Introduction to 8086 Assembly

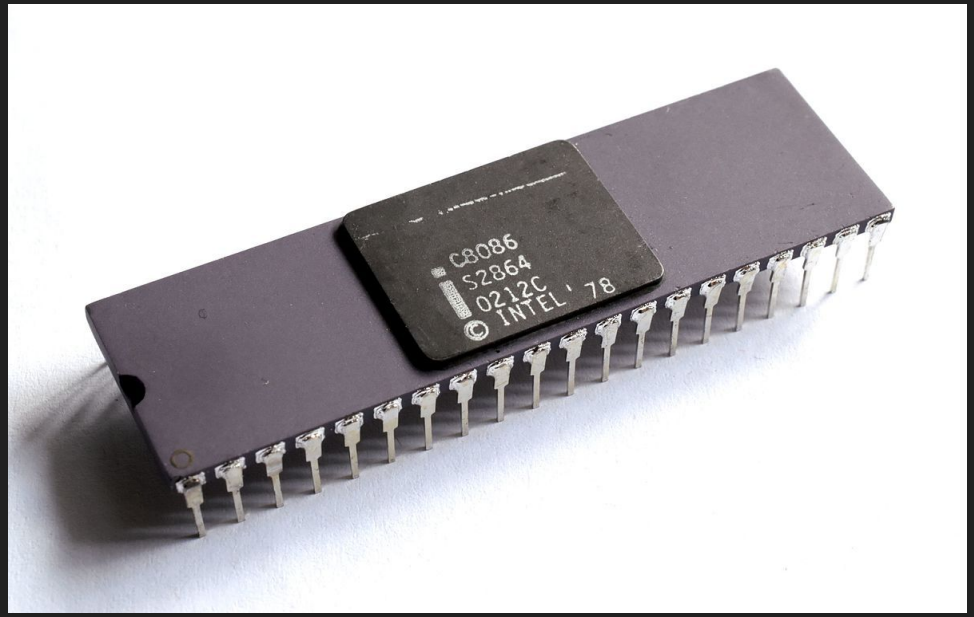
Lecture 2

80x86 architecture, registers and basic assembly

Intel 8086 microprocessor

K. N. Toosi
University of Technology

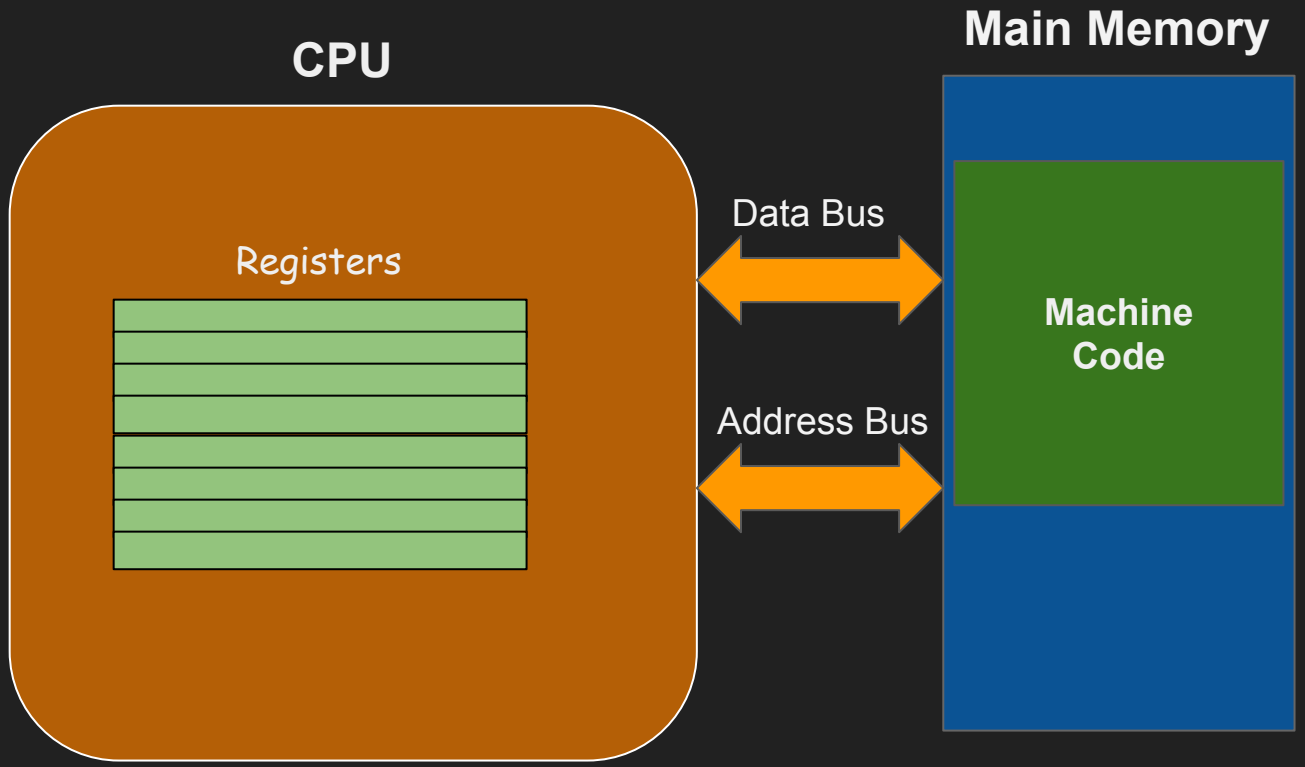
- released in 1978
- **16 bit**
- the **x86** family



