

**Tehnike programiranja**

**PREDAVANJE 10**

**Uvod v binarni svet**

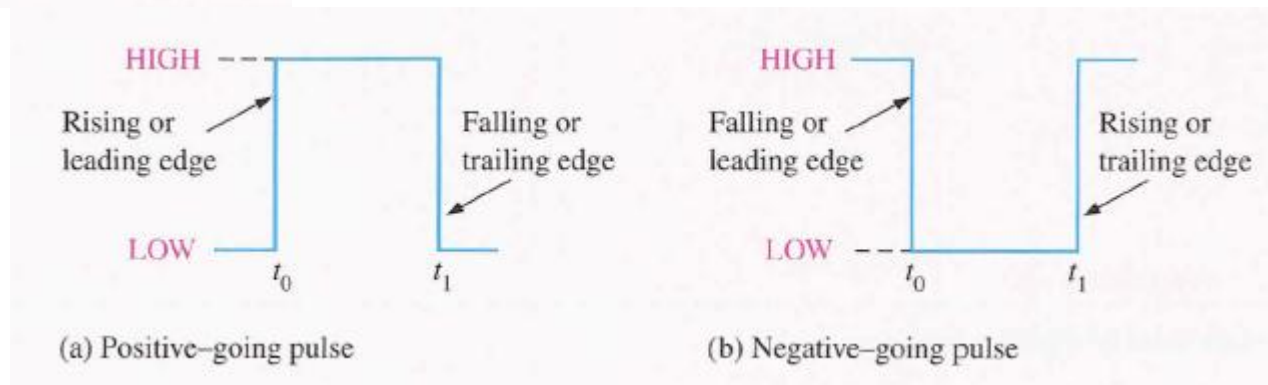
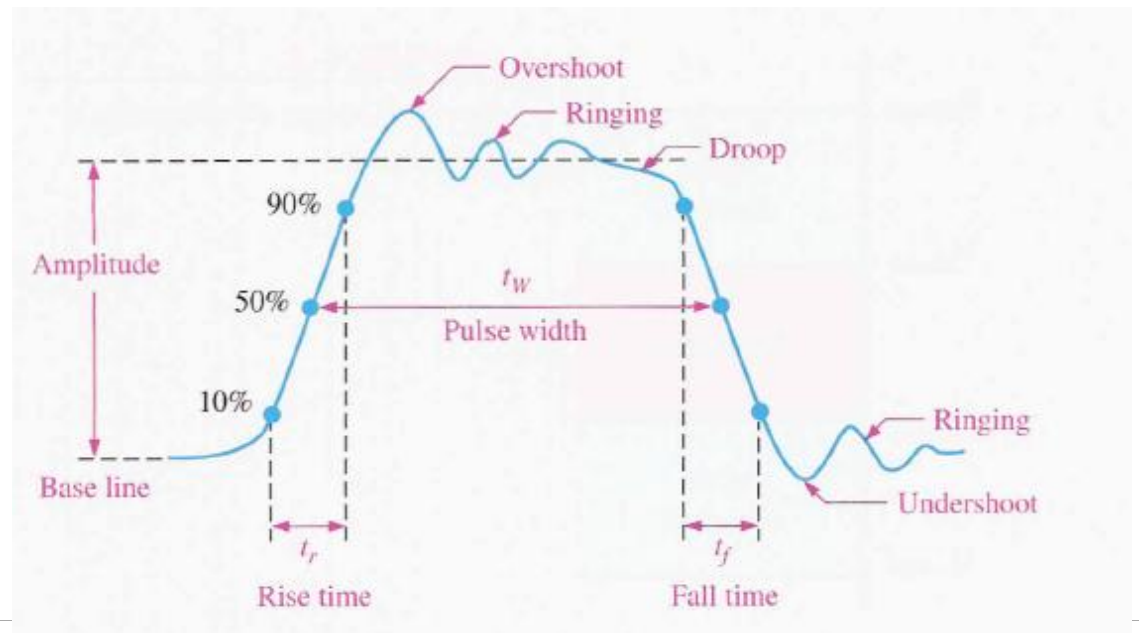
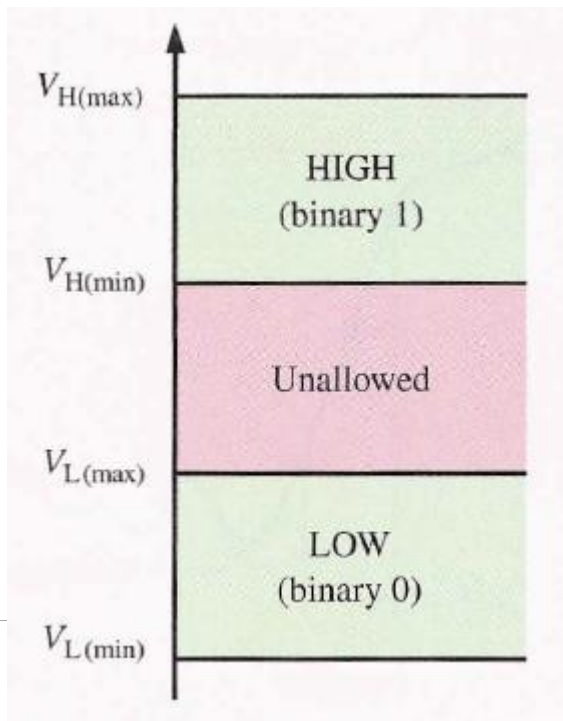
**in računalništvo**

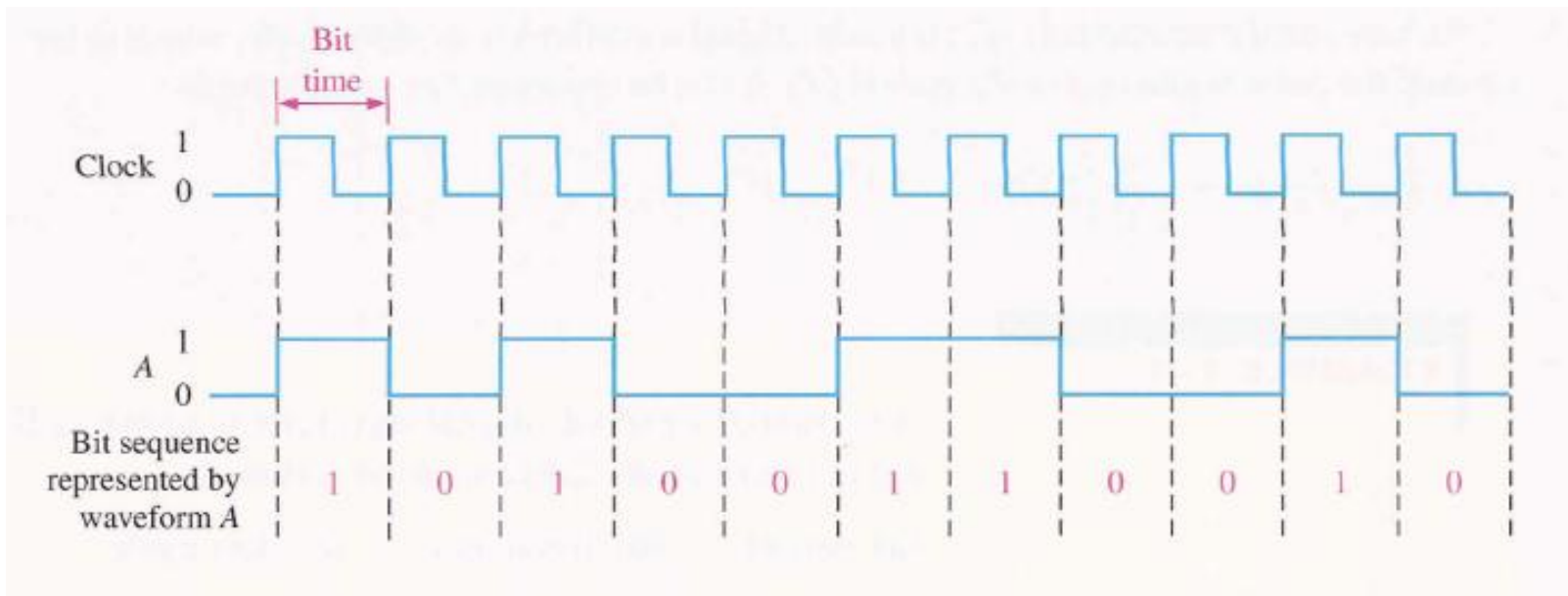
**(nadaljevanje)**

# Logične operacije

Ponovitev in ilustracija

---





## Logične operacije

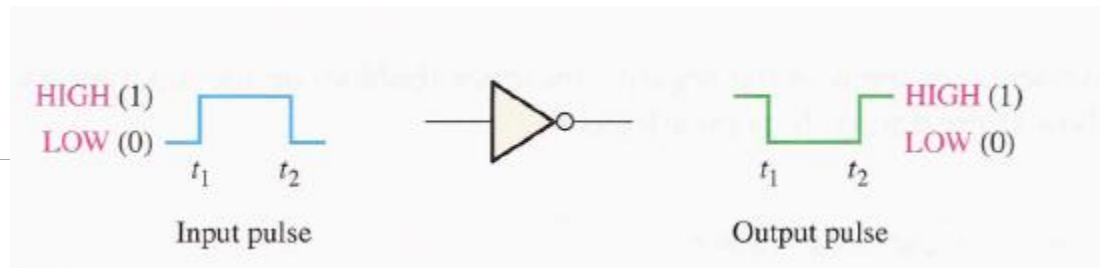
- Negacija (eniški komplement)
  - Negiramo vse bite v besedi

