Introduction to 8086 Assembly

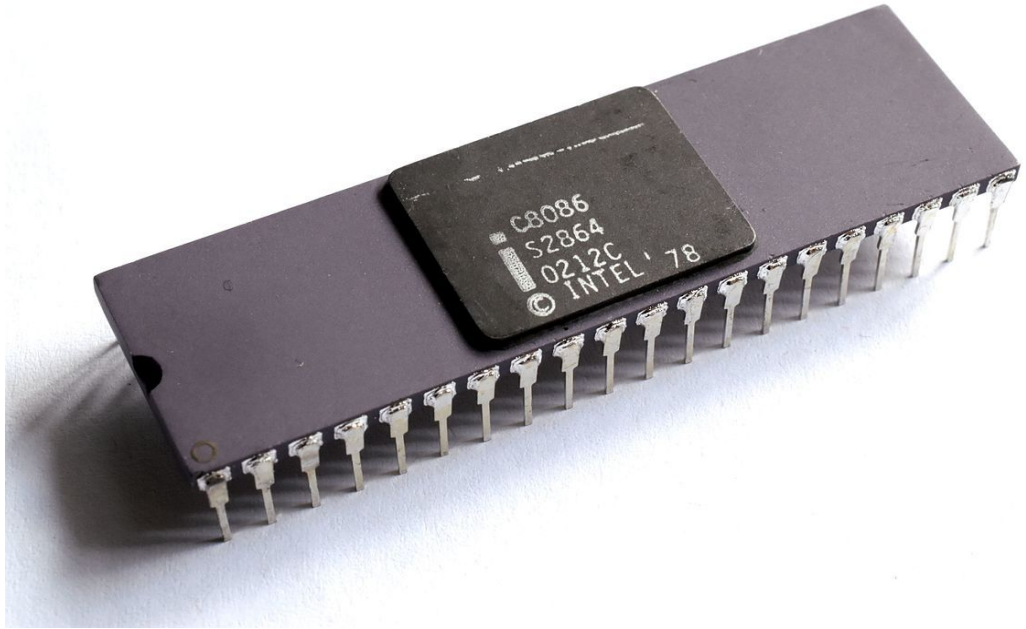
Lecture 2

80x86 architecture, registers and basic assembly

Intel 8086 microprocessor

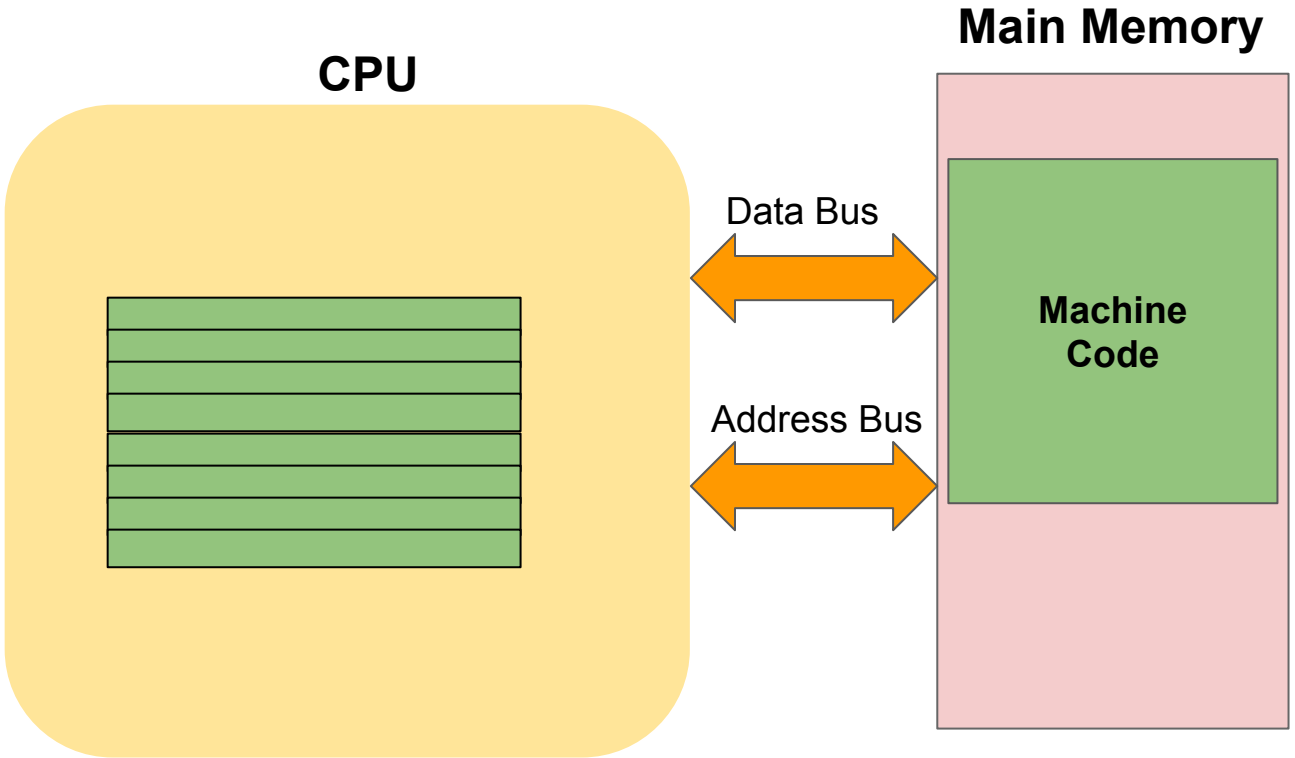
1928
K. N. Toosi University of Technology