https://en.wikipediB.org/wiki/Intel_8086

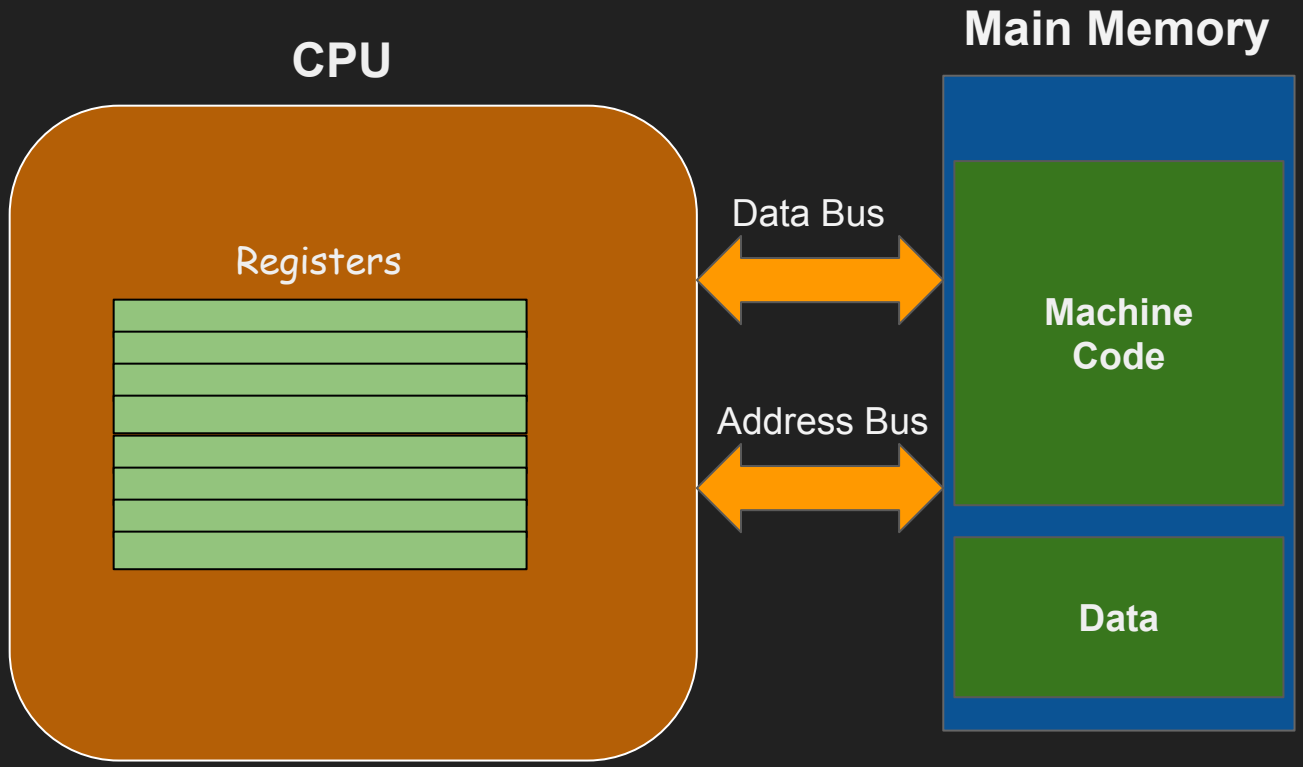
CPU, Memory, instructions and data

K. N. Toosi
University of Technology



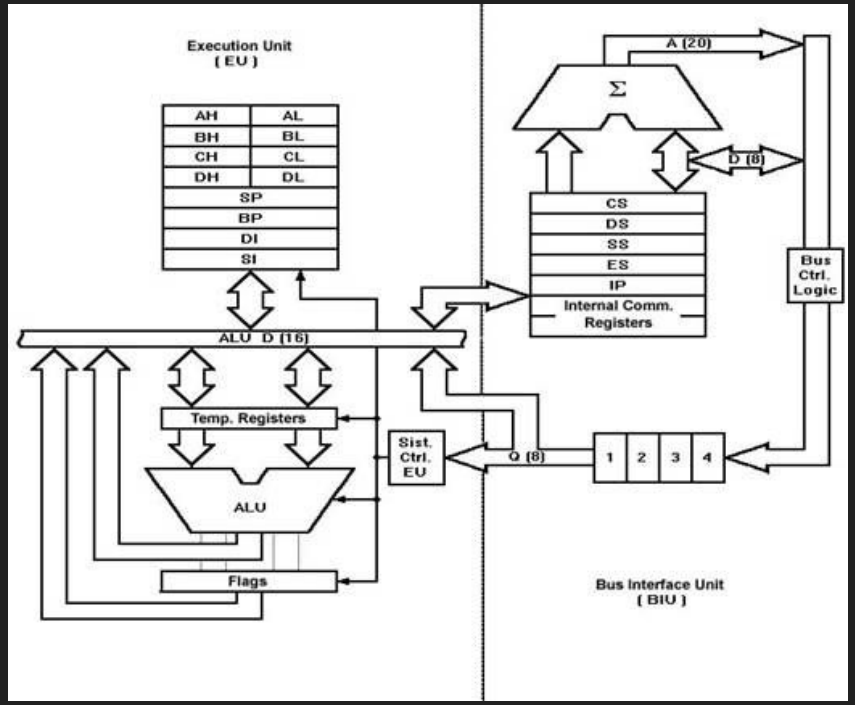
CPU, Memory, instructions and data

K. N. Toosi
University of Technology



Intel 8086 architecture

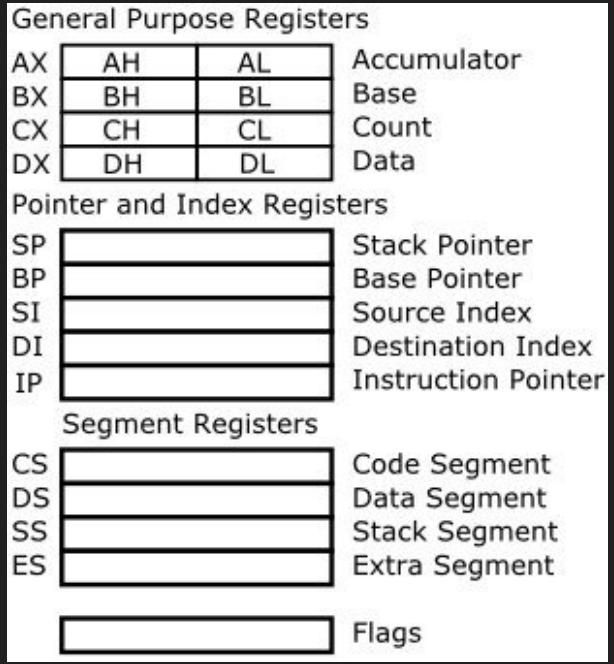
K. N. Toosi
University of Technology



http://www.cosc.brocku.ca/~bockusd/3p92/Local_Pages/8086_achitecture.htm

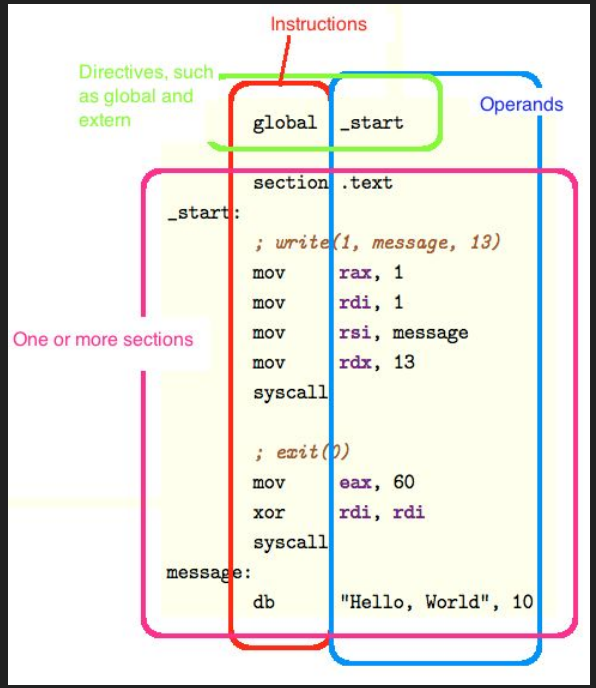
