MICROPROCESOARE I

Obiectivele cursului :

- **Familiarizarea cu arhitectura software Intel 8086 …**
- **Asimilarea setului de instructiuni de baza (8086) + x86 (MMX)**
- **Dezvoltarea de aplicatii in Limbaj Asamblare (LA)**
- **Utilizarea µP 8086 in microsisteme**
- **Pentium**

BIBLIOGRAFIE RECOMANDATA

1. Lupu, E. si col. Initiere *in L.A. x86. Lucrari practice, teste si probleme. Galaxia Gutenberg 2012*
2. Lungu, V. *Procesoare Intel. Programare în L.A.* TEORA, 2004
3. Burileanu, C. şi col. *Microprocesorul x86 - o abordare software* Ed. Albastră, 1999
4. Musca, Gh. *Programare în limbaj de asamblare,* TEORA 2000
5. Hyde, R. The *Art of Assembly Language,* 2000
6. Buchanan, W. *PC interfacing,Communications and Windows Programing* Addison Wesley, 1999
7. Carter, Paul A. PC assembly language, 2003 www.computer-books.us
8. Rollins, D. *Program Tech help V 6.0. The electronic technical reference manual,* 1995
9. [***] www.intel.com
10. [***] www.x86.org
11. [***] www.softwareforeducation.com
12. [***] www.programmersheaven.com
13. etc.

Slide-uri cursuri MP1: http://users.utcluj.ro/~elupu/Curs/index.php

NOTARE:

- 70 % examen scris (teorie+probleme)
- 30 % teste laborator (4-5) Media $\geq$ 5

OBS: Intrare la examen: maxim 2 absente Nemotivate la laborator!!

BONUS:- Prezenta la curs > 50 % permite rotunjirea notei finale in sus intre 0.5 ….1 punct

Exemplu : Media = 8.66 Prezenta la curs 3/12

Nota catalog = 8

Moto: “ Merituos este cel ce termina un lucru inceput, nu cel ce il incepe”

Curs 1

- INTRODUCERE
- SCURT ISTORIC – Evolutia calculatoarelor si µP
- ARHITECTURI DE PRELUCRARE
- LIMBAJ de ASAMBLARE . COD MASINA.
- Tema

1. INTRODUCERE

Sistem numeric - O structura de dispozitive asamblate in vederea prelucrarii sau transmiterii informatiei numerice

- Avantajele prelucrarii numerice:

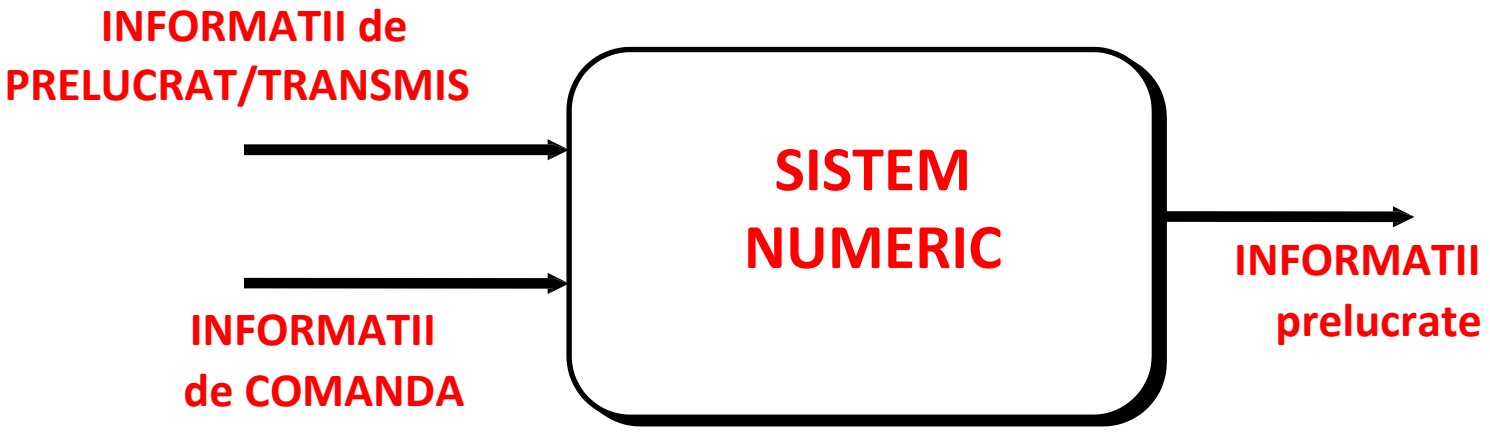
=> stabilitate si imunitate la perturbatii

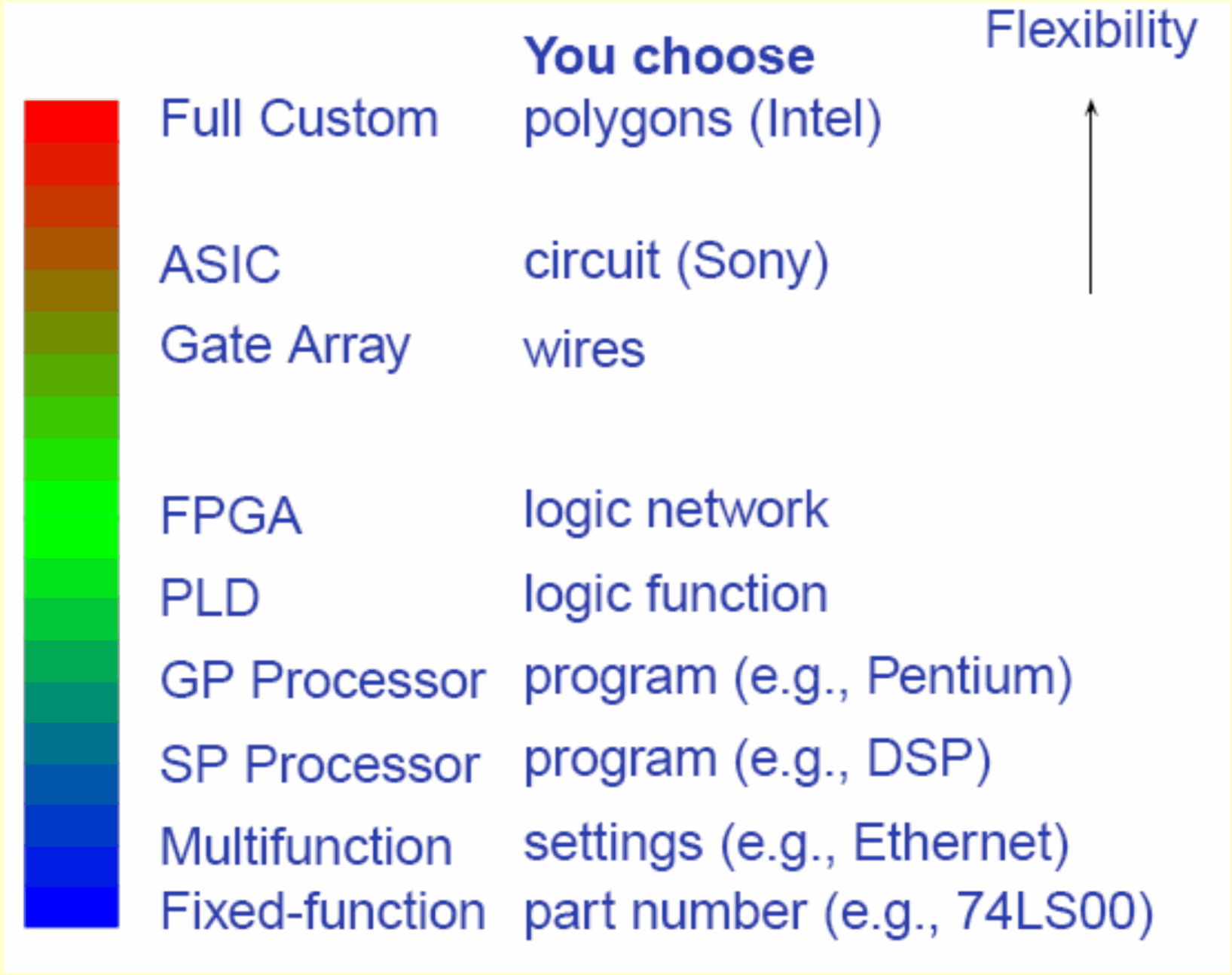
=> siguranta in functionare chiar la variatii ale parametrilor in timp