- released in 1978
- **16 bit**
- The **x86** Architecture

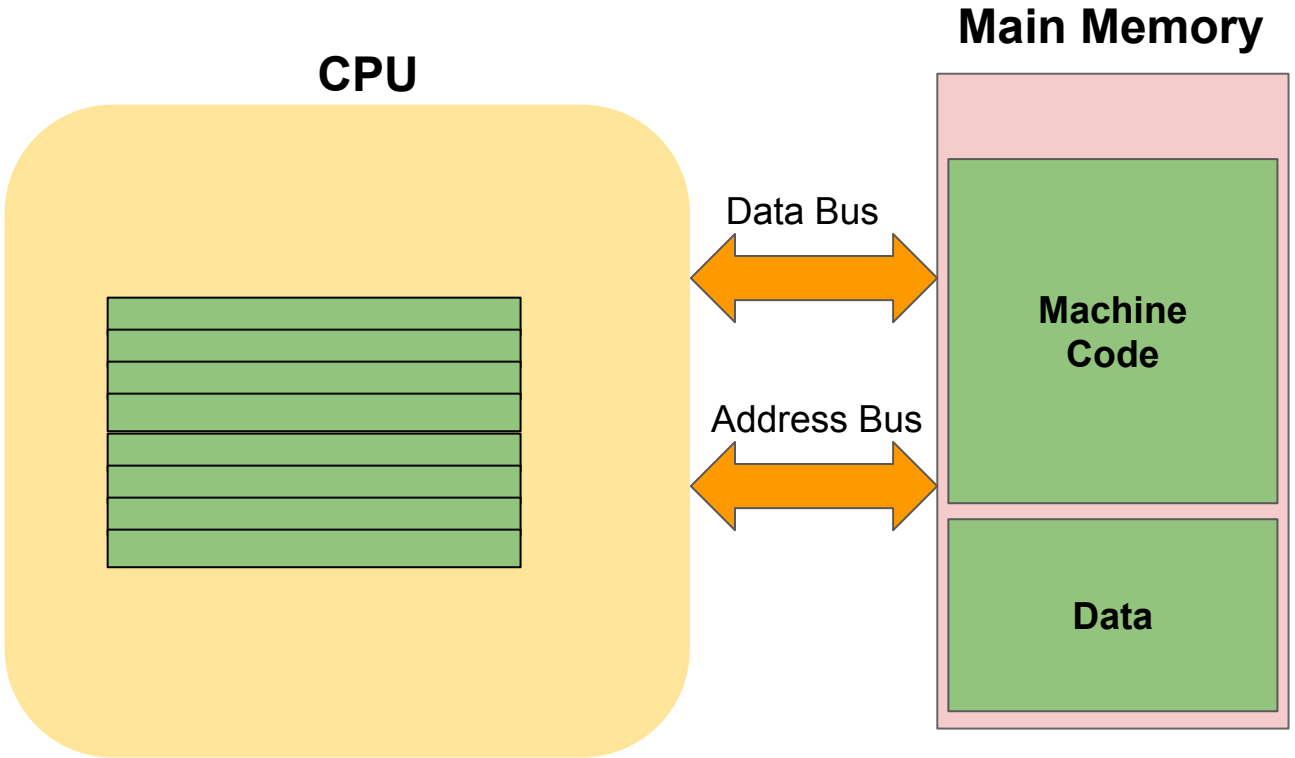


https://en.wikipediB.org/wiki/Intel_8086

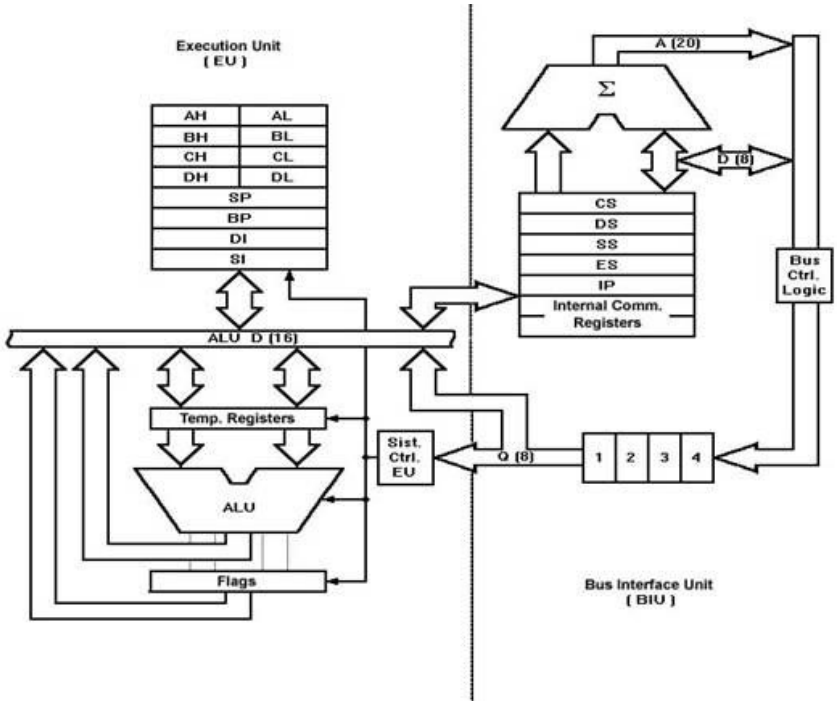
CPU, Memory, instructions and data



CPU, Memory, instructions and data



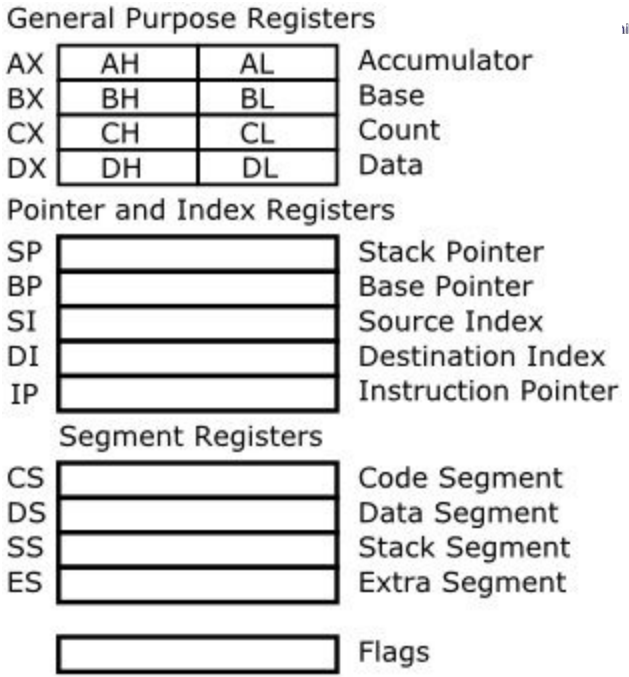
Intel 8086 architecture



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