1011 1101 1111 0000

→

0100 0010 0000 1111

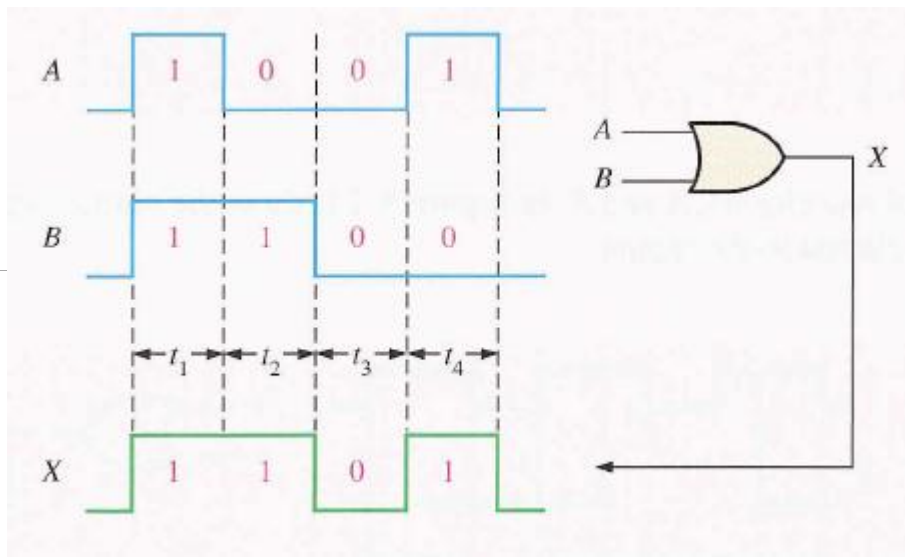
a	NE a
0	1
1	0



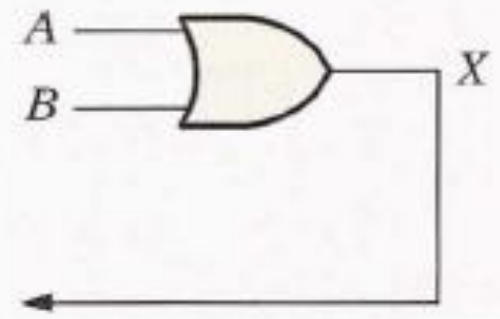
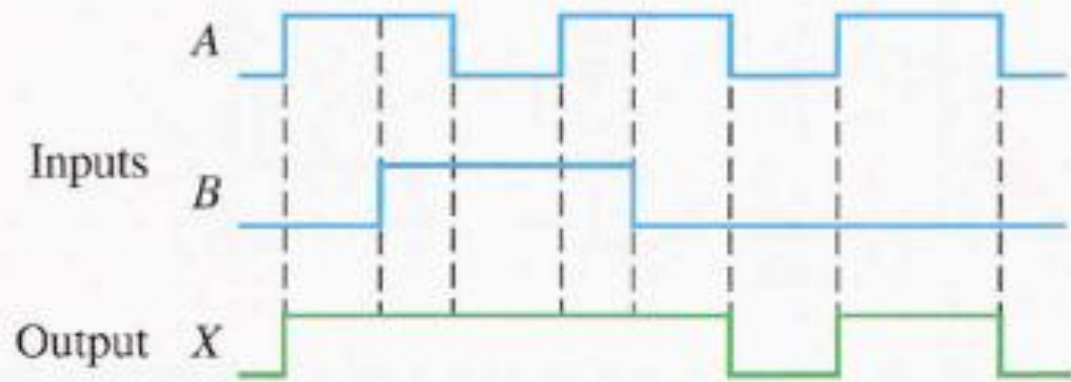
## Logične operacije

- Logični ALI (OR)
  - Izhod je 1, če je 1 prvi ali drugi ali oba

0001 | 0010 = 0011



a	b	a ALI b
0	0	0
0	1	1
1	0	1
1	1	1

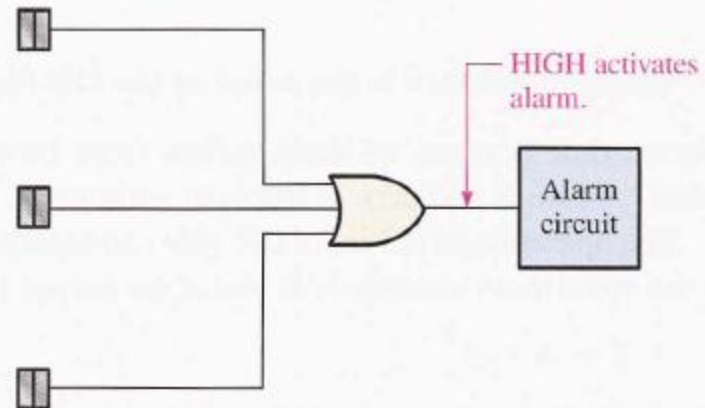


► **FIGURE 3-24**

A simplified intrusion detection system using an OR gate.