=> precizie (nu e nevoie de reglaje/compensari ca la circuitele analogice)

=> afisare digitala

- *Problemele practice sunt de diverse complexitati si vitezele proceselor urmarite au o gama larga de desfasurare*
- ***Logica cablata (circuite combinationale-secventiale) / Logica programata***




Flexibility
You choose
Full Custom
polygons (Intel)
ASIC
circuit (Sony)
Gate Array
wires
FPGA
logic network
PLD
logic function
GP Processor
program (e.g., Pentium)
SP Processor
program (e.g., DSP)
Multifunction
settings (e.g., Ethernet)
Fixed-function
part number (e.g., 74LS00)

2. SCURT ISTORIC AL CALCULATOARELOR

- **abacul (antichitate)**

  <u>calculatoare mecanice – (??-1940)</u>

- **sec. XVII – Pascal –masina de calcul mecanica (+, -)**
- **sec. XVII-XVIII – Leibnitz – (+,-,*,/)**
- **sec XIX - Ch. Babbage (Cambridge) – masina diferentiala si masina analitica (memorie, unitate de calcul, cititor de cartele si perforator de cartele)**

  <u>sec. XX</u>

- **Howard Aiken (Harvard 1937) – Mark I, II – calculatoare cu secventa de comanda automata (Babbage+IBM)**

  (relee + comutatoare) => inceputul noii ere a calculatoarelor

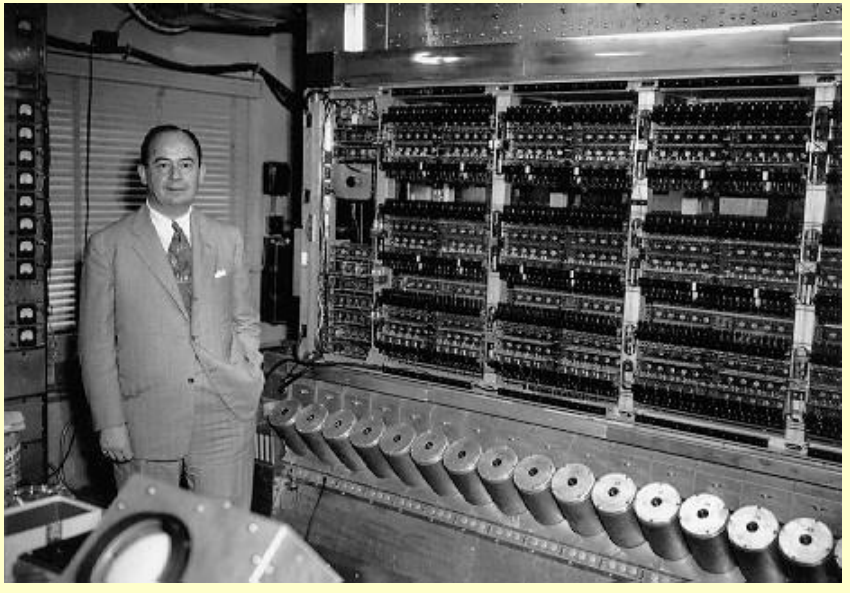
Prima generatie ~ 1943-55

***tehnologie*: tuburi electronice**

1943-46 – P. Eckert & J. Mauchley (Univ. Pensilvania- Aberdeen)
– ENIAC – primul calculator electronic (versiunea MARK I)
~ 18000 tuburi, 1500 relee - 30 tone
- conceptele si ideile - John von Neumann – calculatorul cu program memorat

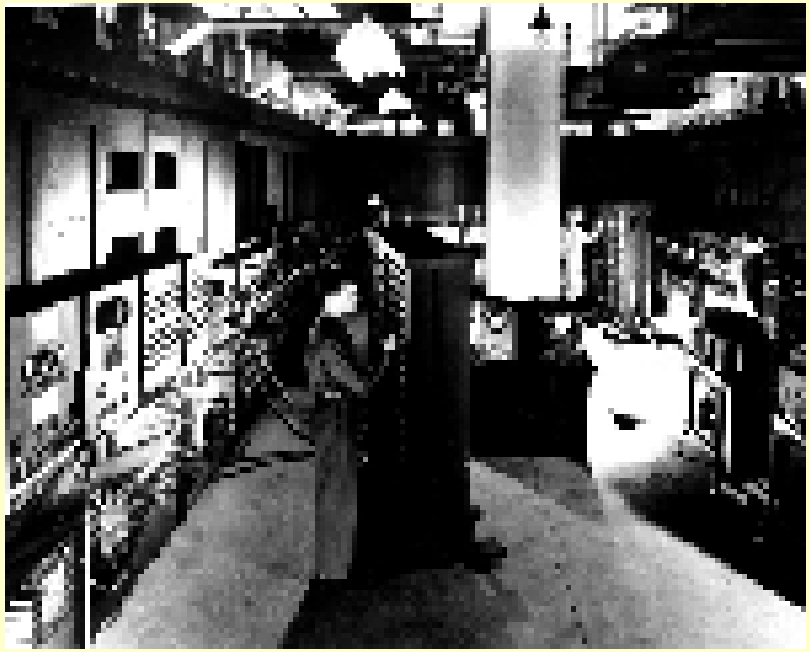
- alte variante: EDVAC, ILLIAC, MANIAC, Wirlwind, UNIVAC, IBM 701, 704, 709 – primele calculatoare comerciale
DACICC, CIFA, MECIPT – variante romanesti

