

# Unit 5

## LECTURE 7

# 8086 Programmer's Model

BIU registers  
(20 bit adder)

ES
CS
SS
DS
IP

Extra Segment  
Code Segment  
Stack Segment  
Data Segment  
Instruction Pointer

AX  
BX  
CX  
DX

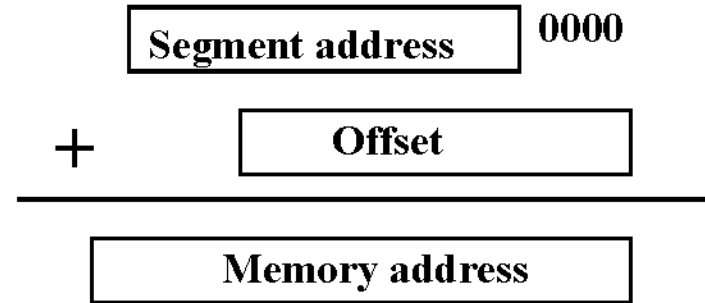
AH	AL
BH	BL
CH	CL
DH	DL
SP	
BP	
SI	
DI	
FLAGS	

Accumulator  
Base Register  
Count Register  
Data Register  
Stack Pointer  
Base Pointer  
Source Index Register  
Destination Index Register

EU registers  
16 bit arithmetic

# Memory Address Calculation

- ❑ Segment addresses must be stored in segment registers
- ❑ Offset is derived from the combination of pointer registers, the Instruction Pointer (IP), and immediate values
- ❑ Examples



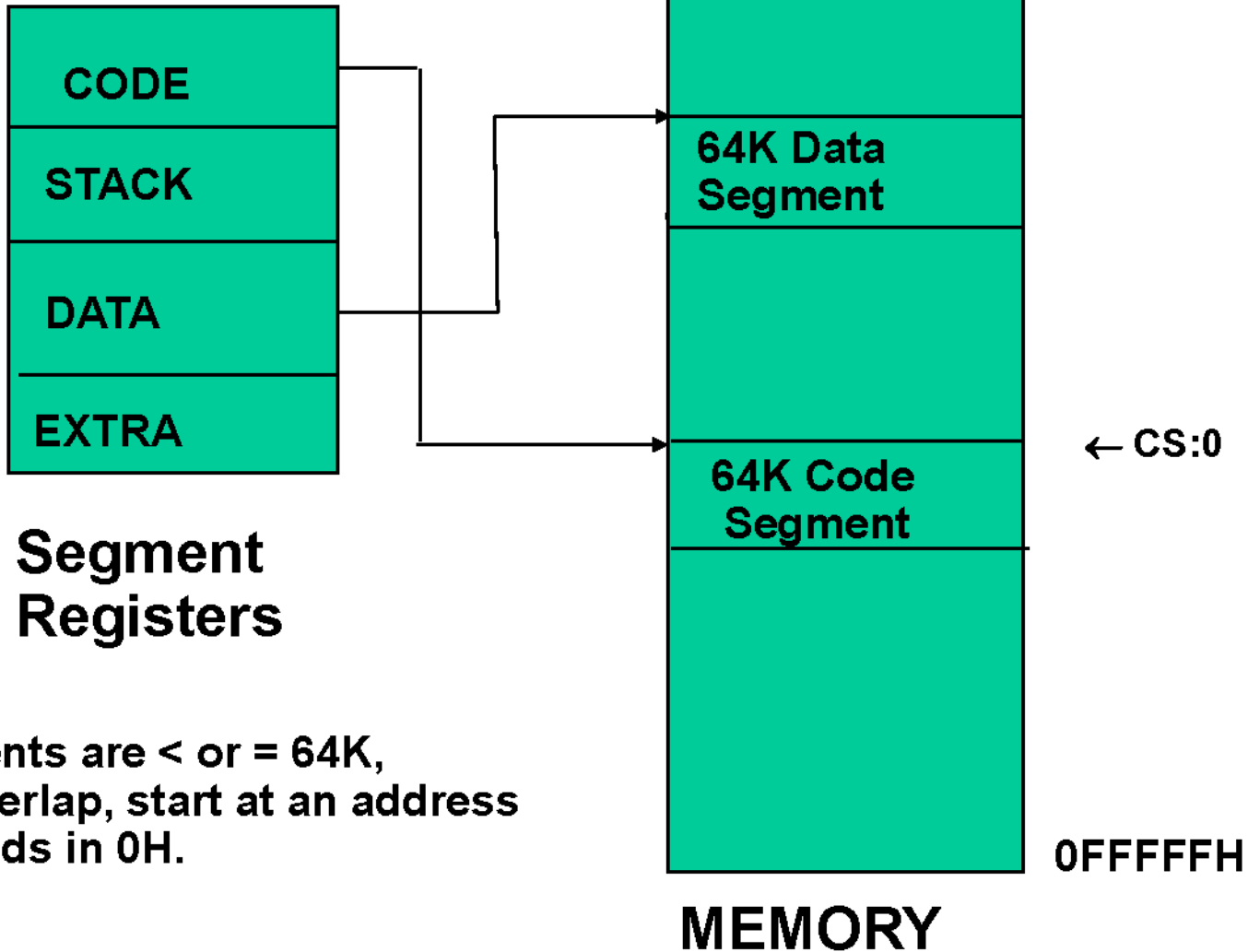
CS	3	4	8	A	0
IP +		4	2	1	4
Instruction address	3	8	A	B	4