Open door/window sensors

HIGH = Open  
LOW = Closed



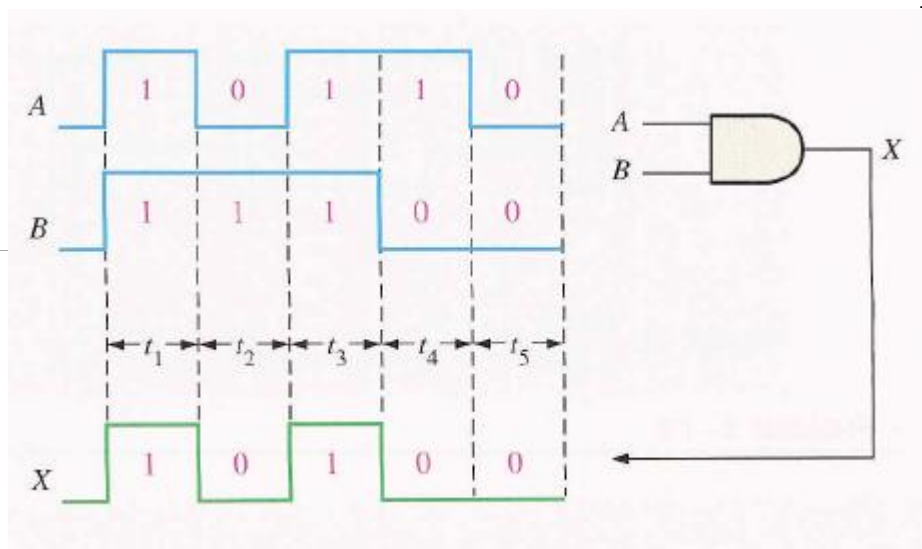


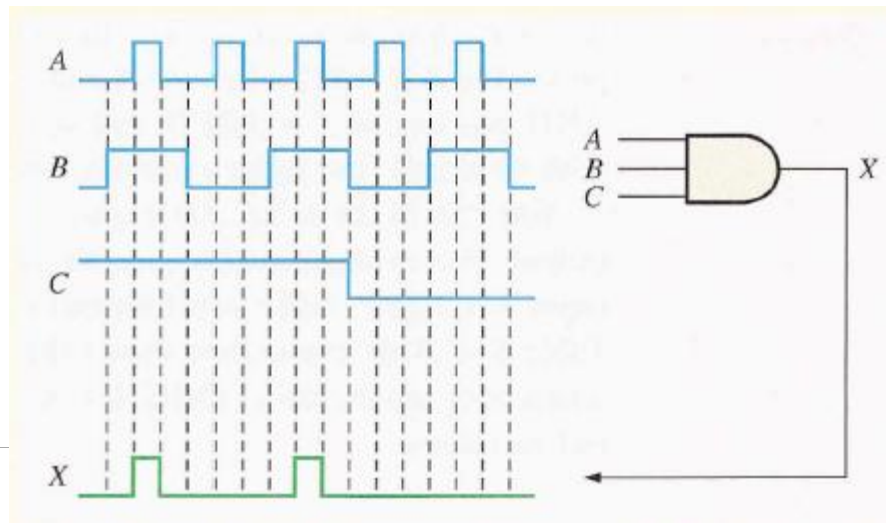
## Logične operacije

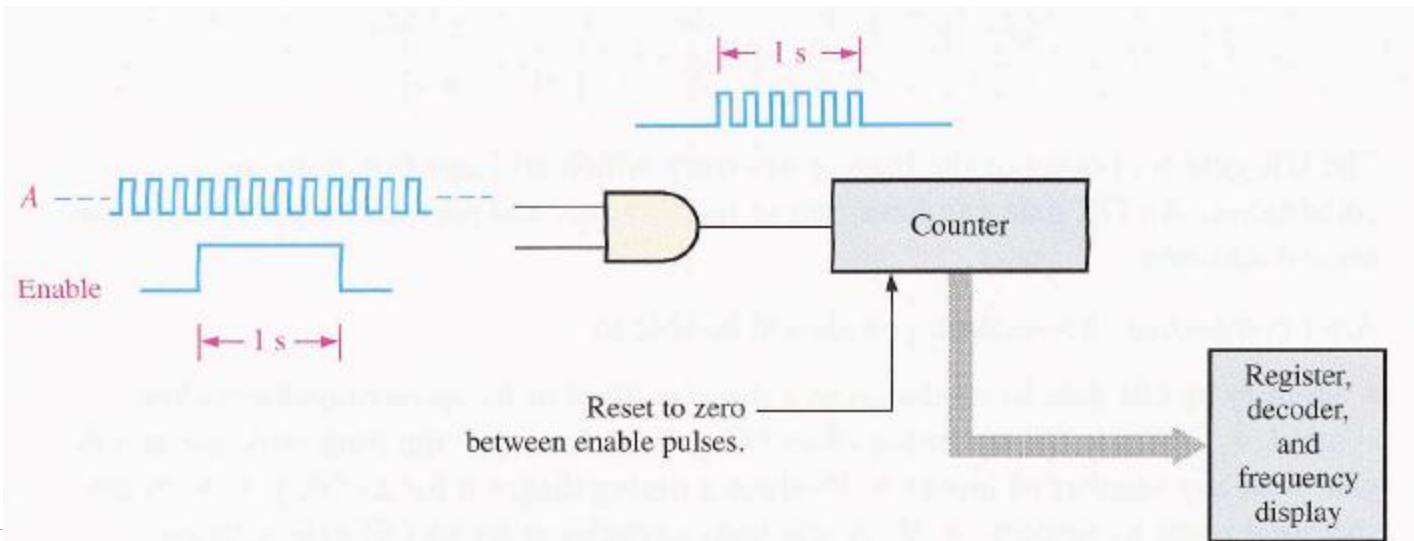
- Logični IN (AND)
  - Izhod je 1, če je 1 prvi in drugi

0011 & 0001 = 0001

a	b	a IN b
0	0	0
0	1	0
1	0	0
1	1	1







▲ **FIGURE 3-15**

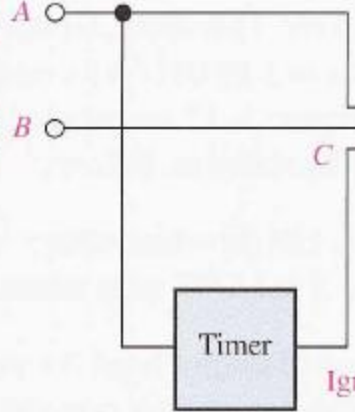
An AND gate performing an enable/inhibit function for a frequency counter.

HIGH = On  
LOW = Off

HIGH = Unbuckled  
LOW = Buckled

Ignition switch  
*A*

Seat belt  
*B*



▲ **FIGURE 3-16**

A simple seat belt alarm circuit using an AND gate.

# Predavanje 10

- Računalnik – Mikroprocesor
- Programski jeziki: strojni jezik – višjenivojski programski jeziki

[idos.fe.uni-lj.si](http://idos.fe.uni-lj.si)

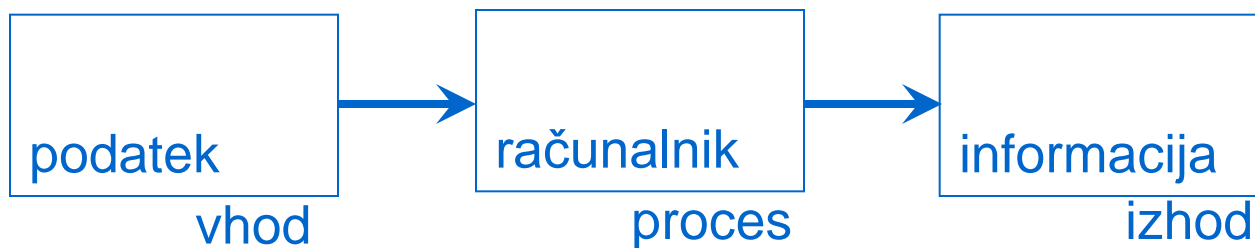
>študij >Tehnike programiranja

>Gradiva

---

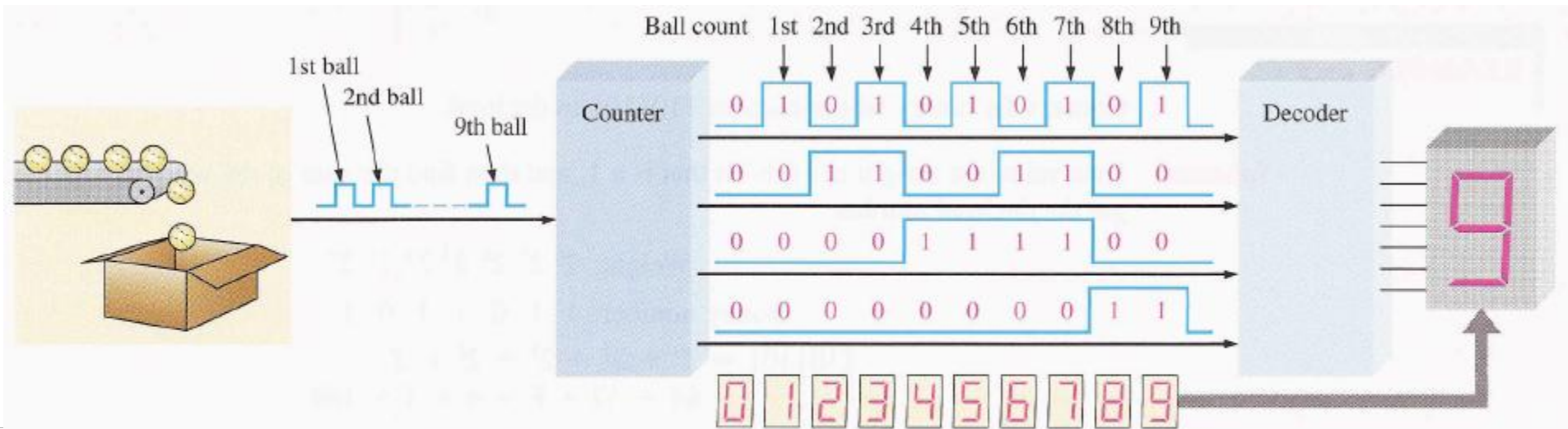
## Podatki in informacije

- informacija, kot obdelan podatek
- računalnik:
  - komunikacija z zunanjim svetom
  - obdelava podatkov



- Primer: podatek - informacija
-

# Binarni svet



▲ FIGURE 2-1

Illustration of a simple binary counting application.