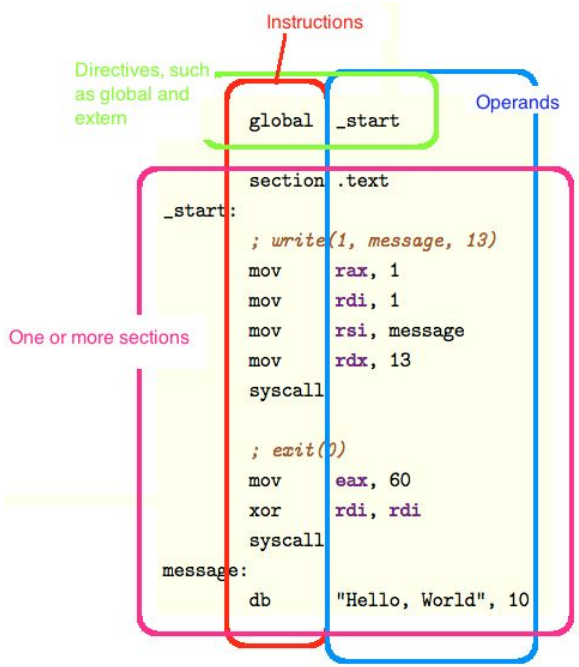
Intel 8086 registers

- 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/

General Purpose Registers

AX	AH	AL	Accumulator
BX	BH	BL	Base
CX	CH	CL	Count
DX	DH	DL	Data

Pointer and Index Registers

SP		Stack Pointer
BP		Base Pointer
SI		Source Index
DI		Destination Index
IP		Instruction Pointer