SS	5	0	0	0	0
SP +		F	F	E	0
Stack address	5	F	F	E	0

DS	1	2	3	4	0
DI +		0	0	2	2
Data address	1	2	3	6	2

# Segments

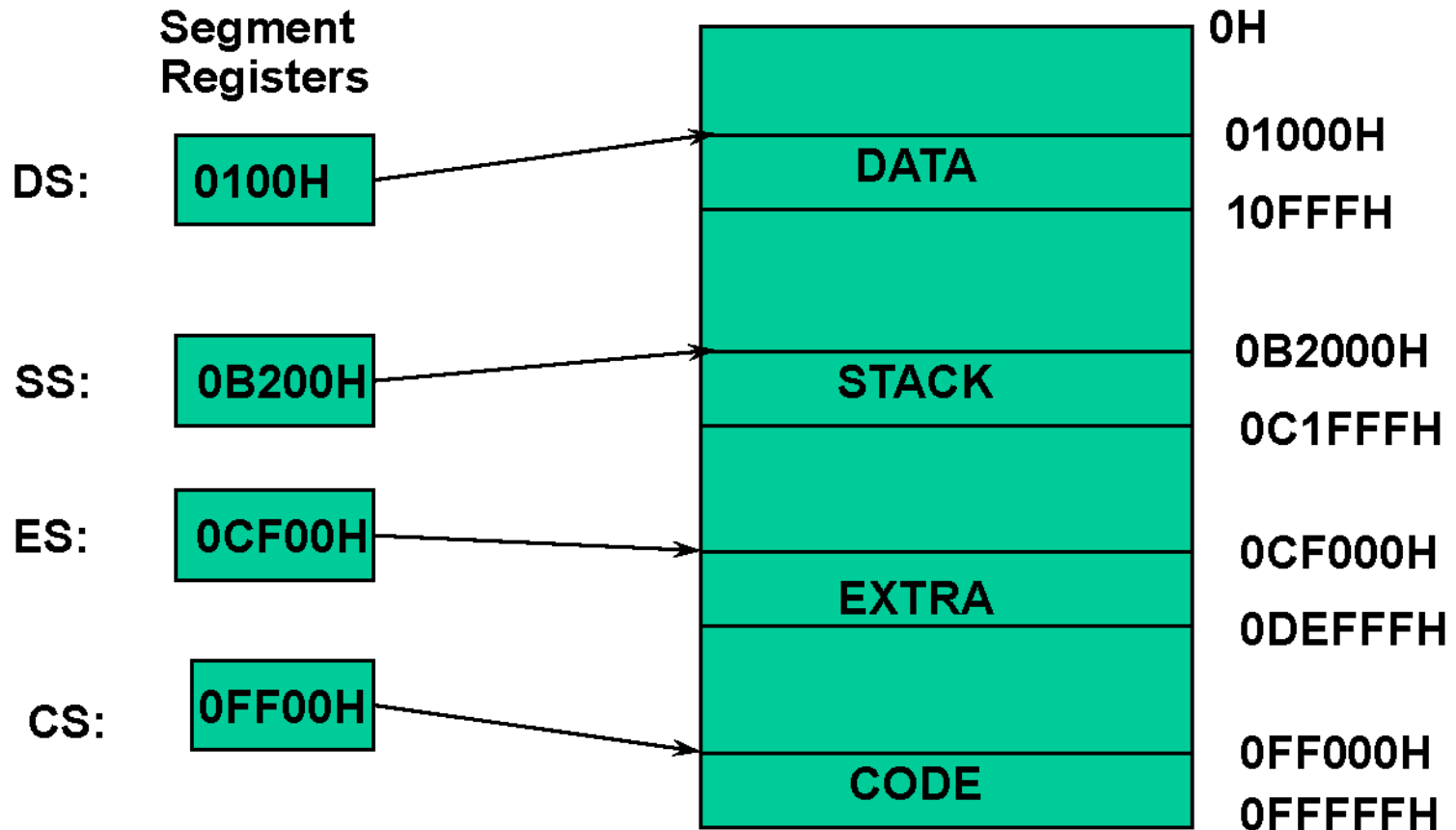
Segment Starting address is segment register value shifted 4 places to the left.