# Računalnik

- osnovne komponente
    - CPE: centralno procesna enota
      - aritmetično-logična enota
      - nadzorna enota
    - pomnilnik
    - vhodno/izhodne enote
  - von Neumannova arhitektura
-



# Multimedijska oprema



## **Računalnik je orodje**

- osebni računalnik
  - strojna oprema
  - programska oprema
  - programiranje
- 
- ? računalniki v multimediji
  - ? programiranje v multimediji
-

## Vgrajeni sistemi

- namenski procesorski sistemi
- izvajajo nekaj namenskih funkcij
- delo v realnem času



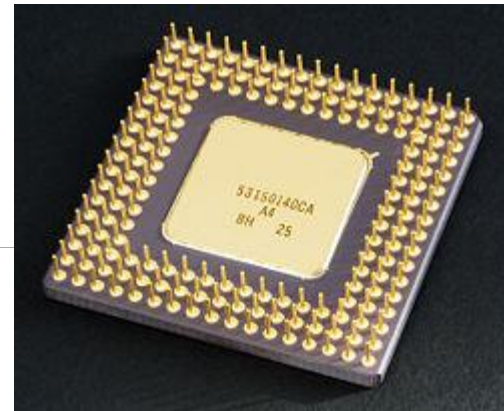
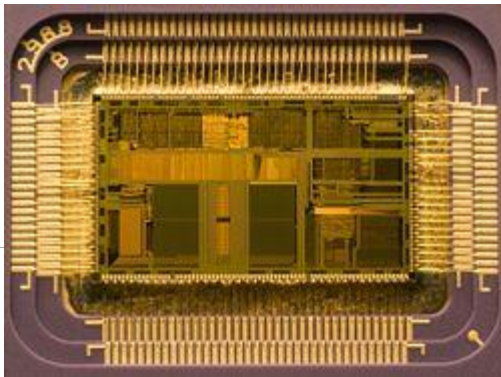
## Vgrajeni sistemi

- okoli 90% vseh mikroprocesorjev
- primeri:
  - mobilni telefoni
  - digitalne kamere
  - TV STB
  - telekonferenčni sistem
  - MPEG dekodirniki



# Centralna procesna enota

- procesna enota
- izvaja računalniški program
- mikroprocesorji (1970)
- osnovni element je tranzistor



# Programiranje 1

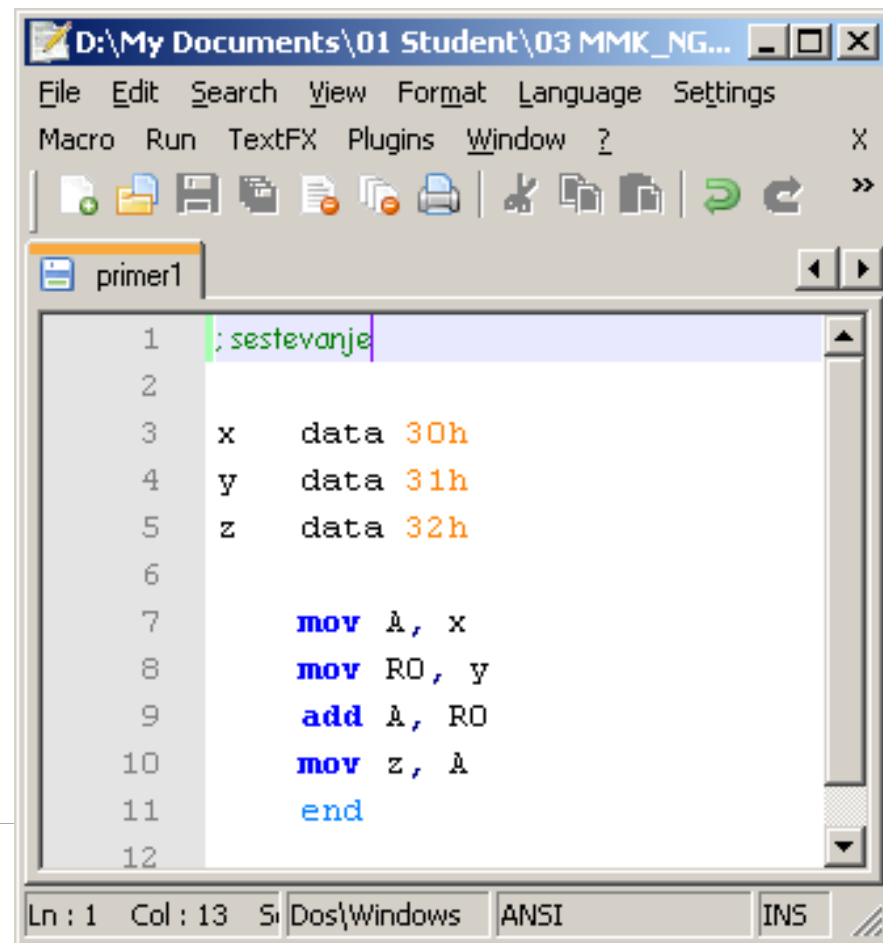
- Strojni jezik
- Zbirni jezik (assembler) – simbolični strojni jezik

- Primer

<u>zbirnik</u>	<u>strojna koda (binarni zapis)</u>
mov a, #1	01110100 00000001
mov r1, #1	01111000 00000001
add a, r1	00101000

## Zbirni jezik – zbirnik (assembler)

- Zbirni jezik sestavlja nabor ukazov
  - mov: beri/pisi
  - add: seštej
- Nabor ukazov je prilagojen arhitekturi procesorja
  - primer: Intel 8051



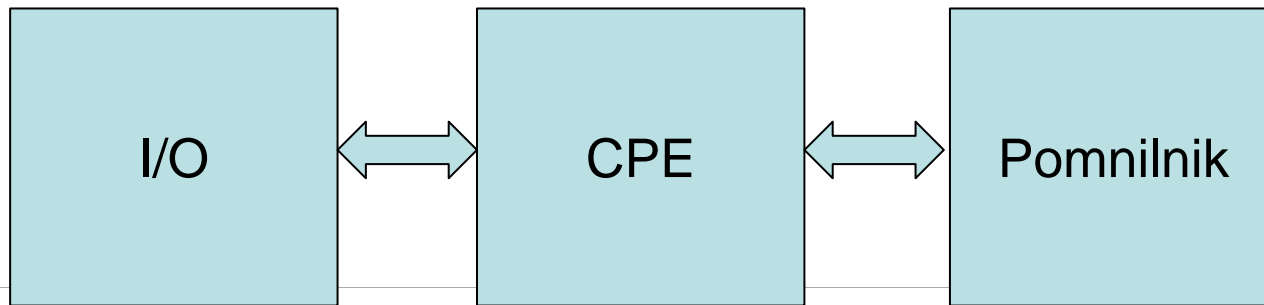
The screenshot shows a window titled "D:\My Documents\01 Student\03 MMK\_NG..." with a menu bar (File, Edit, Search, View, Format, Language, Settings, Macro, Run, TextFX, Plugins, Window, ?) and a toolbar. The main text area contains assembly code for an Intel 8051 processor, with line numbers 1 through 12 on the left. The code is as follows:

```
1 ; sestevanje
2
3 x    data  30h
4 y    data  31h
5 z    data  32h
6
7     mov  A, x
8     mov  R0, y
9     add  A, R0
10    mov  z, A
11    end
12
```

The status bar at the bottom shows "Ln : 1 Col : 13 S Dos\Windows ANSI INS".

## Arhitektura računalniškega sistema

- CPE: centralno procesna enota (CPU) - procesor
- Pomnilnik (memory): RAM, ROM, disk, ...
- Vhodno/izhodne enote (I/O): tipkovnica, zaslon, ...

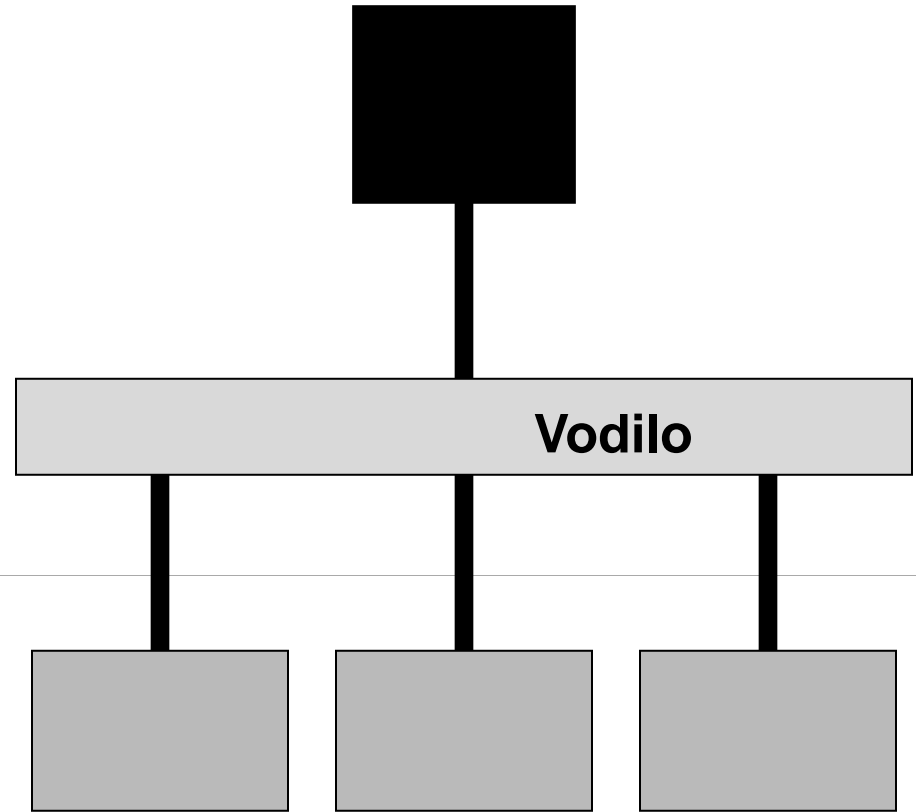




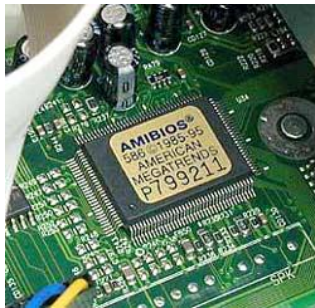
# Mikroprocesor - Pomnilnik

- Pomnilniki:
  - podatki
  - ukazi
- Komunikacija s mikroprocesorjem
  - sistemsko vodilo
- Pomnilniki
  - RAM
  - ROM