Eckart si Mauchley

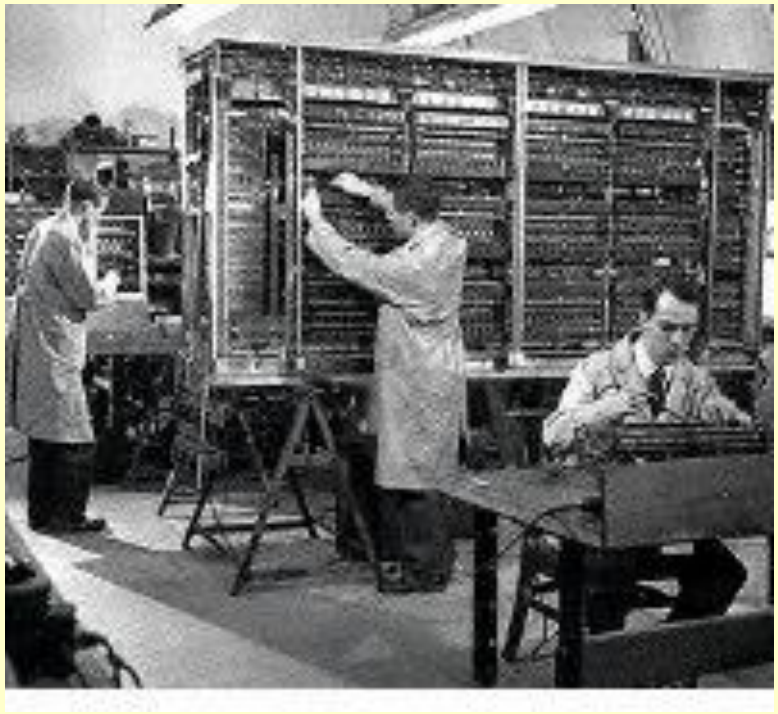


John von Neumann

UNIVAC



ENIAC



ADVAC

IBM 701

Generatia a II-a ~ 1955-65

tehnologia: **tranzistorul**

- **Shockley, Brattain si Bradley – (Bell labs) - 1 Iulie 1947**
- **primul calculator tranzistorizat: TX-0**
- **BM 7090 – varianta tranzistorizata, IBM 1401**
- **Wirlwind – MIT**
- **PDP-1, PDP-8, firma DEC**
- **CDC 6600 – primul calculator paralel**
- **CETA – calc. romanesc**

TX-0

PDP-1

Generatia a III-a ~ 1965-75

***tehnologia*: circuite integrate**

Primul CI digital 12 sept. 1958 ? (Fairchild ?? Texas Instr.)

familii de calculatoare:

- **mainframe: IBM 360, IBM 370**
- **mini: PDP 11**

calculatoare romanesti:

- **Felix C-256, C-512, C-32**
- **Independent, Coral – copiaza PDP-11**

imbunatatiri:

- **Viteza,fiabilitate, dimensiuni, capacitatea memoriei (256k-512k)**
- **Noi periferice: consola-display (PDP11)**

Calculator HP

Apollo

HP (1972)

Generatia a IV-a 1975 -

tehnologia: VLSI =>> µP

-aparitia primului microprocesor - Intel 4004 (1971)

- avantaje: viteza, grad ridicat de integrare, fiabilitate mare, cost redus, dimensiuni mici

- CI ROM, RAM, DRAM de capacitate mare (1-16ko)

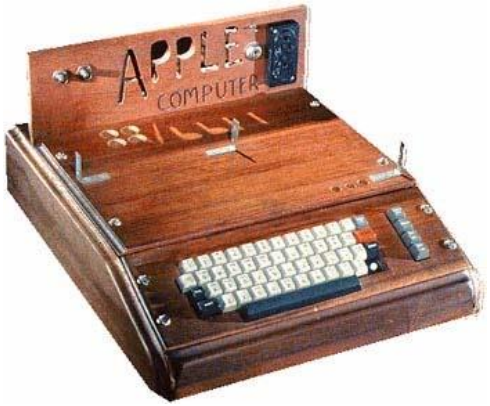
- aparitia µcalculatoarelor – pe baza de microprocesor

- apar calculatoarele personale:

- home-computer: ZX81, Spectrum

- PC: IBM-PC-1981, XT, AT, Apple, Machintosh

- calculatoare romanesti: seria M18, PRAE, aMIC, Felix PC, Telerom-PC, ECAROM



Apple I 1976

Sinclair ZX80 1980

IBM PC 1981

Atari 400 1979

Apple Mac 1984

Bill Gates

Steve Jobs si Steve Wozniak

Generatia a V-a ??? (1982-

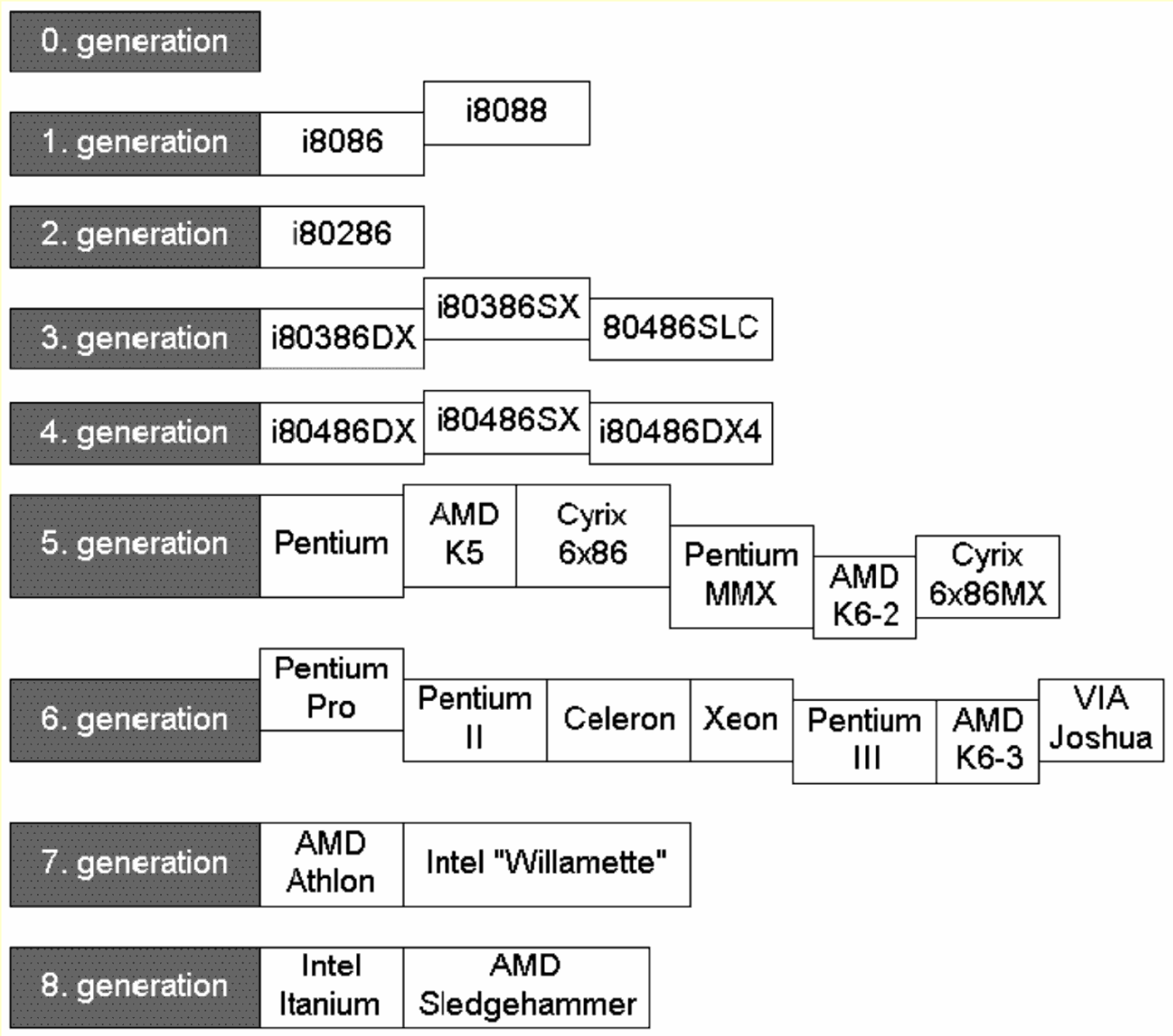
-proiect japonez ambitios - esec

obiective: -viteze f.mari de calcul (mil. inferente/s)
- interfete om-calculator naturale (voce, imagine)
- aplicatii de inteligenta artificiala
- arhitecturi paralele de calcul

ce nu s-a prevazut:
- dezvoltarea sistemelor bazate pe microprocesoare
- dezvoltarea retelelor de calculatoare
-dezvoltarea sistemelor / aplicatiilor distribuite (Internet)

-http://en.wikipedia.org/wiki/Fifth_generation_computer

Width	Processor	Application
4 bit	4004	Pocket calculators
8 bit	8080	Small CP/M based home computers
16 bit	8086, 8088, 80286	IBM-compatible PC's running MS-DOS
32 bit	80386 - Pentium 4	32 bit versions of Windows (Windows 95/98/2000/ XP)
64 bit	Athlon 64 Pentium 4 Itanium	Server software 64 bits versions of Windows, Linux etc.


0. generation
1. generation
i8086
i8088
2. generation
i80286
3. generation
i80386DX
i80386SX
80486SLC
4. generation
i80486DX
i80486SX
i80486DX4
5. generation
Pentium
AMD K5
Cyrix 6x86
Pentium MMX
AMD K6-2
Cyrix 6x86MX
6. generation
Pentium Pro
Pentium II
Celeron
Xeon
Pentium III
AMD K6-3
VIA Joshua
7. generation
AMD Athlon
Intel "Willamette"
8. generation
Intel Itanium
AMD Sledgehammer

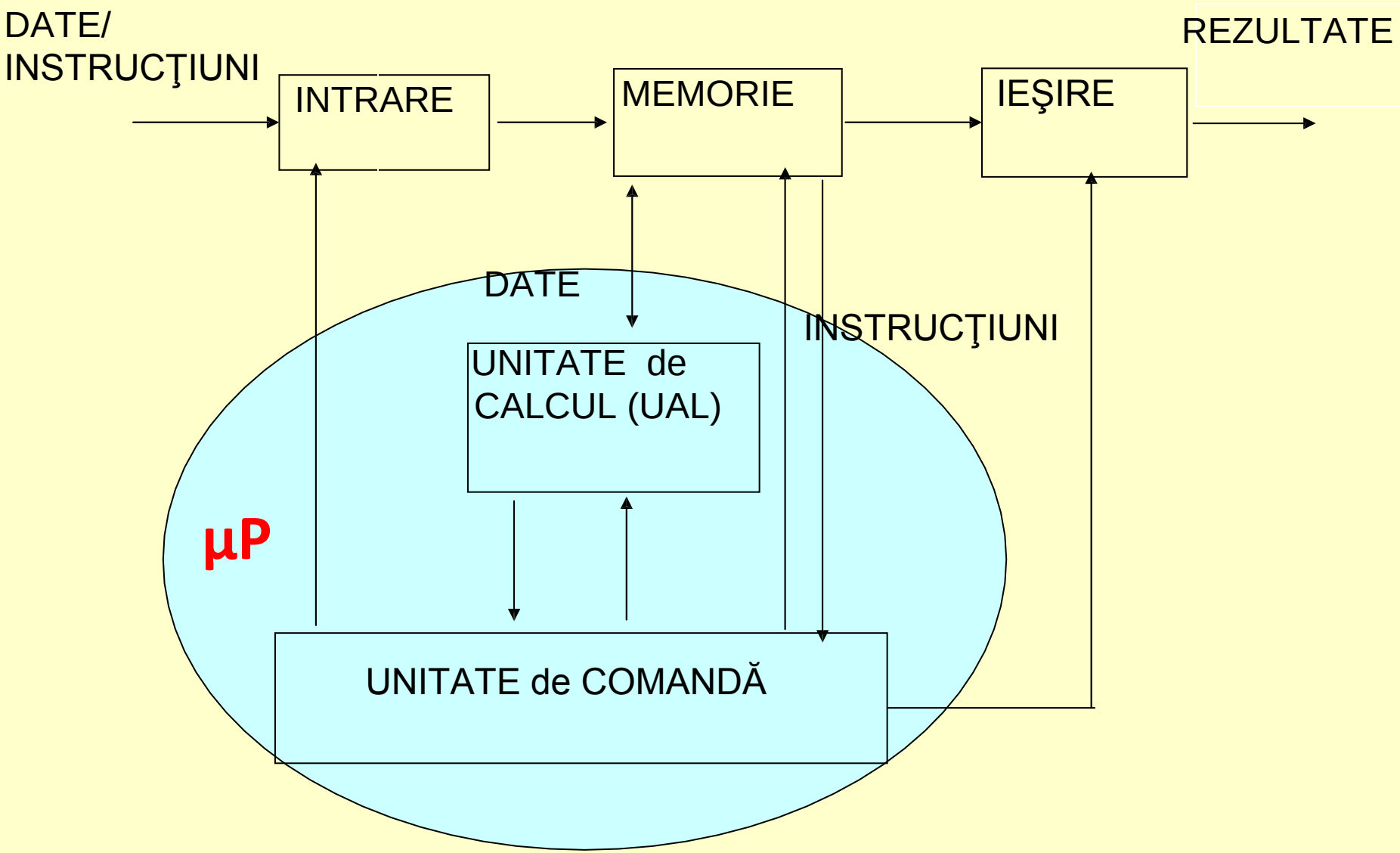
PC	CPUs	Year	Number of transistors
1st. Generation	8086 and 8088	1978-81	29,000
2nd. Generation	80286	1984	134,000
3rd. Generation	80386DX and 80386SX	1987-88	275,000
4th. Generation	80486SX, 80486DX, 80486DX2 and 80486DX4	1990-92	1,200,000
5th. Generation	Pentium Cyrix 6X86 AMD K5 IDT WinChip C6	1993-95 1996 1996 1997	3,100,000 -- -- 3,500,000
Improved 5th. Generation	Pentium MMX IBM/Cyrix 6x86MX IDT WinChip2 3D	1997 1997 1998	4,500,000 6,000,000 6,000,000
6th. Generation	Pentium Pro AMD K6 Pentium II AMD K6-2	1995 1997 1997 1998	5,500,000 8,800,000 7,500,000 9,300,000
Improved 6th. Generation	Mobile Pentium II Mobile Celeron Pentium III AMD K6-3 Pentium III CuMine	1999	27,400,000 18,900,000 9,300,000 ? 28,000,000
7th. Generation	AMD original Athlon AMD Athlon Thunderbird Pentium 4	1999 2000	22,000,000 37,000,000 42,000,000