Segments are  $\leq 64K$ , can overlap, start at an address that ends in 0H.

# 8086 Memory Terminology

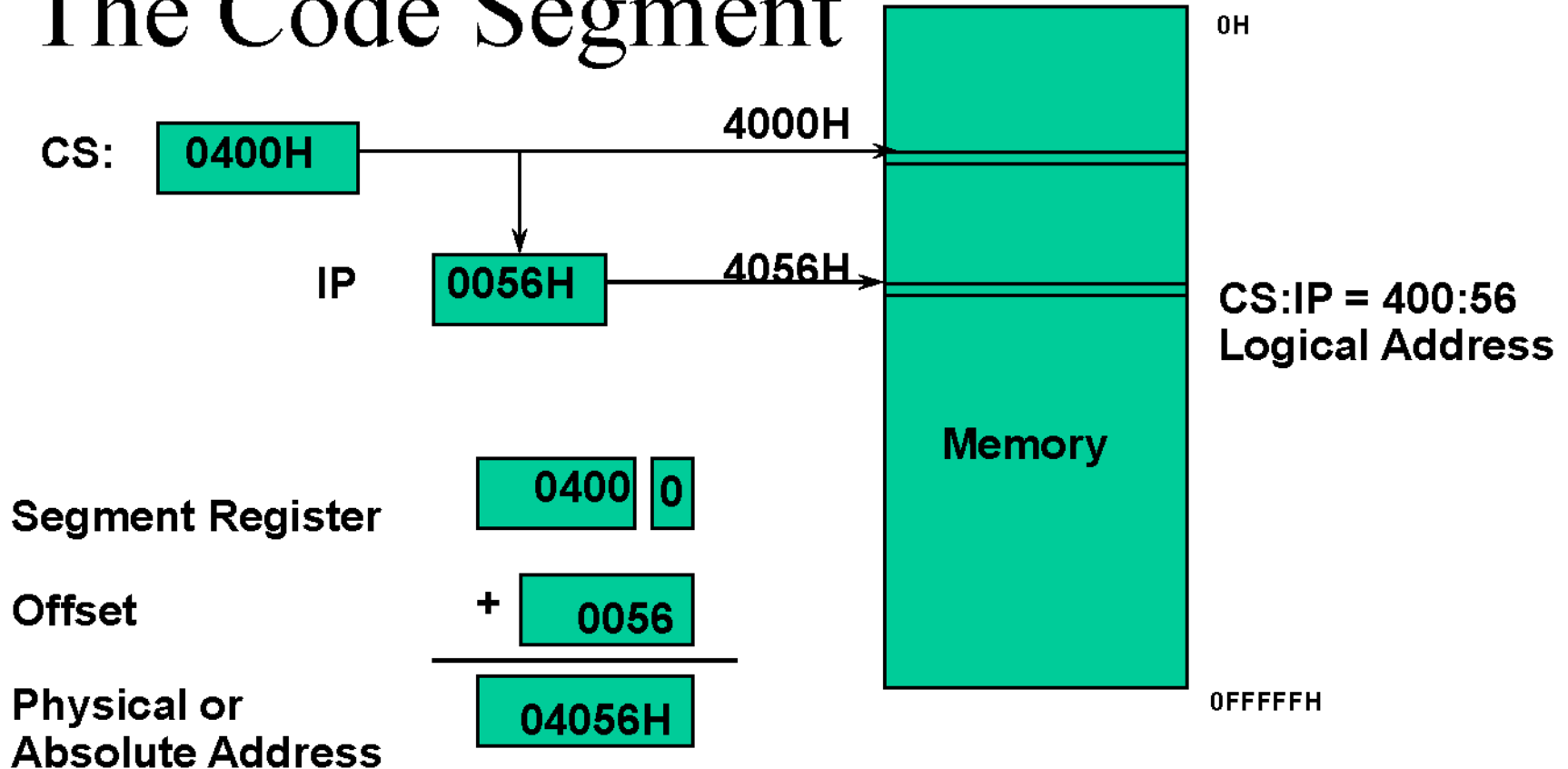
## Memory Segments



Segments are  $\leq 64K$  and can overlap.