Mikroprocesor

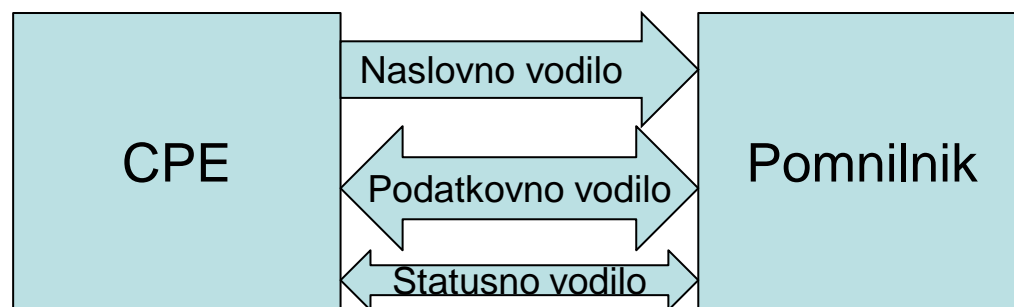


Pomnilniki



## CPE in Pomnilnik

- Enota: byte (8 bitov)
- Vsaka lokacija ima svoj naslov
- Daljše besede: uporabimo več zaporednih bajtov (byte)
  - 32 bitna beseda: 4 zaporedni bajti

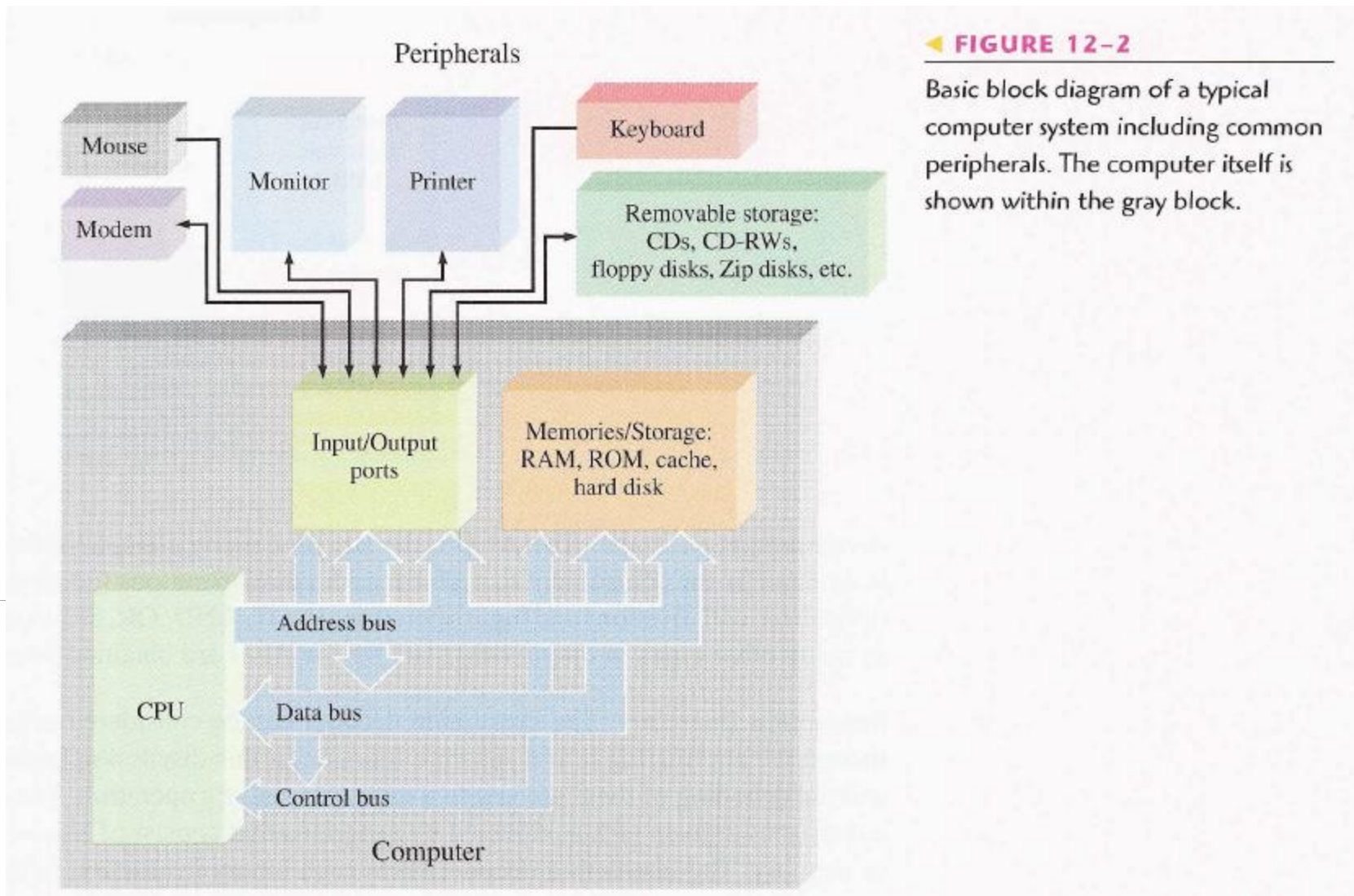


1 bit

8 bits = 1 byte

1kbyte =  $2^{10}$  = 1024 bytes

1Mbyte =  $2^{20}$  = 1048576 bytes

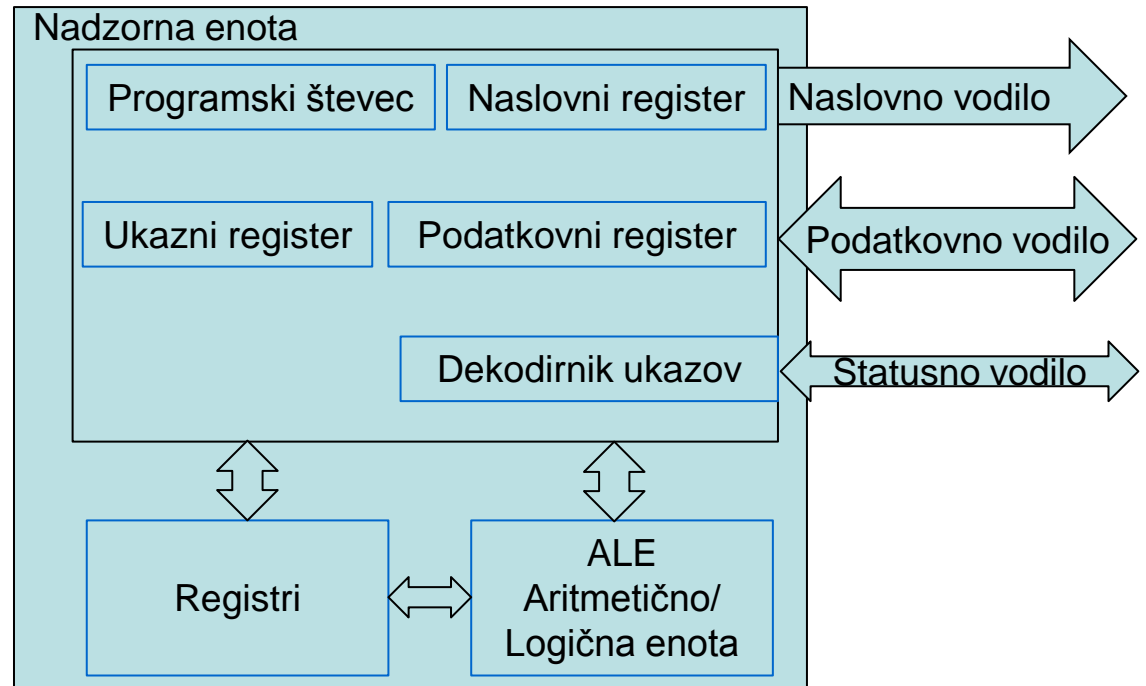


◀ **FIGURE 12-2**

Basic block diagram of a typical computer system including common peripherals. The computer itself is shown within the gray block.