Intel 8086 registers

- 16 bit registers
- 8 bit access
  - AX,BX,CX,DX
  - e.g. AX = (AH | AL)

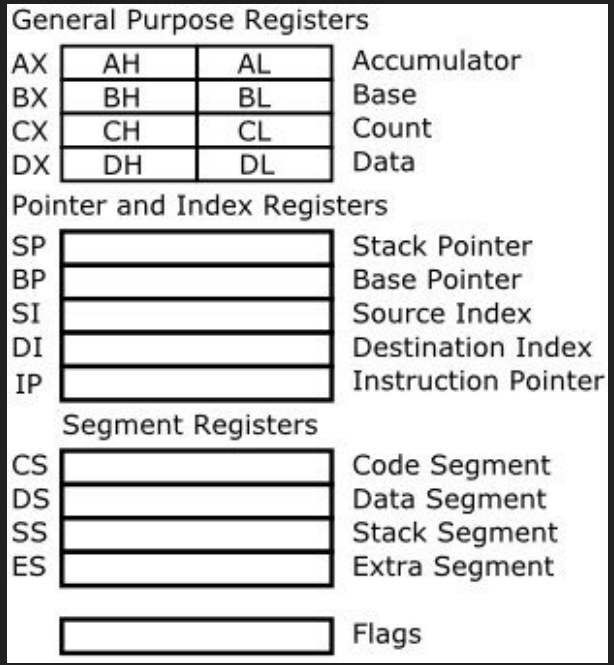


http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly syntax



http://cs.lmu.edu/~ray/notes/nasmtutorial/



http://bucarotechelp.com/computers/architecture/86011201.asp

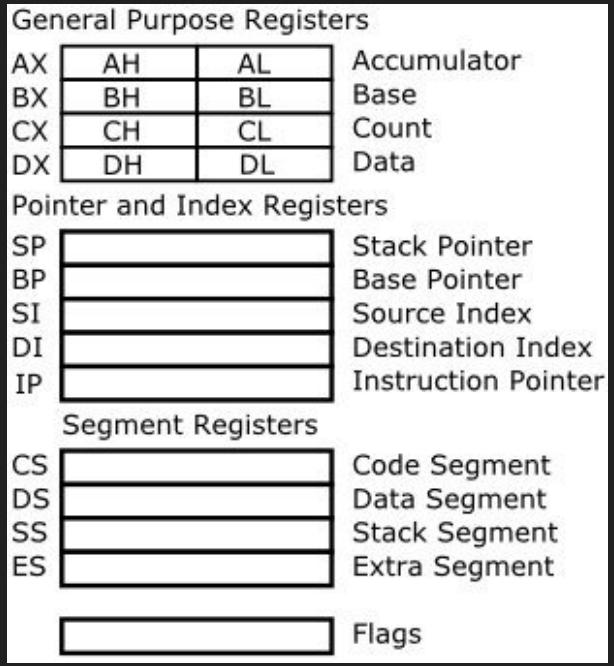
Intel 8086 assembly commands

```
mov x,y
xchg x,y

inc x
dec x

add x,y
sub x,y
neg x

; bitwise operators
and x,y
or  x,y
xor x,y
not x
```