Segment Registers

CS		Code Segment
DS		Data Segment
SS		Stack Segment
ES		Extra Segment

	Flags

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

Intel 8086 assembly commands

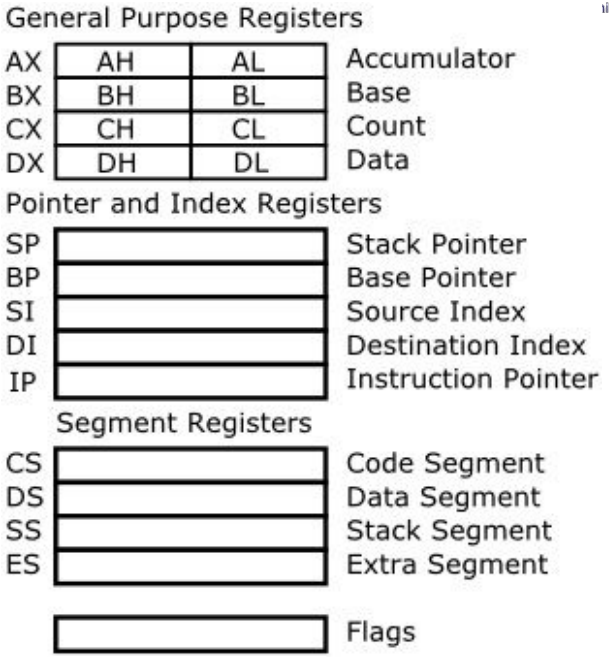
```
mov x,y
xchg x,y

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
```

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



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

Intel 8086 assembly commands

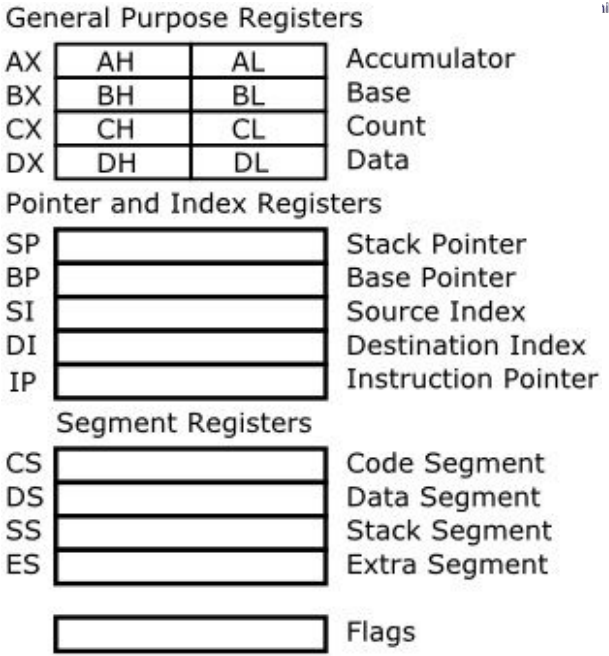
```
mov x,y          ; x = y
xchg x,y         ; x <-> y

inc x            ; x++
dec x            ; x--

add x,y          ; x += y
sub x,y          ; x -= y
neg x            ; x = -x

; bitwise operators
and x,y          ; x = x & y
or  x,y          ; x = x | y
xor x,y          ; x = x ^ y
not x            ; x = ~x
```

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



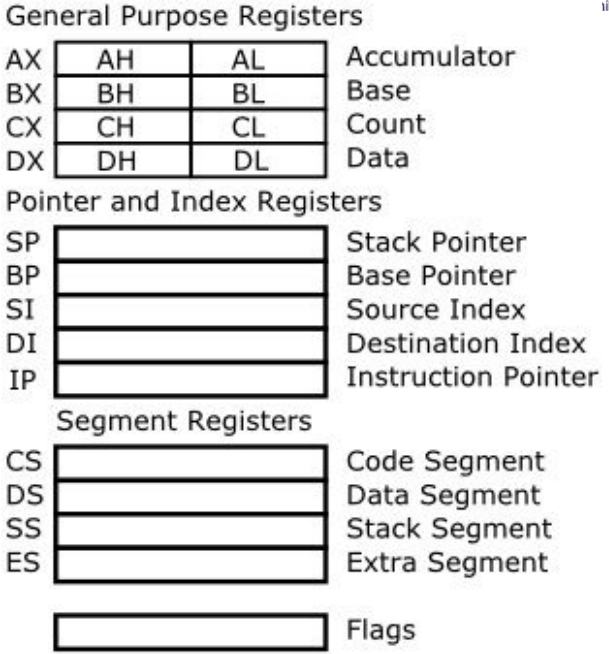
http://bucarotechelp.com/computers/architecture/86011201.asp