# CPE

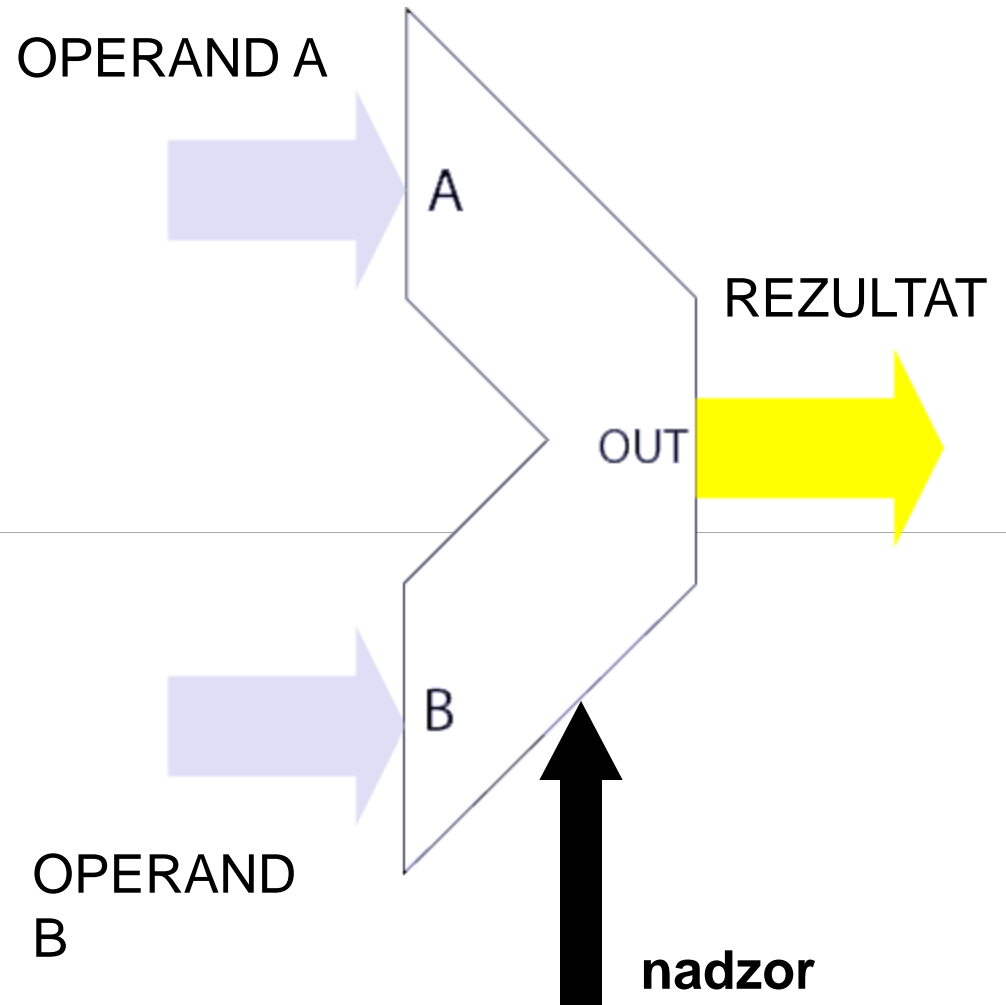
Fetch  
Decode  
Execute  
Store



Primer: tekoči trak

# Aritmetično logična enota (ALE)

- Seštevanje
- Odštevanje
- Množenje
- Deljenje
- Primerjava
- Logične operacije
- ...



## Registri

- Registri so pomnilne enote, ključne pri izvrševanju ukazov.
  - Največkrat nam služijo za hranjenje vmesnih rezultatov.    `MOV A, R4`
  
  - Akumulator A je 8 bitni splošno namenski register. Več kot polovica od 255 ukazov uporablja akumulator.    `MOV A, #20h`
-

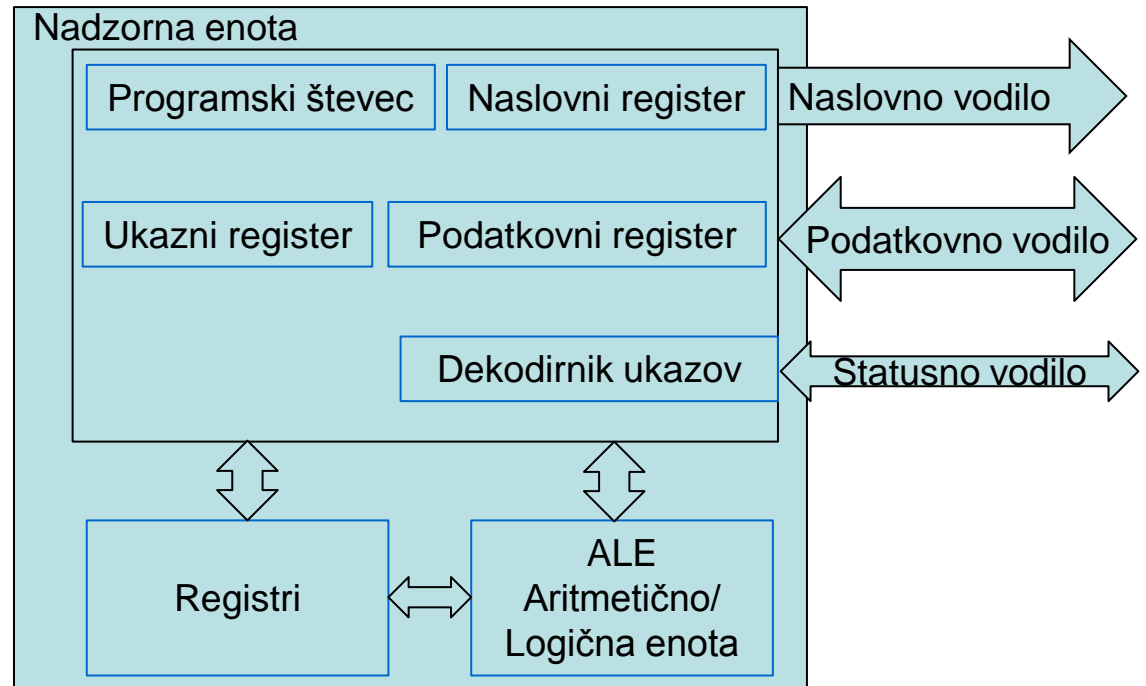
## Nabor ukazov

- Ukaz v zbirnem jeziku sestavljata mnemonična koda in operand, v strojni kodi pa ukazna koda in operand.

ukaz	opis	besede	periode
<u>ADD A, Rn</u>	Add register to Accumulator	1	12
<u>ADD A, #data</u>	Add immediate data to Accumulator	2	12
<u>SUBB A, Rn</u>	Subtract Register from Accumulator with borrow	1	12
<u>SUBB A, direct</u>	Subtract indirect RAM from Accumulator with borrow	2	12
<u>INC A</u>	Increment Accumulator	1	12
<u>INC Rn</u>	Increment register	1	12
<u>DEC A</u>	Decrement Accumulator	1	12
<u>DEC Rn</u>	Decrement Register	1	12
<u>MUL AB</u>	Multiply A & B	1	48
<u>DIV AB</u>	Divide A by B	1	48

# CPE

Fetch  
Decode  
Execute  
Store



Primer: tekoči trak



## Delovanje CPE

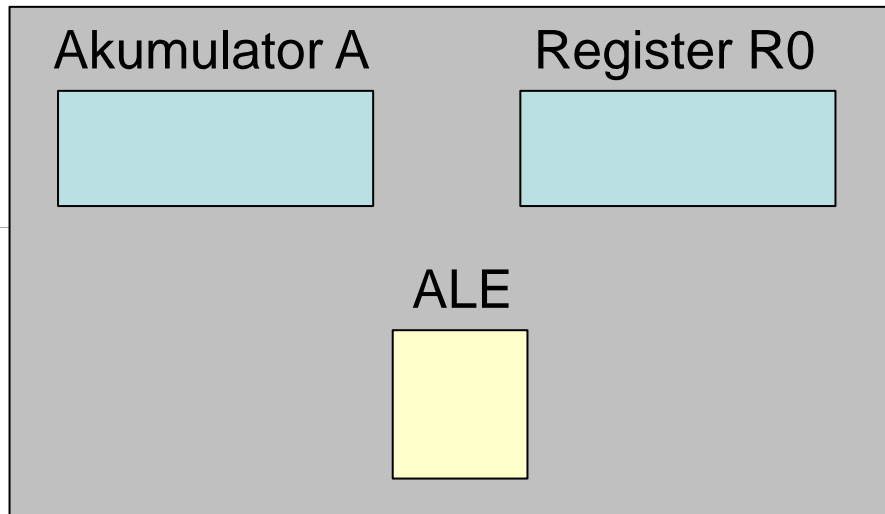
- osnovni cikel izvedbe ukaza (von Neumannov model)
    - beri (read)
    - dekodiraj (decode)
    - izvedi (execute)
    - shrani (store)
  - strojna koda: ukazi in podatki, ki jih CPE neposredno izvaja
  - zbirni jezik: simbolični zapis strojne kode
-