http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly commands

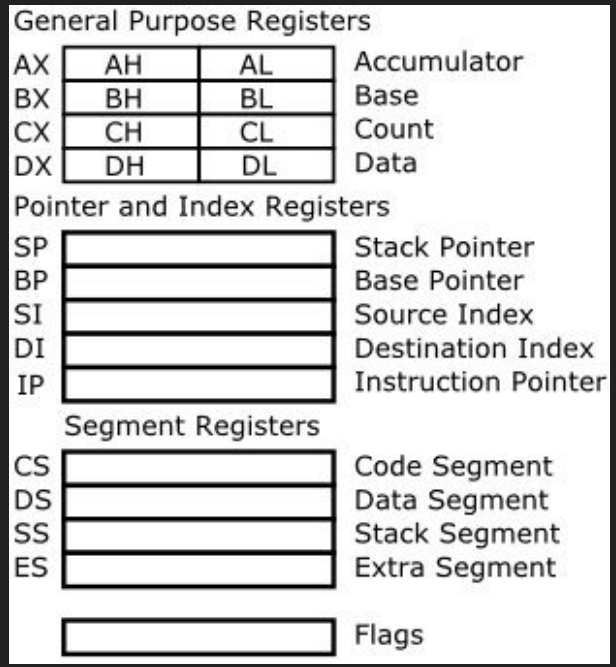

```
mov x,y

inc x
dec x

add x,y     ; x <- x+y
sub x,y     ; x <- x-y

; bitwise operators
and x,y     ; x <- x & y
or  x,y     ; x <- x | y
xor x,y     ; x <- x ^ y
```

`x,y:` **register, constant, memory (address)**



http://bucarotechelp.com/computers/architecture/86011201.asp

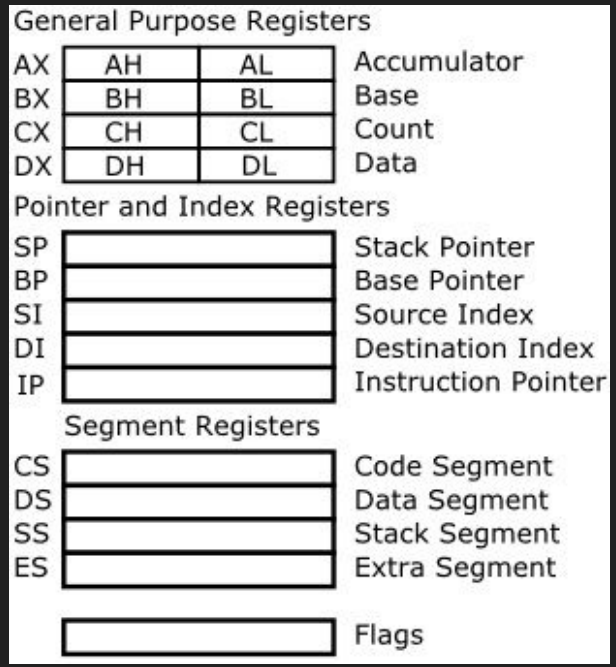
Intel 8086 assembly commands

K. N. Toosi
University of Technology

assume u, v are memory locations (variables)

```
mov ax, bx
mov ax, 1
mov al, ah
mov cl, 123
mov ax, [u]
mov [v], bx
mov byte [v], 12

mov [v], [u]
```



http://bucarotechelp.com/computers/architecture/86011201.asp

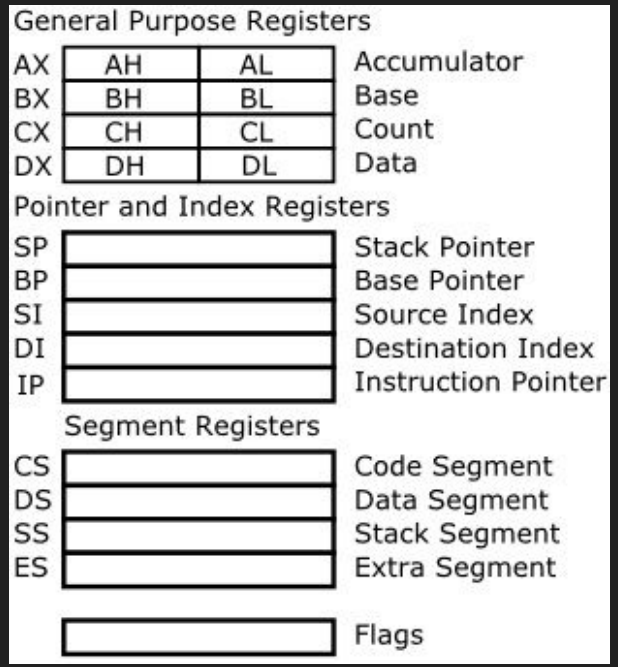
Intel 8086 assembly commands

K. N. Toosi
University of Technology

assume u, v are memory locations (variables)

```
mov ax, bx
mov ax, 1
mov al, ah
mov cl, 123
mov ax, [u]
mov [v], bx
mov byte [v], 12

mov [v], [u]
```