Intel 8086 assembly commands

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 [v], 12

mov [v], [u]
```



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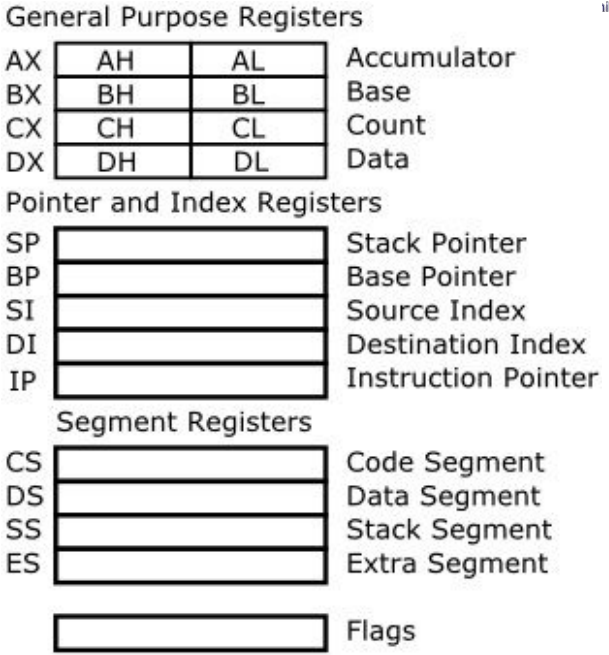

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Intel 8086 assembly commands

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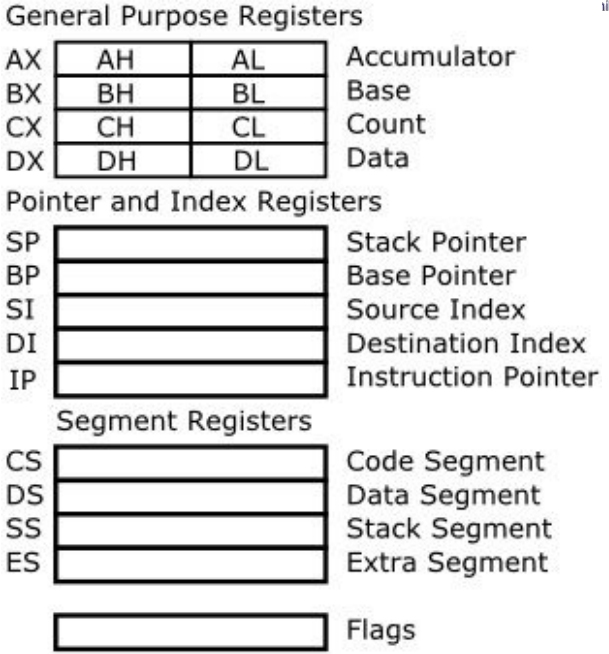
mov [v], bx
mov [v], 12

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



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

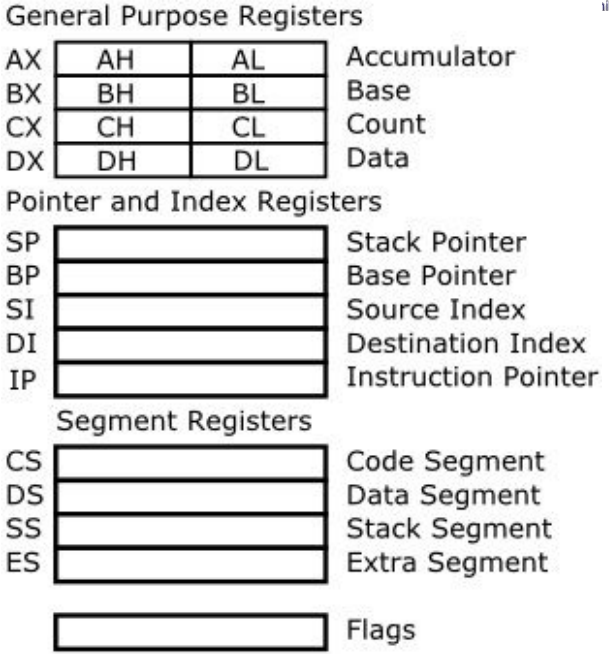

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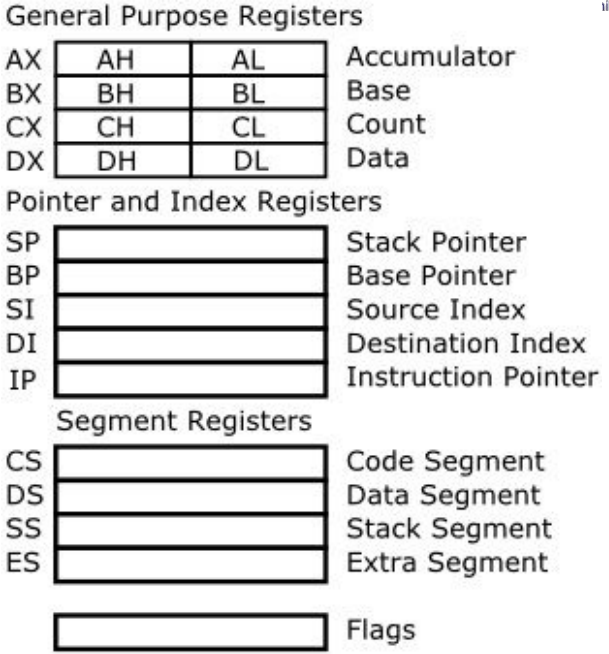
add [v], [u]
```



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Intel 8086 assembly commands