- ?  $z = x + y$ ;

Pomnilnik

x	0000 0001
y	0000 0001
z	0000 0000

CPE

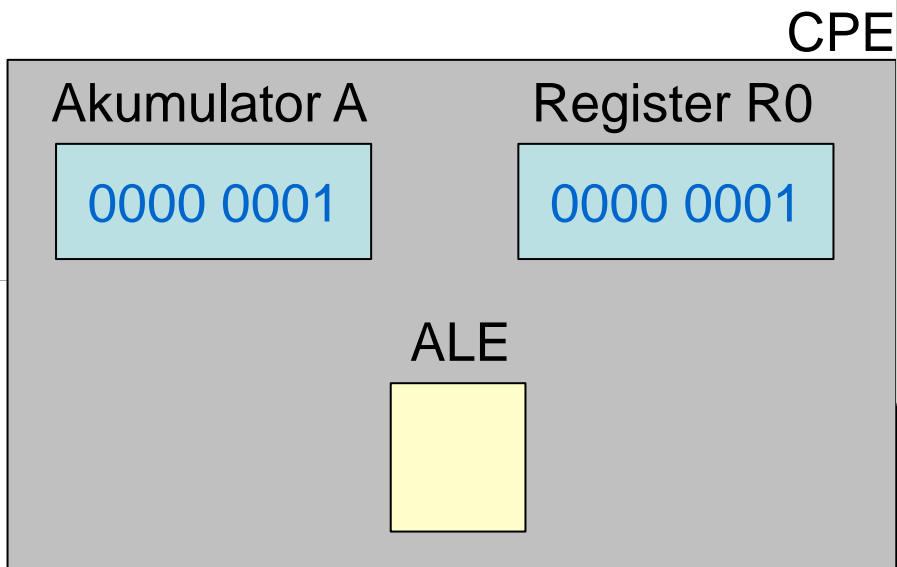


```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
[Icons]
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12
Ln : 1 Col : 13 S Dos\Windows ANSI INS
```

mov A, x  
mov R0, y

Pomnilnik

x	0000 0001
y	0000 0001
z	0000 0000



```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
[Icons: New, Open, Save, Print, etc.]

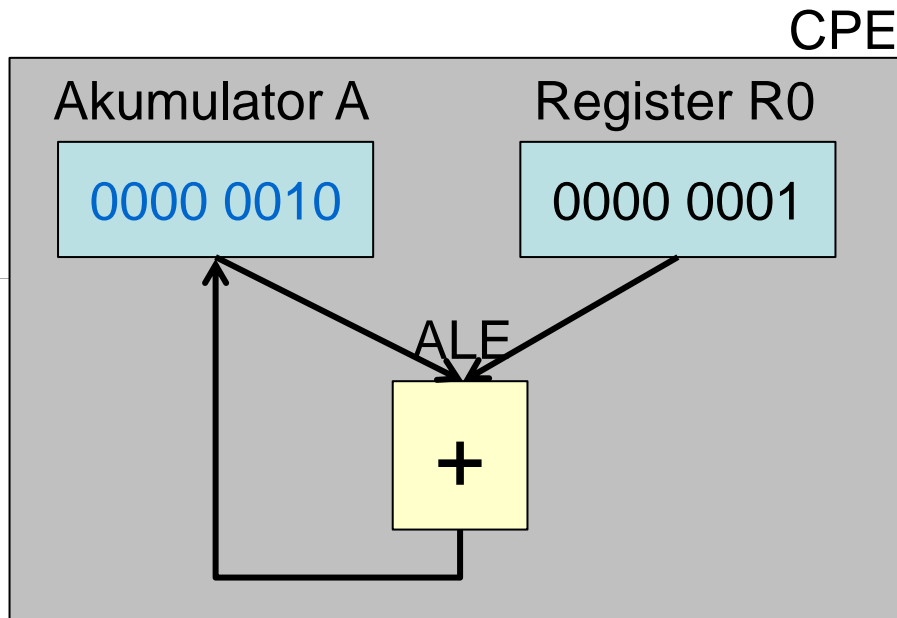
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12

Ln : 1 Col : 13 S Dos\Windows ANSI INS
```

add A, R0

Pomnilnik

x	0000 0001
y	0000 0001
z	0000 0000

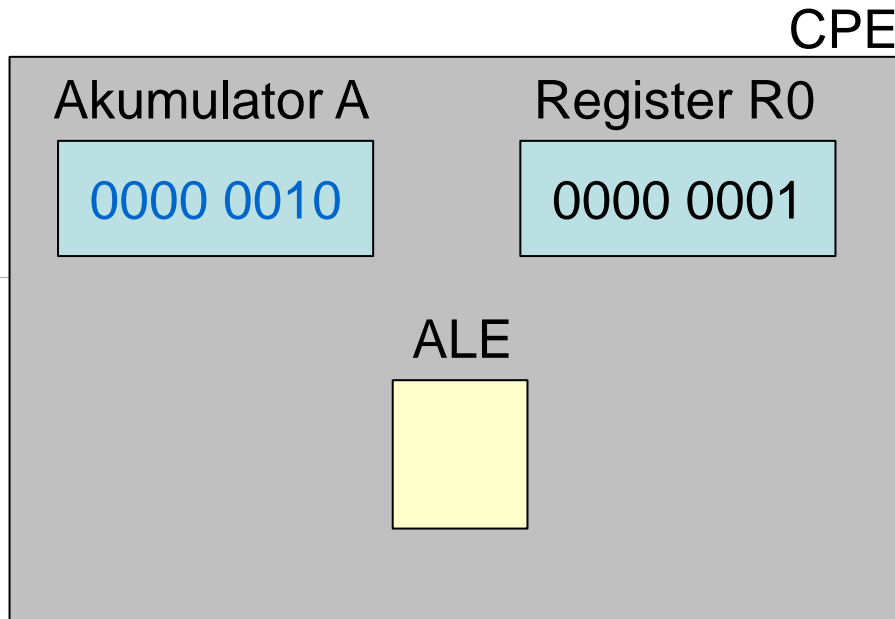


```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
[Icons]
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12
Ln : 1 Col : 13 S Dos\Windows ANSI INS
```