http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly commands

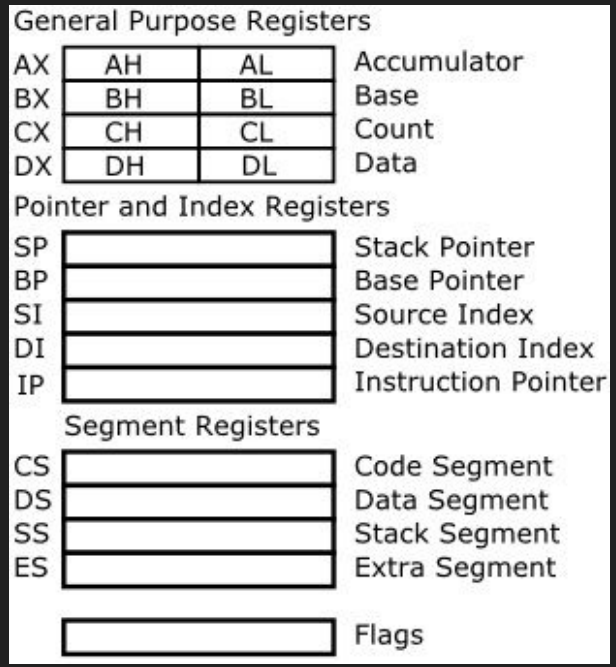
K. N. Toosi
University of Technology

assume u,v are memory locations (variables)

```
mov ax, bx
mov ax, 1
mov al, ah
mov cl, 123
mov ax, [u]
mov [v], bx
mov byte [v], 12
```

~~`mov [v], [u]`~~

```
mov ax,[u]
mov [v], ax
```



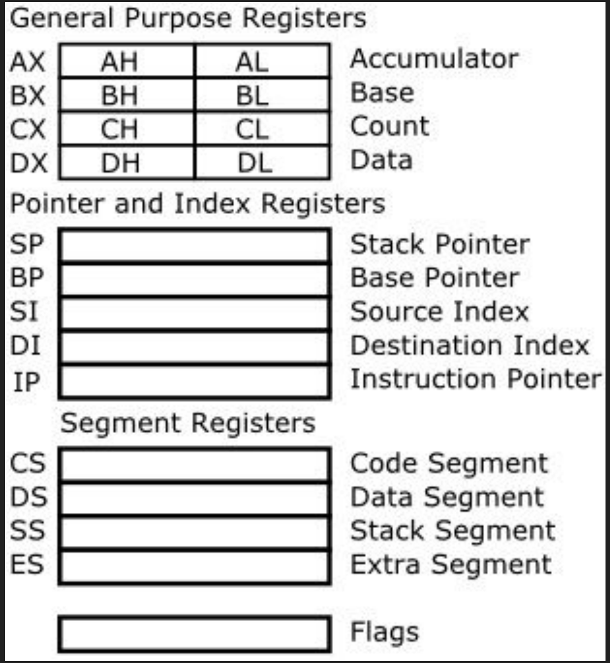
http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly commands

assume `u`,`v` are memory locations (variables)

```
add ax, bx
add ax, 1
add al, ah
add cl, 123
add ax, [u]
add [v], bx
add byte [v], 12

add [v], [u]
```



http://bucarotechelp.com/computers/architecture/86011201.asp

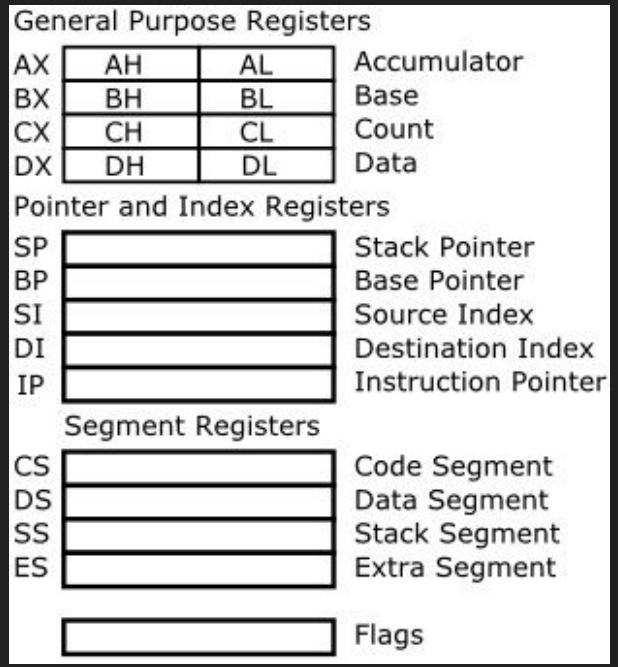
Intel 8086 assembly commands

K. N. Toosi
University of Technology

assume u, v are memory locations (variables)

```
add ax, bx
add ax, 1
add al, ah
add cl, 123
add ax, [u]
add [v], bx
add byte [v], 12
```