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

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

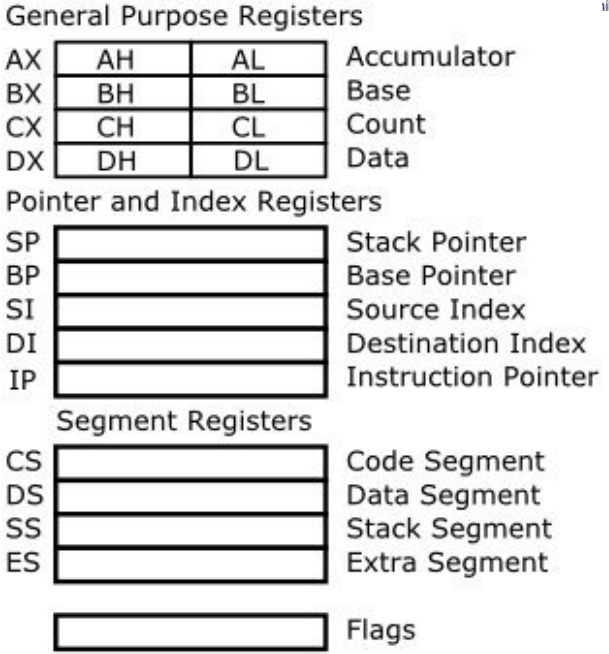

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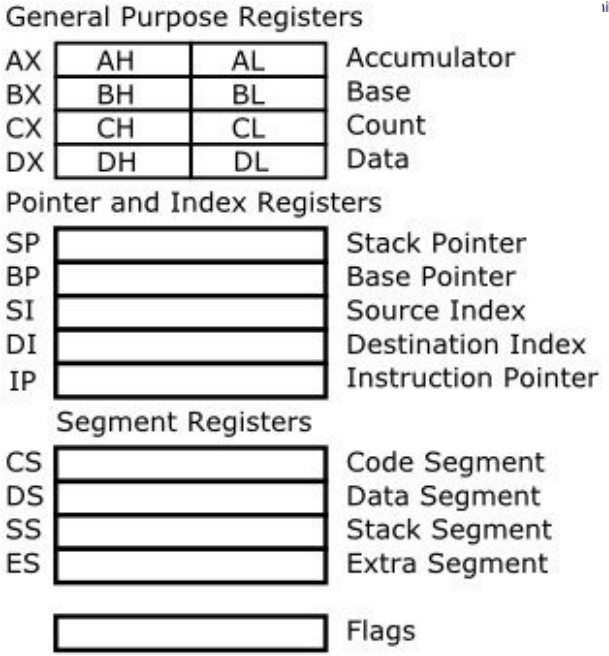
Intel 8086 assembly commands

; bx = (ax-10)*2

; ax = (ax+1)*8

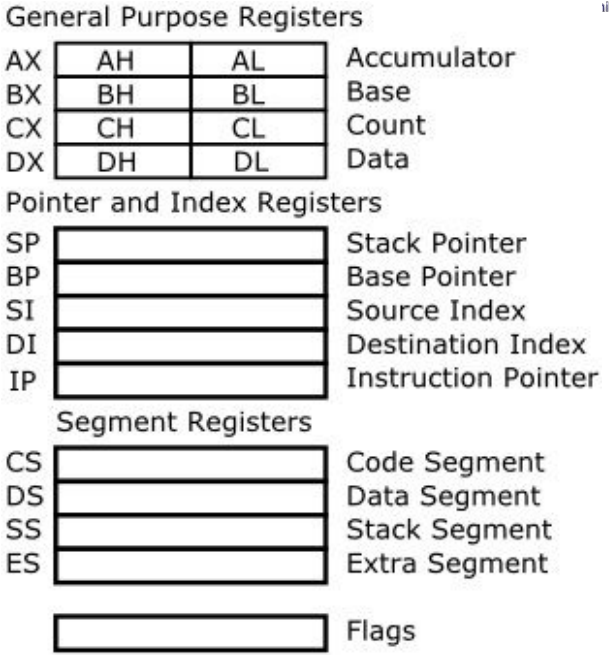
; ax = (ax-1)*9



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

Intel 8086 assembly commands

```
; 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
```



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80386 (IA-32, i386)