Note that the Code segment is  $< 64K$  since 0FFFFFH is the highest address.

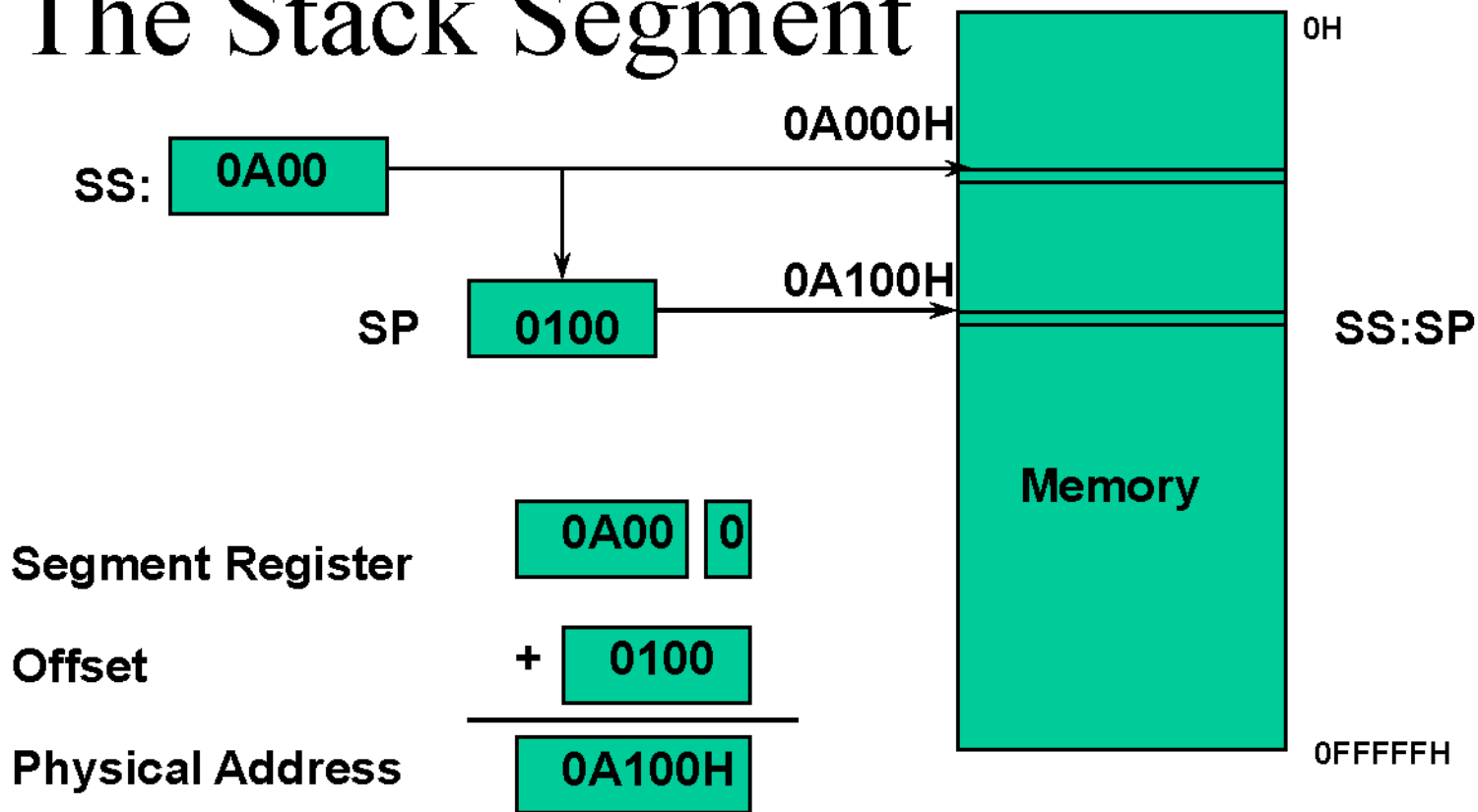
# The Code Segment



The offset is the distance in bytes from the start of the segment. The offset is given by the IP for the Code Segment. Instructions are always fetched with using the CS register.