~~`add [v], [u]`~~



http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly commands

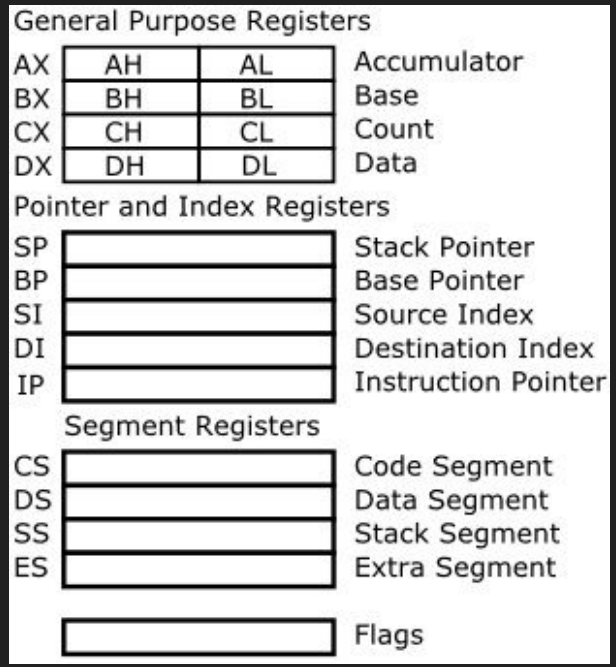
K. N. Toosi
University of Technology

assume u, v are memory locations (variables)

```
add ax, bx
add ax, 1
add al, ah
add cl, 123
add ax, [u]
add [v], bx
add byte [v], 12
```

~~`add [v], [u]`~~

```
mov ax,[u]
add [v],ax
```



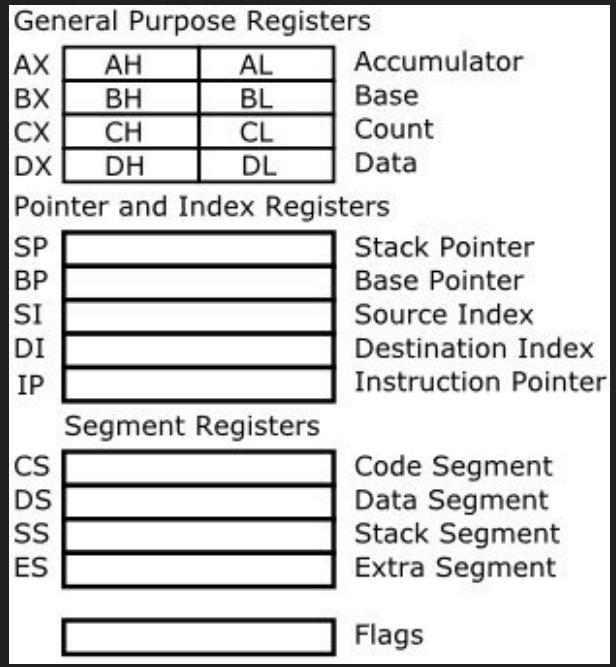
http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly commands


```
; bx = (ax-10)*2

; ax = (ax+1)*8

; ax = (ax-1)*9
```



http://bucarotechelp.com/computers/architecture/86011201.asp

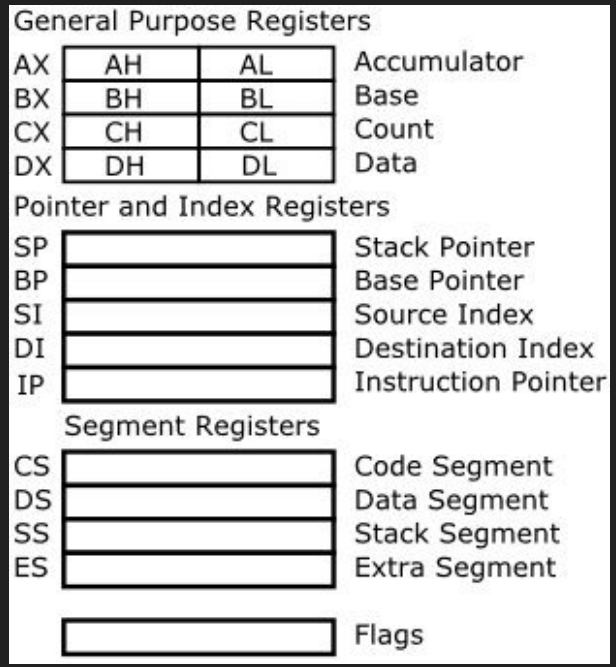
Intel 8086 assembly commands

K. N. Toosi
University of Technology

```
; bx = (ax-10)*2
mov bx, ax
sub bx, 10
add bx, bx

; ax = (ax+1)*8
inc ax
add ax,ax
add ax,ax
add ax,ax

; ax = (ax-1)*9
dec ax
mov si,ax
add ax,ax
add ax,ax
add ax,ax
add ax,si
```



http://bucarotechelp.com/computers/architecture/86011201.asp

80386 (IA-32, i386)