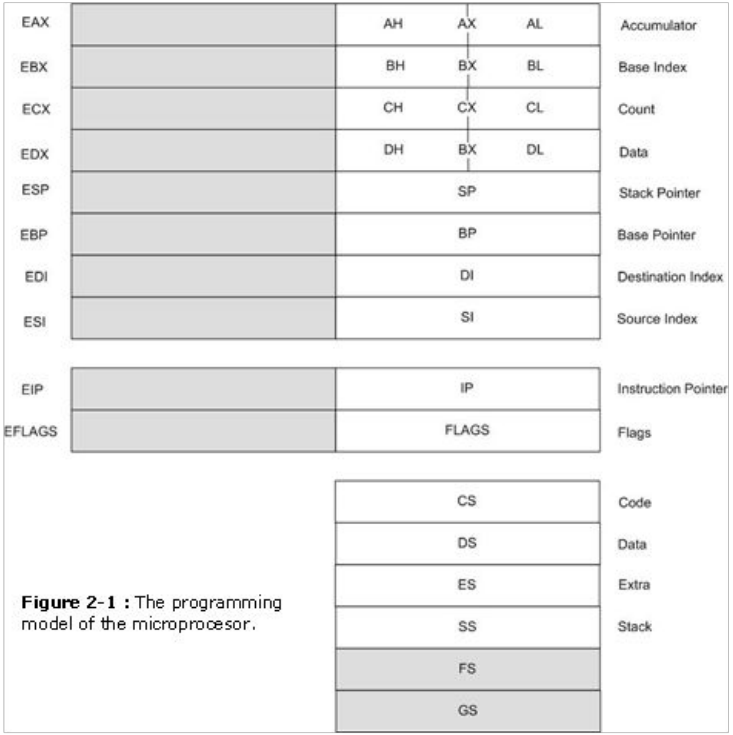
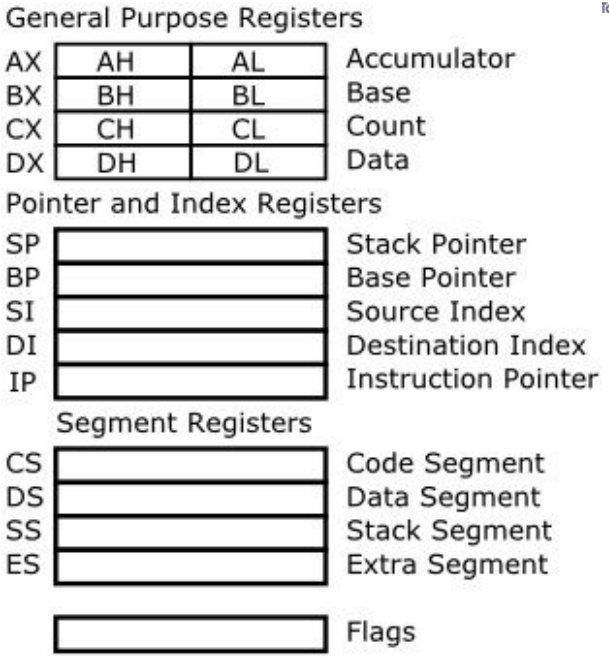


Figure 2-1 : The programming model of the microprocesor.

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

8086, 80286



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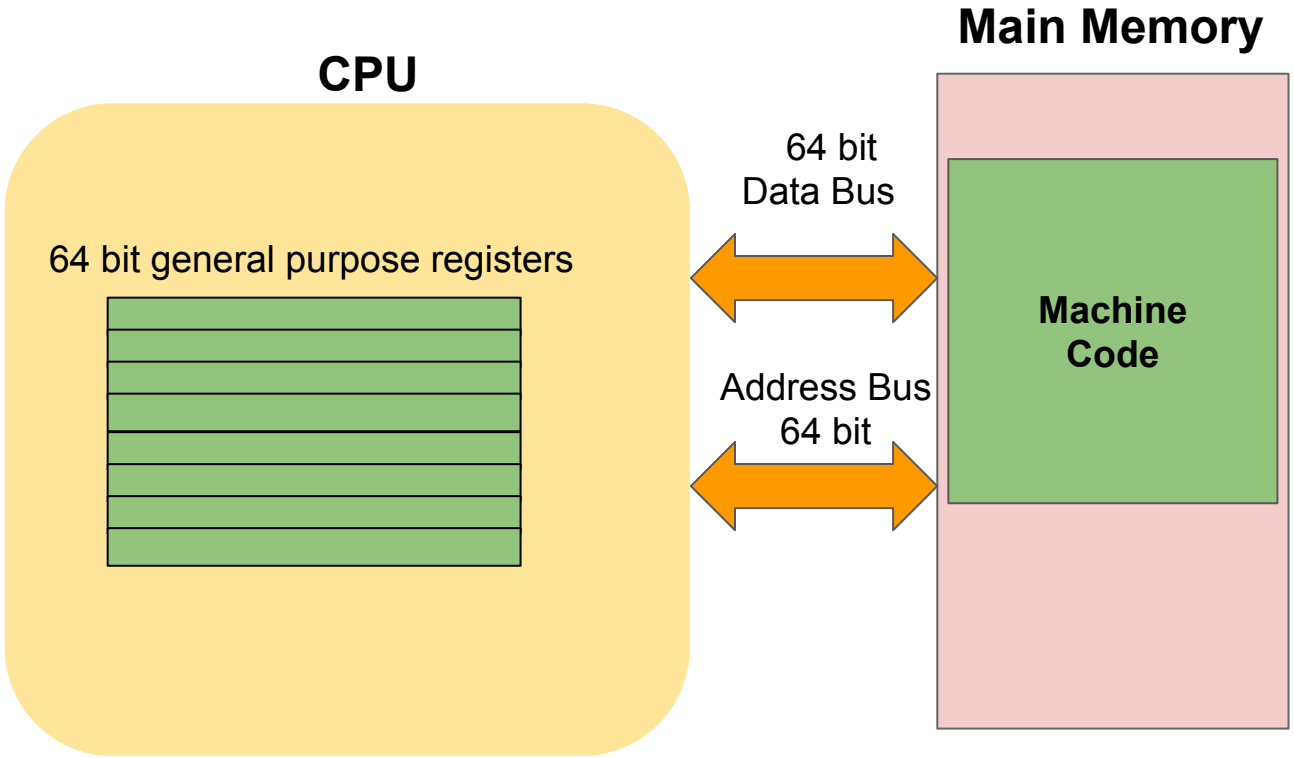
64 bit x86 systems (x86-64)