GENERATII DE PROCESOARE

Alte familii de microprocesoare:

- **Motorola:** 6800 (8 biti), 68000 (16 biti), 68020, 68030 (32 biti), 68040
- **Zilog:** Z80, Z8000
- **Texas Instruments:** -Digital Signal Procesors: TMS320c10/20/30/5x/6x; Digital Signal Controller
- **Microchip:** microcontrolere: PICxxx
- **Atmel** AT89Sxxx, AT90SXXX (AVR)
- **MIPS, ARM** etc.

3. ARHITECTURI DE PRELUCRARE



Schema bloc a calculatorului cu program memorat (von Neumann)

Un calculator cu program memorat trebuie să posede :

1. Intrare pentru un număr nelimitat de date şi instrucţiuni

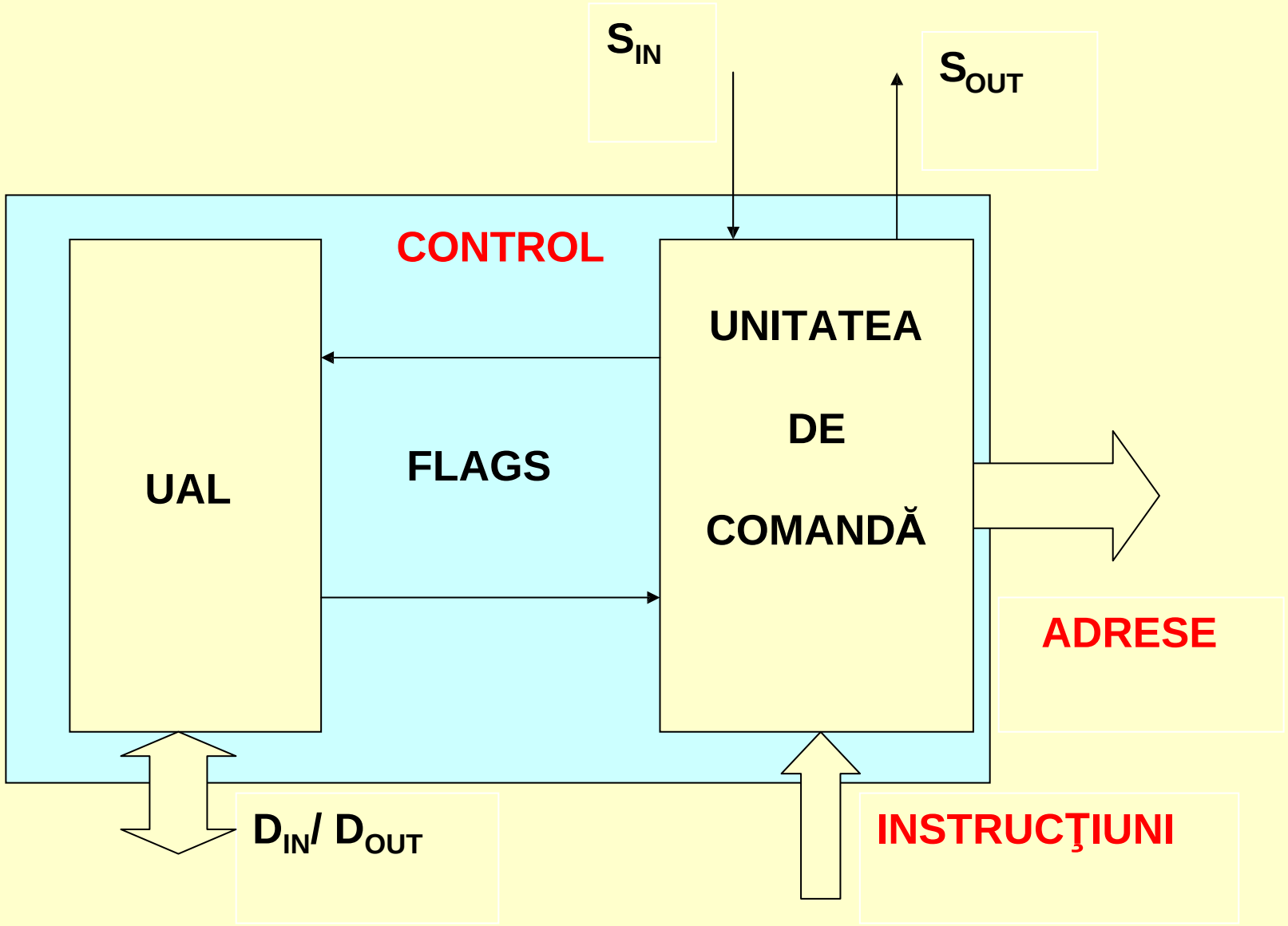
2. Memorie din care se pot citi instrucţiuni şi operanzi şi se depun rezultate