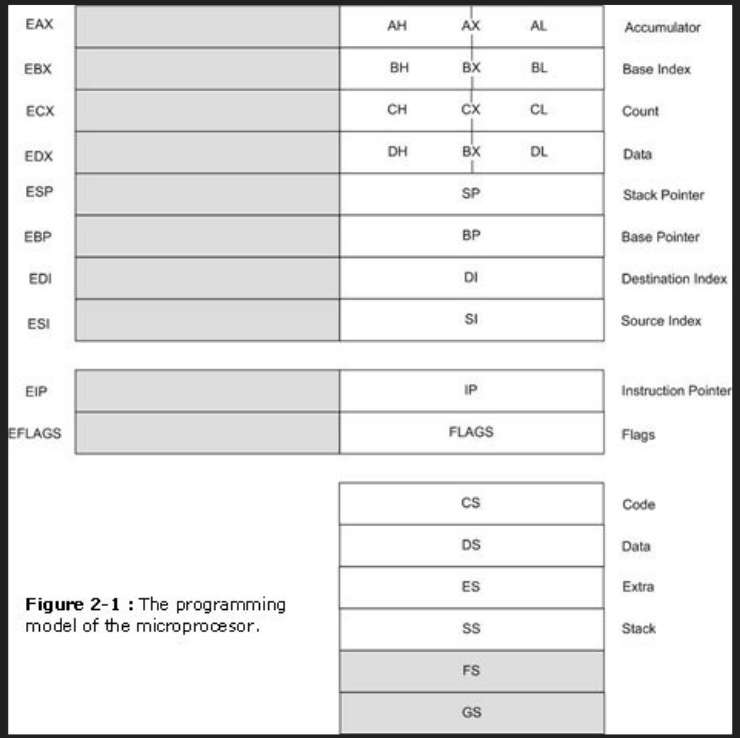
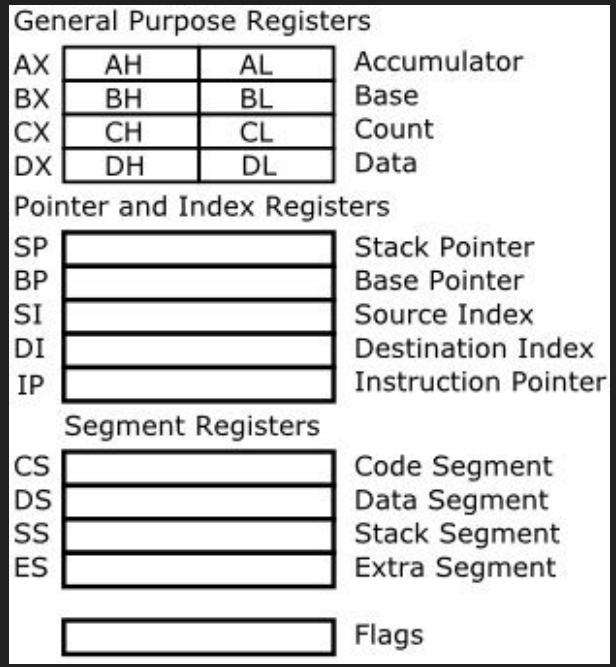


Figure 2-1 : The programming model of the microprocesor.