x86-64 bit registers

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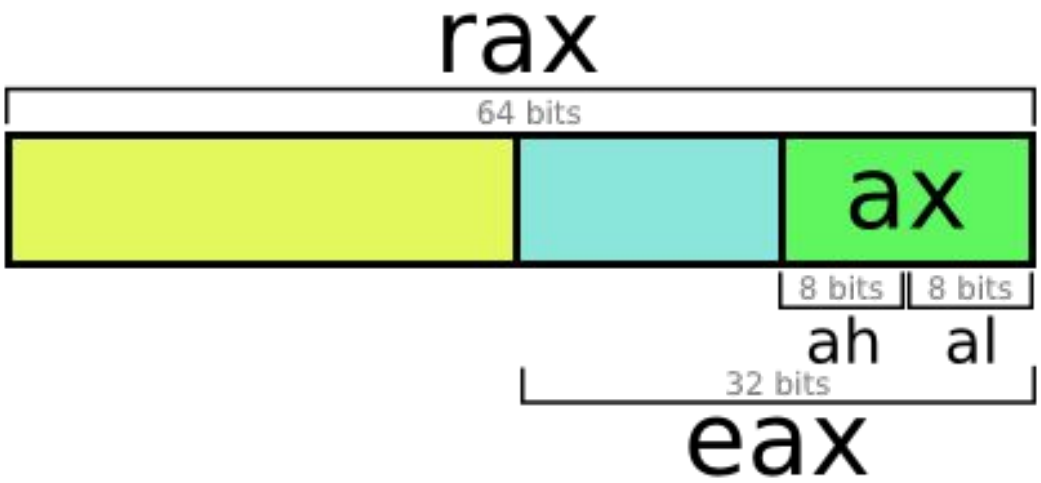
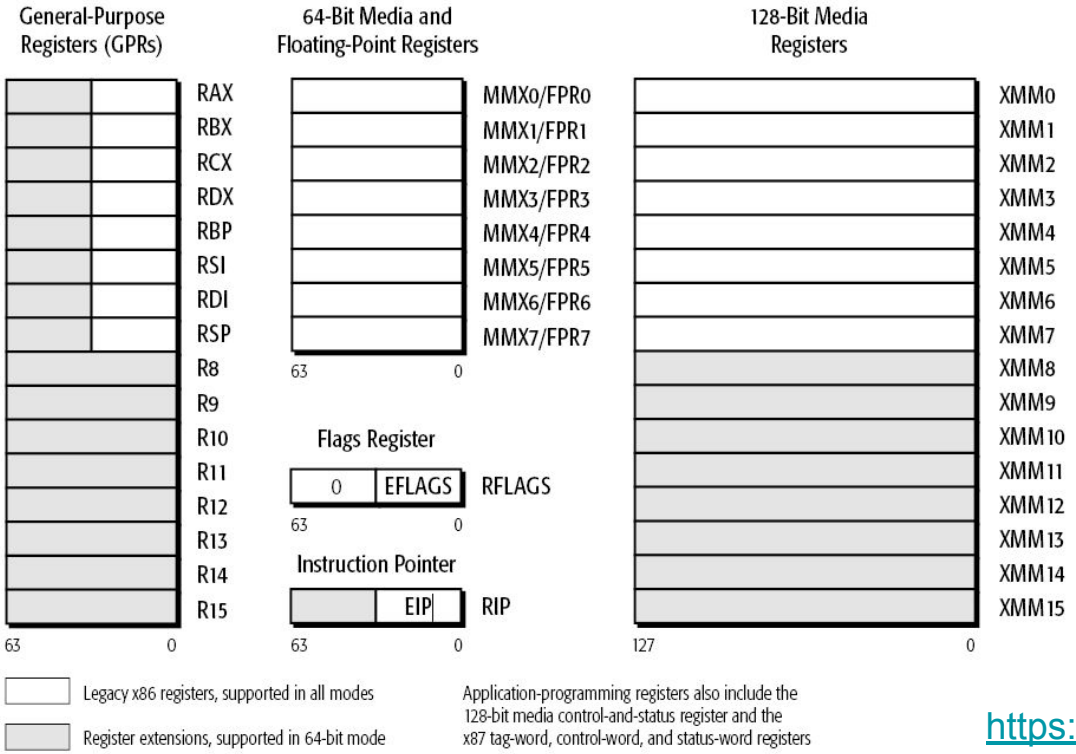


http://nullprogram.com/blog/2015/05/15/

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



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