3. Ieşire prin care să pună rezultatele la dispoziţia utilizatorului

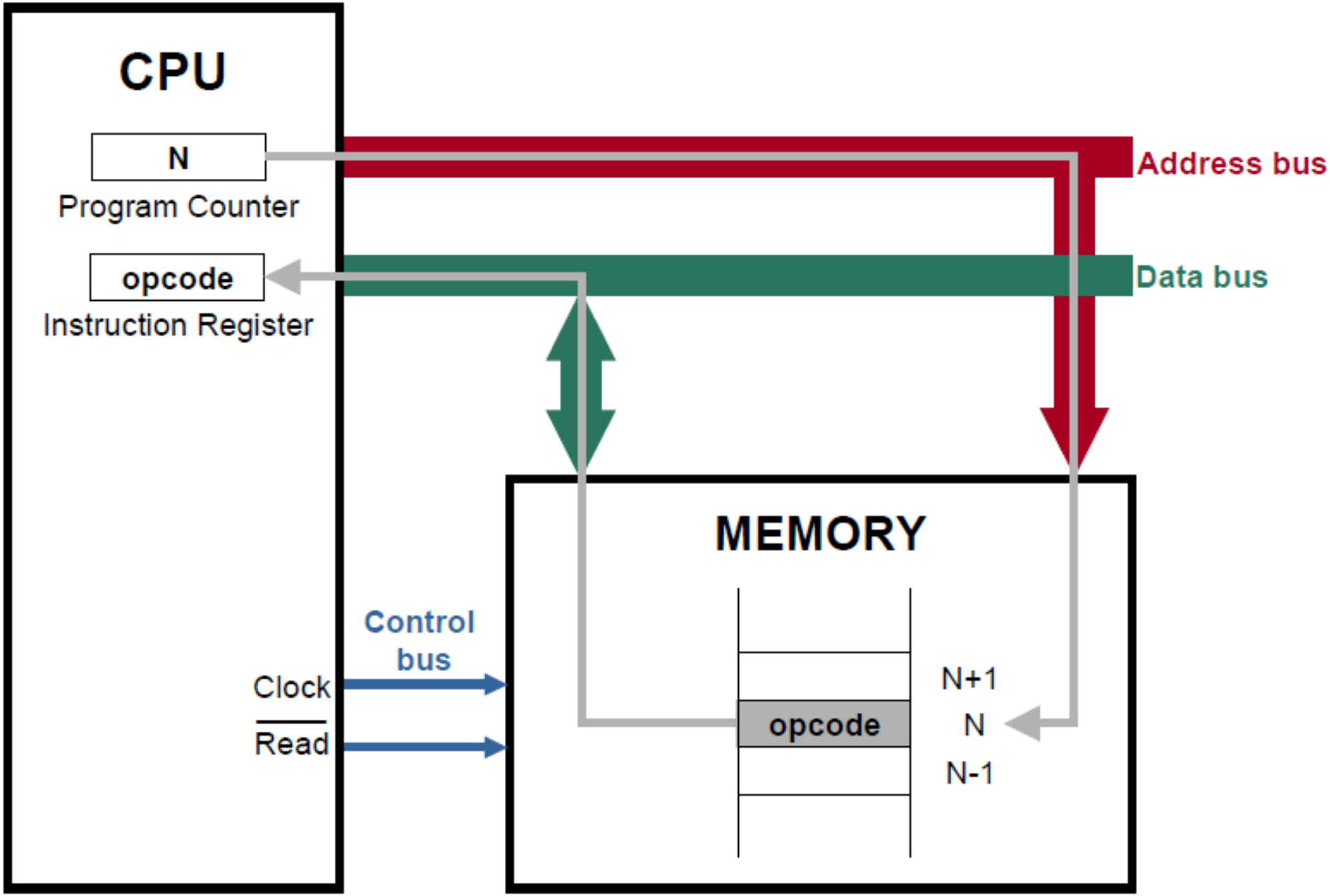
4. Unitate de calcul (UAL –unitate aritmetică şi logică sau de execuţie) care să execute operaţii aritmetice şi logice asupra datelor din memorie

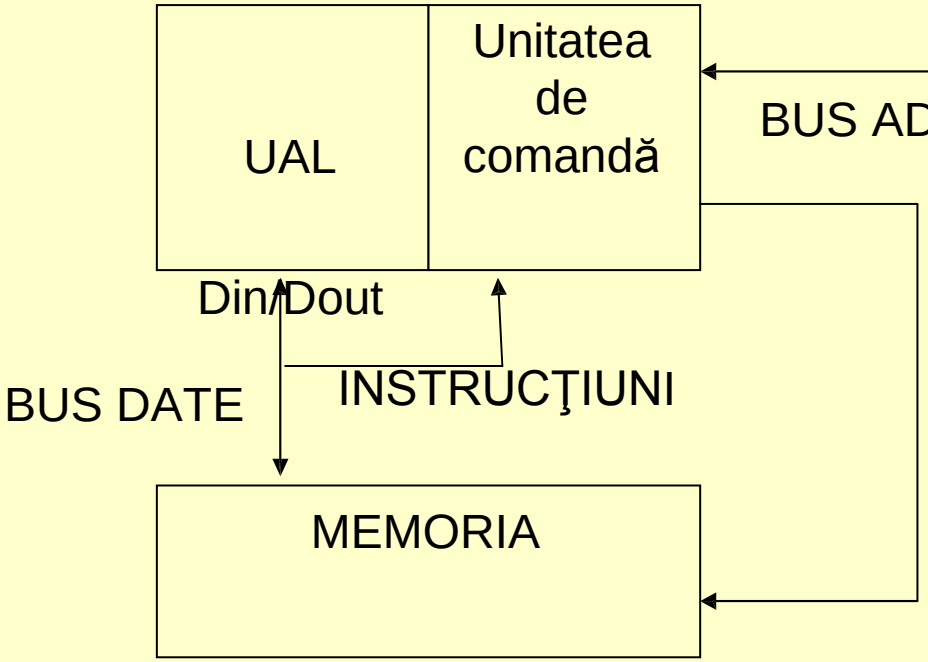
5. Unitate de comandă (control) care să interpreteze instrucţiunile extrase din memorie şi să aleagă diferite acţiuni pe baza rezultatelor calculelor

MICROPROCESOR = Unitate de calcul + **Unitate de comandă** (4+5)
MICROCALCULATOR (single-chip) = 1 +…+ 5 (microcontroler)



SCHEMA BLOC A MICROPROCESORULUI


CPU
N
Program Counter
opcode
Instruction Register
Address bus
Data bus
MEMORY
Control bus
Clock
Read
N+1
N
opcode
N-1