http://www.byclb.com/TR/Tutorials/microprocessors/ch2_1.htm

8086, 80286

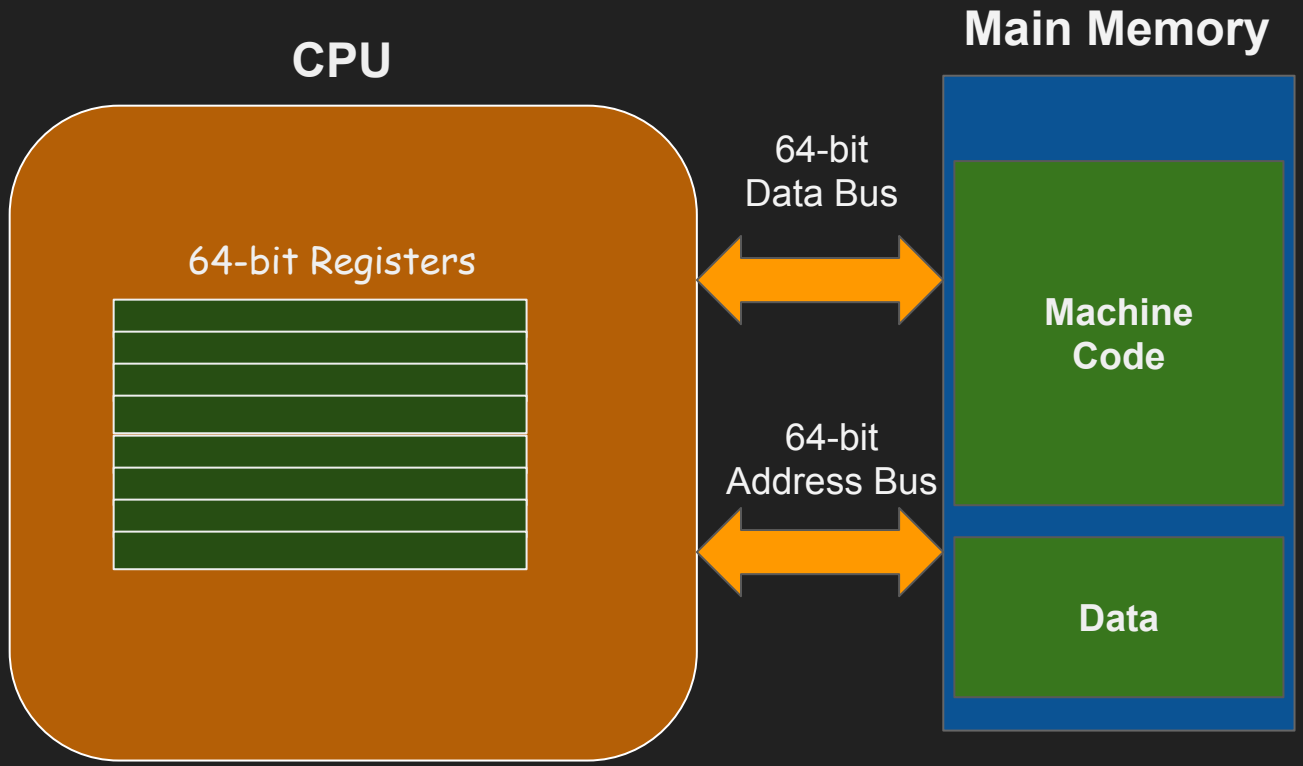


http://bucarotechelp.com/computers/architecture/86011201.asp

K. N. Toosi
University of Technology

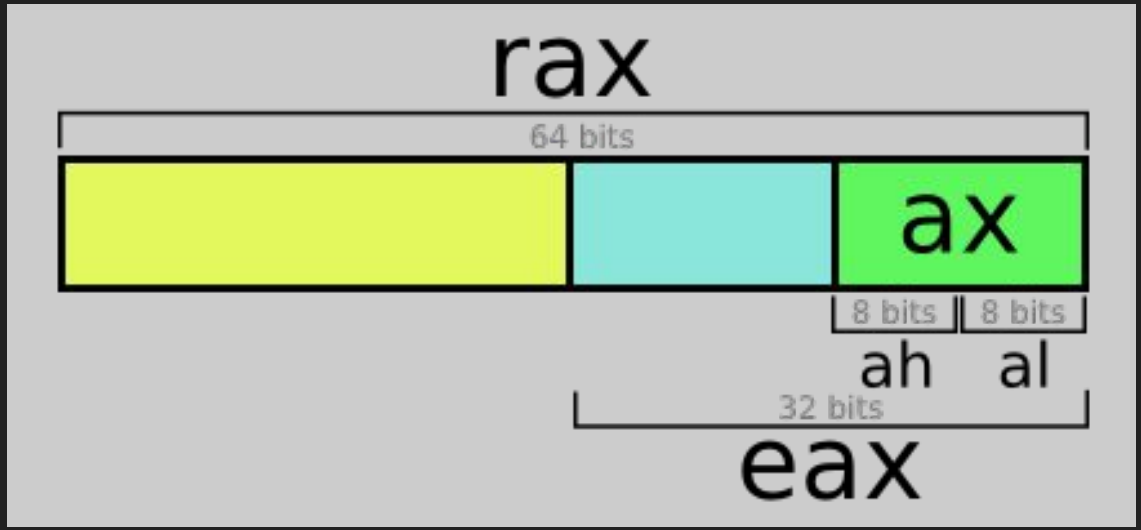
64 bit x86 systems (x86-64, x64, AMD64)

K. N. Toosi
University of Technology



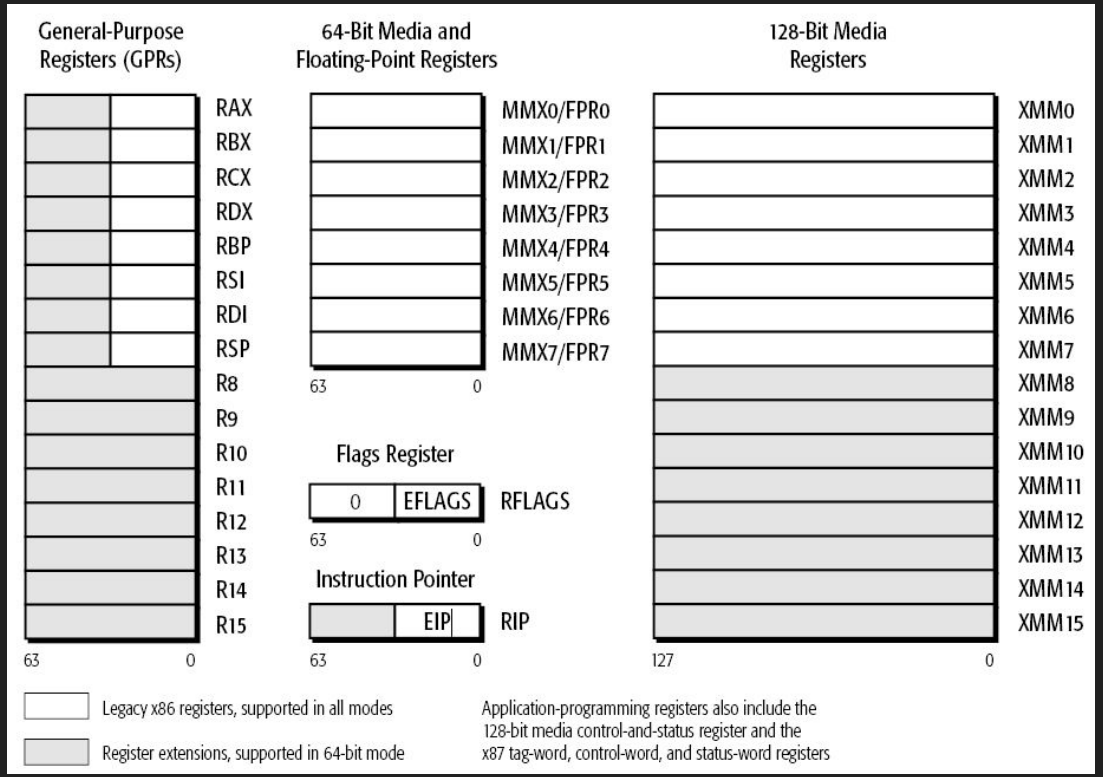
x86-64 bit registers

K. N. Toosi
University of Technology



http://nullprogram.com/blog/2015/05/15/

x86-64 bit registers (x86-64, AMD64, Intel64, x64)



https://www.viva64.com/en/a/0029/