mov z, A

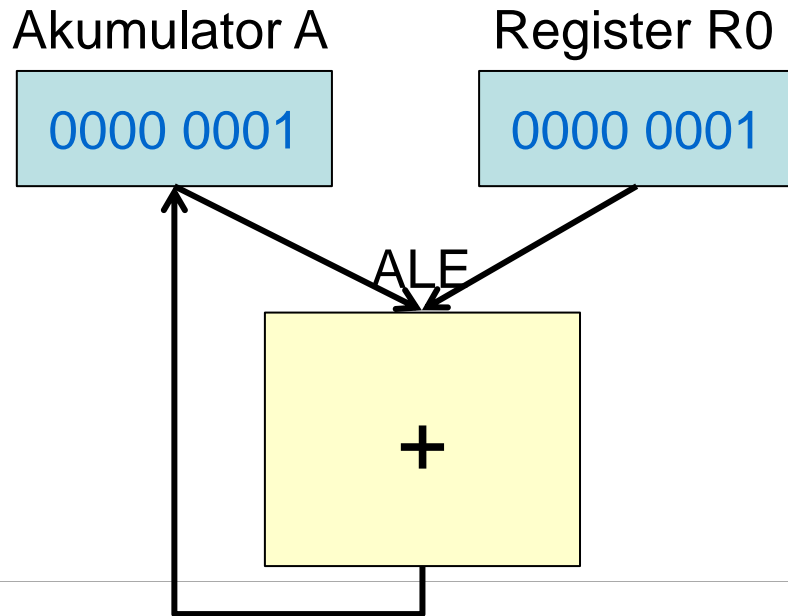
Pomnilnik

x	0000 0001
y	0000 0001
z	0000 0010



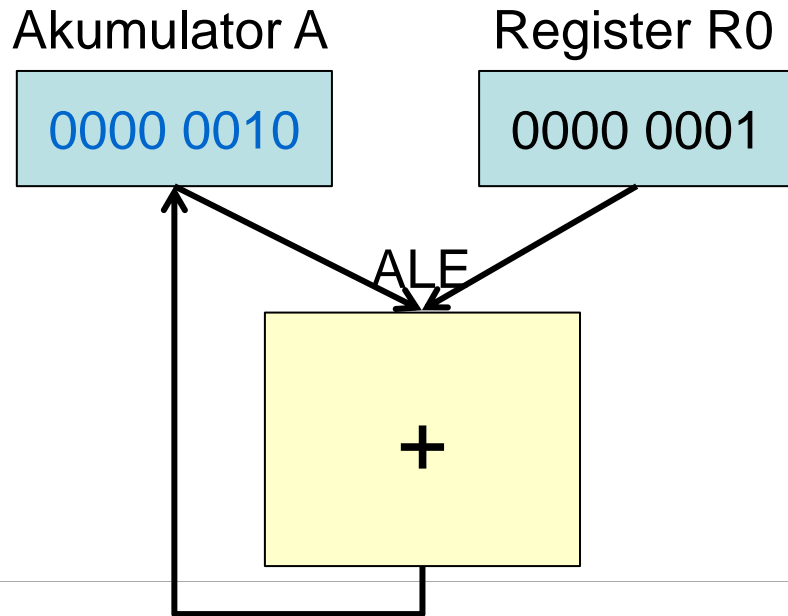
```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
[Icons]
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12
Ln : 1 Col : 13 S Dos\Windows ANSI INS
```

add A, R0



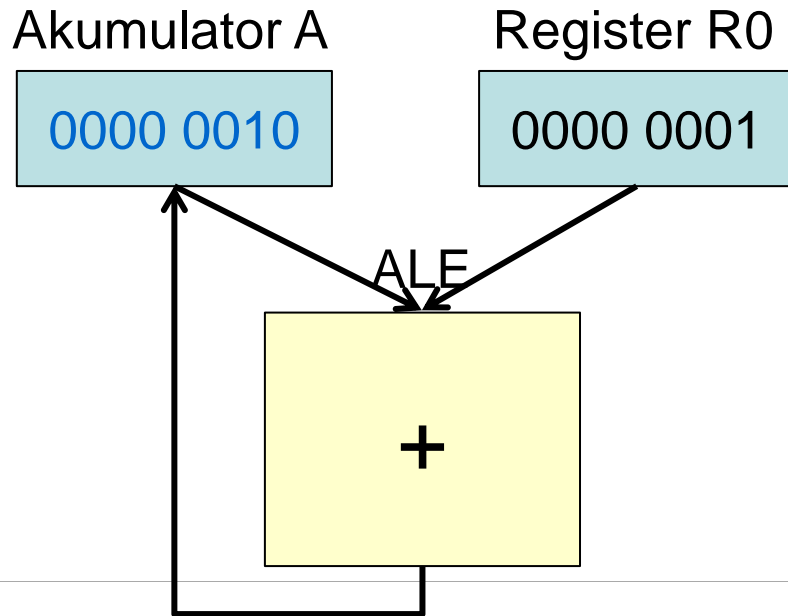
```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
[Icons]
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12
Ln : 1 Col : 13 S Dos\Windows ANSI INS
```

add A, R0



```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
[Icons]
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12
Ln : 1 Col : 13 S Dos\Windows ANSI INS
```

add A, R0



```
D:\My Documents\01 Student\03 MMK_NG...
File Edit Search View Format Language Settings
Macro Run TextFX Plugins Window ?
primer1
1 ; sestevanje
2
3 x data 30h
4 y data 31h
5 z data 32h
6
7 mov A, x
8 mov R0, y
9 add A, R0
10 mov z, A
11 end
12
Ln : 1 Col : 13 S Dos\Windows ANSI INS
```



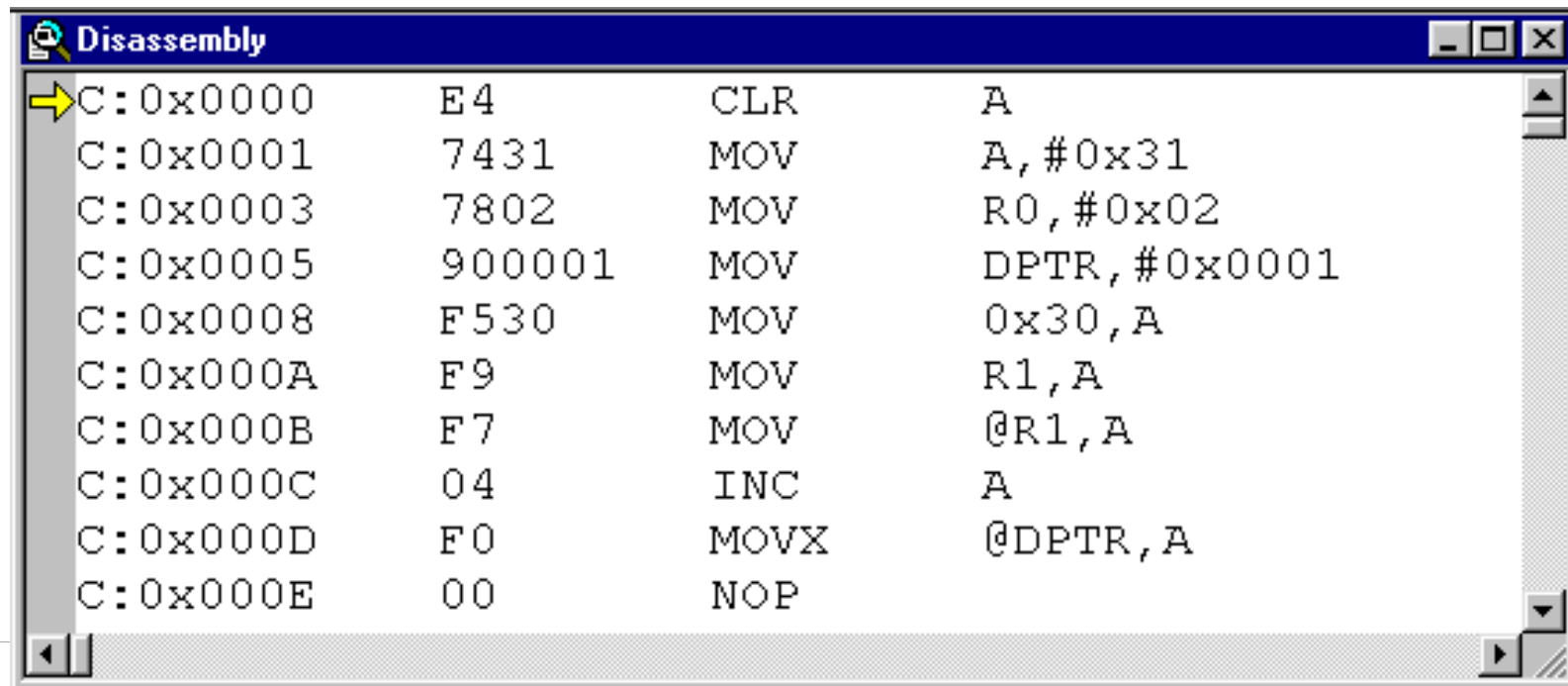
## Strojni jezik

zbirni jezik	strojni jezik
MOV A, #32h	74 32
MOV A, 32h	E5 32

- zbirni jezik:
  - mnemonična koda (mnemonik)
  - operand (konstanta, naslov podatka ali naslov programskega pomnilnika)
  
- strojna koda:
  - ukazna koda
  - operand

## Primer: Intel 8051

- Sled preprostega programa



```
Disassembly
C:0x0000 E4 CLR A
C:0x0001 7431 MOV A, #0x31
C:0x0003 7802 MOV R0, #0x02
C:0x0005 900001 MOV DPTR, #0x0001
C:0x0008 F530 MOV 0x30, A
C:0x000A F9 MOV R1, A
C:0x000B F7 MOV @R1, A
C:0x000C 04 INC A
C:0x000D F0 MOVX @DPTR, A
C:0x000E 00 NOP
```



## Primer: programiranje prvih računalnikov

- stikalni panel za vnos podatkov: [Data General Nova 3](#)
- računalniški program se je ročno vnesel v centralno procesno enoto s pomočjo serije stikal.
- ukaz je določala izbira stikal ("on" / "off")
- kasneje so se uporabljale kartice z luknjicami,