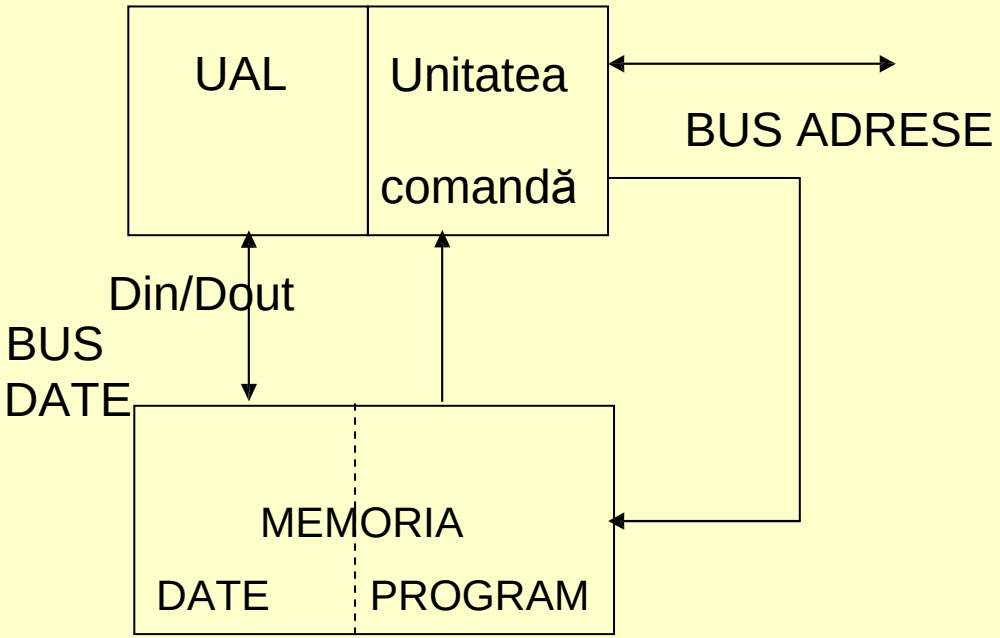


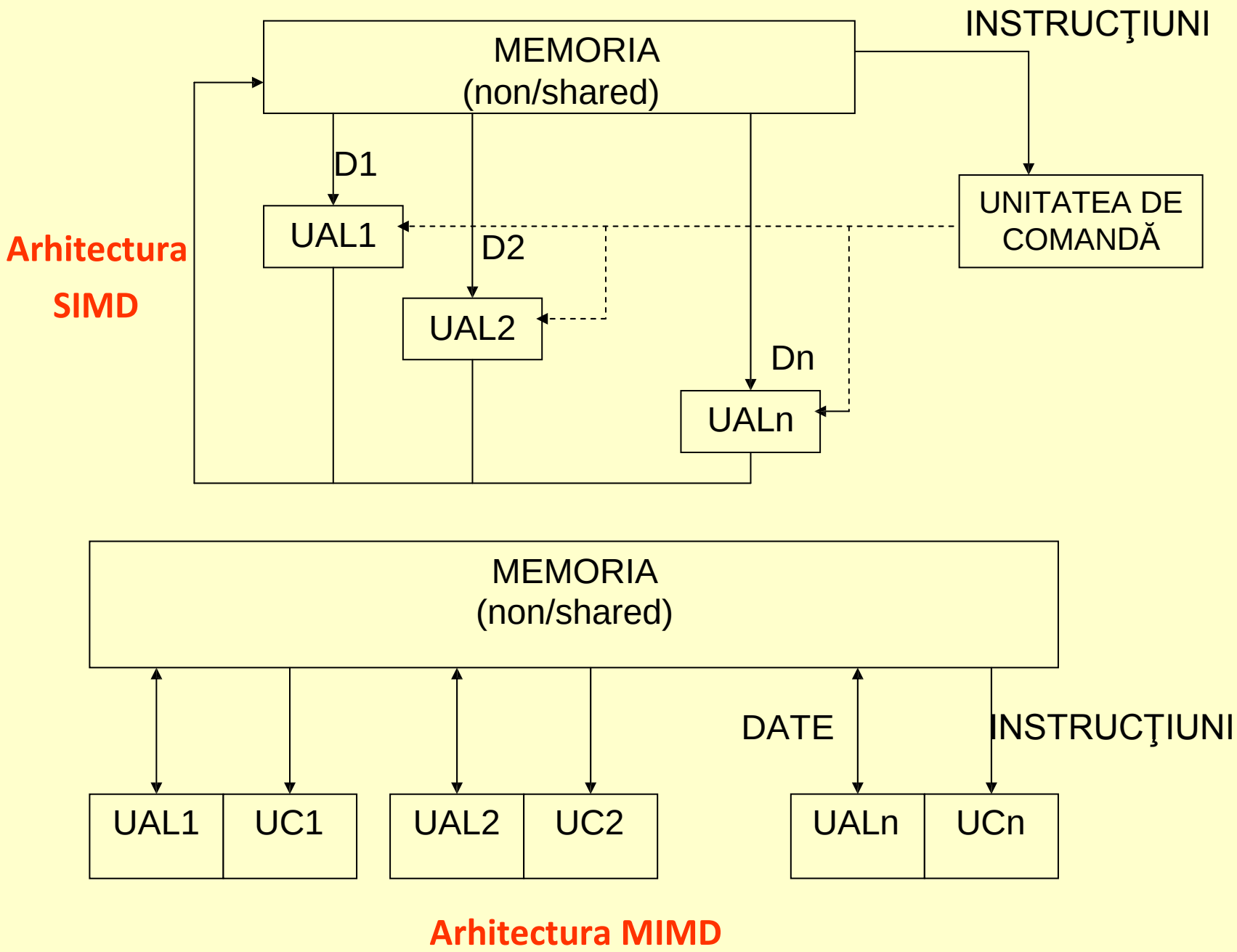
Arhitectura SISD (von Neumann)

