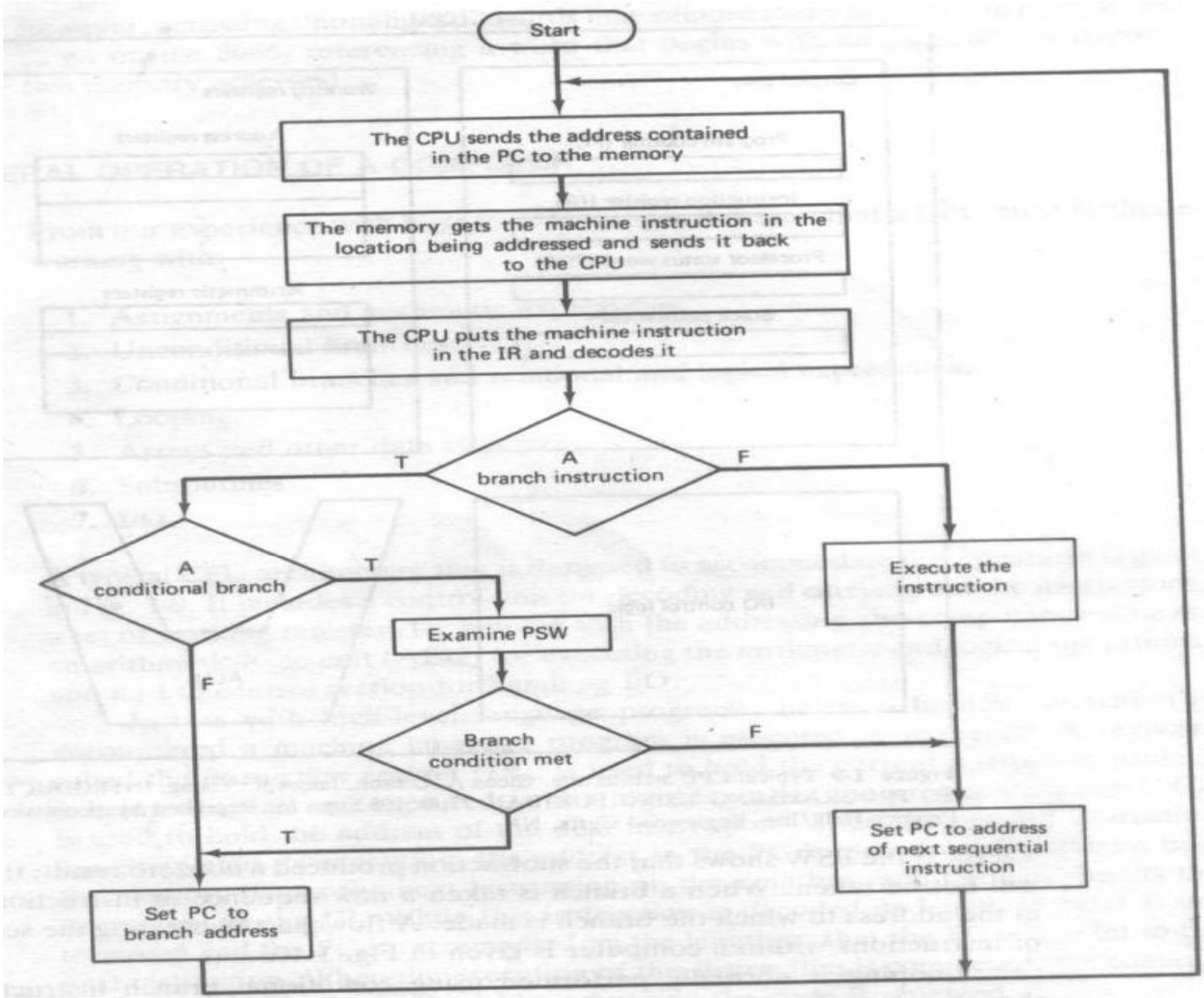
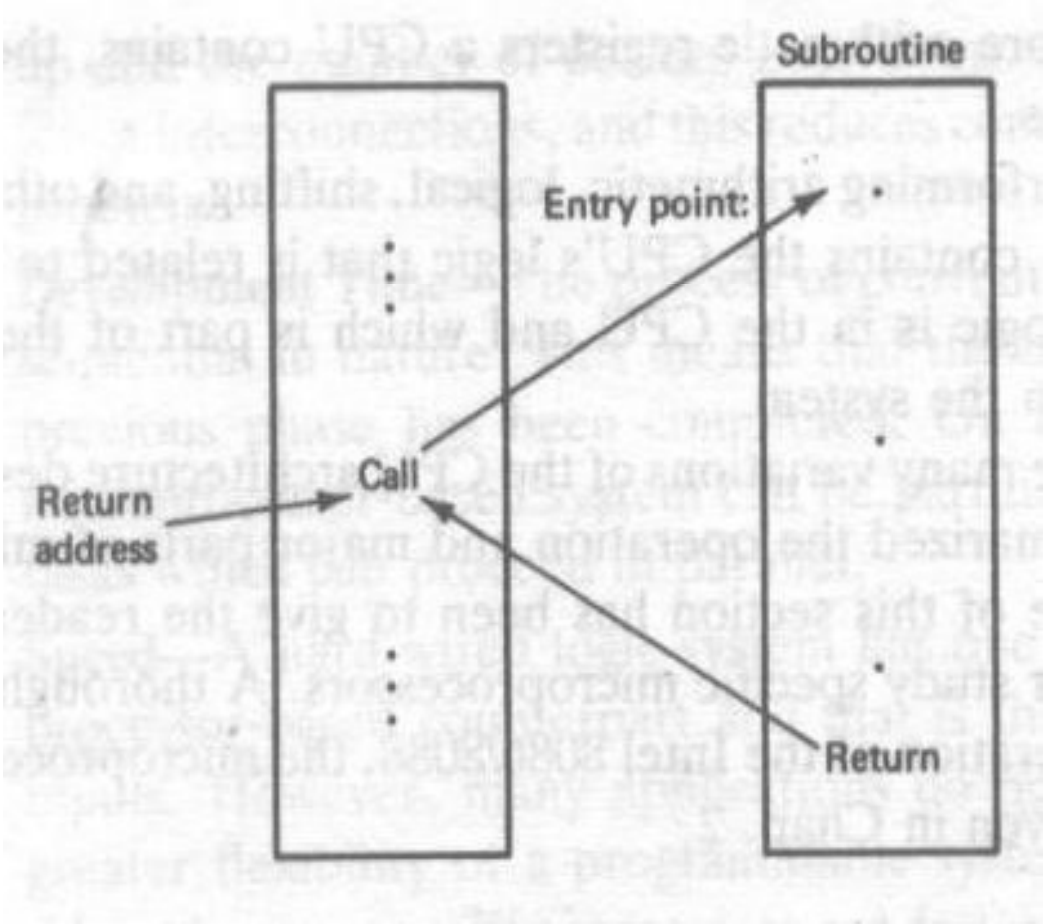


Figure 1-10 Instruction sequencing.

SUBROUTINE CALL



SUBROUTINES

- Branching , but should save the content of PC(return address) before loading with new
- Not only return address also the contents of working registers.
- Use **stack and stack pointers** for this .

WORKING REGISTERS

- Address registers
  - For the temporary address calculations
  - Eg:- base register, index register

- Arithmetic registers
  - for temporarily holding the operands and results of arithmetic operations because accessing a register is faster than accessing memory.

ALU

- For performing arithmetic, logical, shifting and other operations.