Arhitectura HARVARD

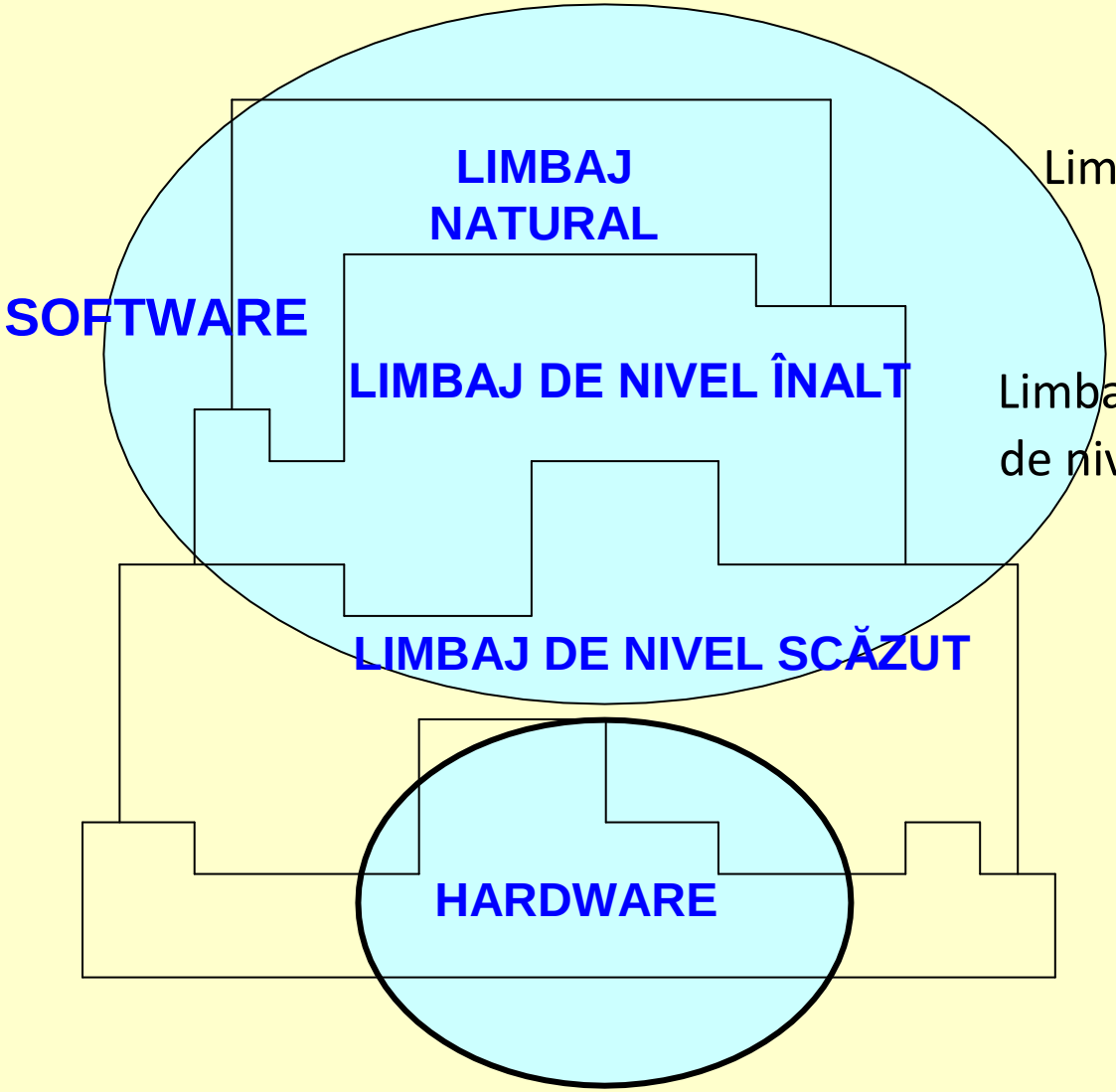
Clasificarea arhitecturilor µP dupa Flynn

- SISD (von Neumann)
- SIMD
- MISD
- MIMD




INSTRUCŢIUNI
MEMORIA
(non/shared)
D1
UAL1
D2
UAL2
Dn
UALn
UNITATEA DE
COMANDĂ
Arhitectura
SIMD
MEMORIA
(non/shared)
DATE
INSTRUCŢIUNI
UAL1
UC1
UAL2
UC2
UALn
UCn
Arhitectura MIMD

4. LIMBAJUL DE ASAMBLARE



Limbajul uman

Limbaje de programare,
de nivel înalt - HLL

Limbaj de asamblare
(cod maşină)
limbaj “low-level”

Ierarhizarea limbajelor

Afiseaza suma dintre A * B si C.

C++: cout << (A * B + C);

Intel - Limbaj Asamblare

```
MOV     eax,A
MUL     B
ADD     eax,C
CALL    WriteInt
```

Intel - Limbaj Masina

```
A1 00000000
F7 25 00000004
03 05 00000008
E8 00500000
```

LIMBAJUL DE ASAMBLARE

DEZAVANTAJE	AVANTAJE
• Assembly is hard to learn •Assembly is hard to read and understand • Assembly is hard to debug • Assembly is hard to maintain • Assembly is hard to write •Assembly language programming is time consuming •Improved compiler technology has eliminated the need for assembly language •Today, machines are so fast that we no longer need to use assembly •If you need more speed, you should use a better algorithm rather than switch to assembly language. •Machines have so much memory today, saving space using assembly is not important. •Assembly language is not portable.	•Speed. Assembly language programs are generally the fastest programs around. •Space. Assembly language programs are often the smallest. •Capability. You can do things in assembly which are difficult or impossible in HLLs. •Knowledge. Your knowledge of assembly language will help you write better programs, even when using HLLs.

Site-uri utile:

Intel Home: www.intel.com
Intel Processor page: http://developer.intel.com/design/processor/
Intel Developer Home: http://developer.intel.com/
Intel Pentium II: http://developer.intel.com/design/PentiumII/
Intel Pentium III: http://developer.intel.com/design/PentiumIII/
Intel Pentium 4: http://developer.intel.com/design/pentium4/
Intel Desktop Boards
(Motherboards):http://developer.intel.com/design/motherbd/
PC Design Guide (Microsoft and Intel): http://www.pcdesguide.org/
AMD Home: www.amd.com
AMD Athlon: http://www.amd.com/products/cpg/athlon/index.html
PC Guide: http://www.pcguide.com/index.htm

5. TEME:

http://en.wikipedia.org/wiki/History_of_computing_hardware
http://www.karbosguide.com/
http://en.wikipedia.org/wiki/List_of_Intel_microprocessors

CPU technologies

Architecture		ISA : CISC · EDGE · EPIC · MISC · OISC · RISC · VLIW · ZISC · Harvard architecture · von Neumann architecture · 4-bit · 8-bit · 12-bit · 16-bit · 18-bit · 24-bit · 31-bit · 32-bit · 36-bit · 48-bit · 64-bit · 128-bit
Parallelism	**Pipeline**	Instruction pipelining · In-order & out-of-order execution · Register renaming · Speculative execution · Hazards
	Level	Bit · Instruction · Superscalar · Data · Task
	Threads	Multithreading · Simultaneous multithreading · Hyperthreading · Superthreading
	Flynn's taxonomy	SISD · SIMD · MISD · MIMD
Types		Digital signal processor · Microcontroller · System-on-a-chip · Vector processor
Components		Arithmetic logic unit (ALU) · Barrel shifter · Floating-point unit (FPU) · Back-side bus · Multiplexer · Demultiplexer · Registers · Memory management unit (MMU) · Translation lookaside buffer (TLB) · Cache · register file · microcode · control unit · clock rate
Power management		APM · ACPI (states) · Dynamic frequency scaling · Dynamic voltage scaling · Clock gating

"Libertatea este dreptul de a le spune oamenilor, ceea ce nu vor să audă !" - George Orwell