The physical address is also called the absolute address.

# The Stack Segment



The offset is given by the SP register.

The stack is always referenced with respect to the stack segment register.

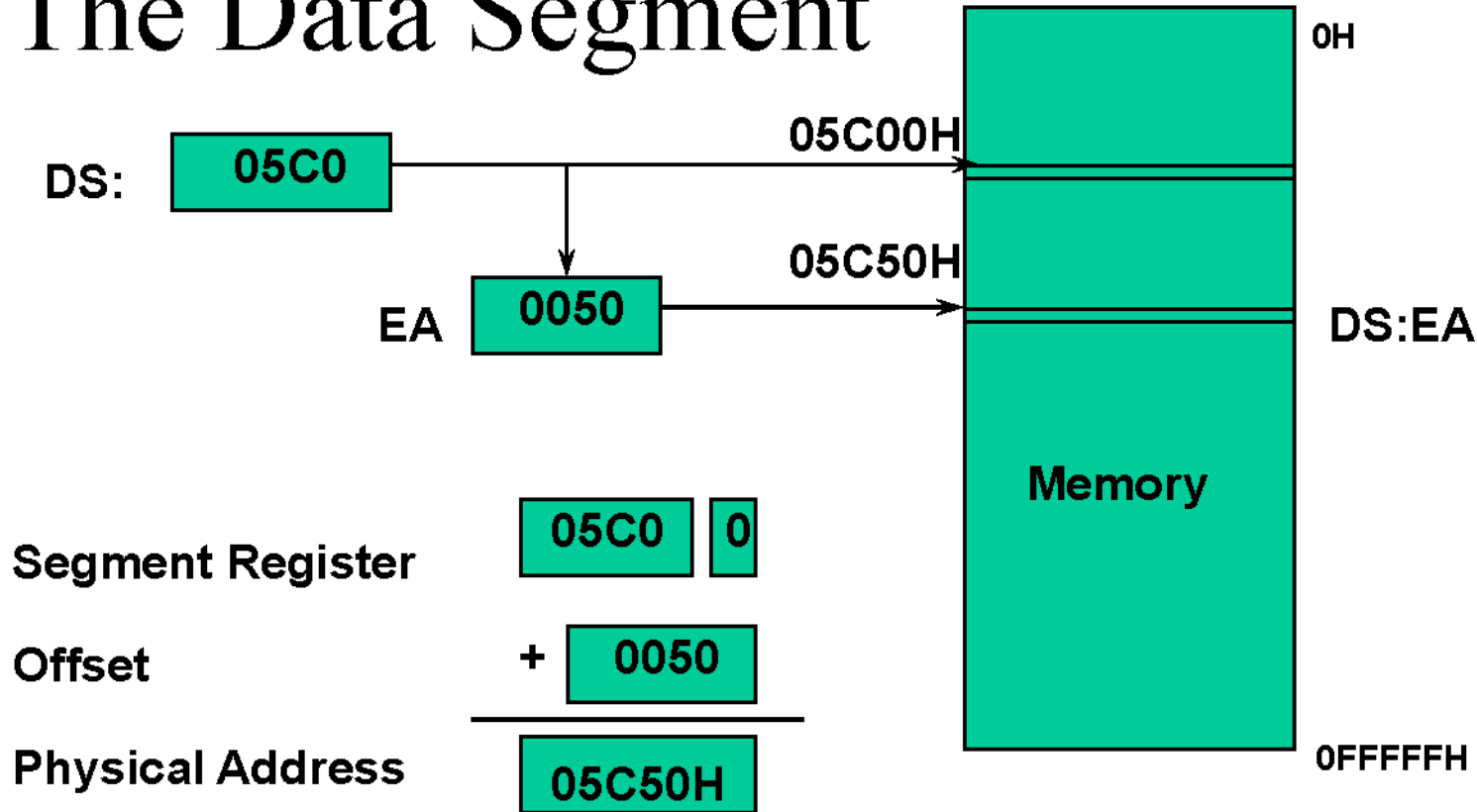
The stack grows toward decreasing memory locations.

The SP points to the last or top item on the stack.

**PUSH** - pre-decrement the SP

**POP** - post-increment the SP

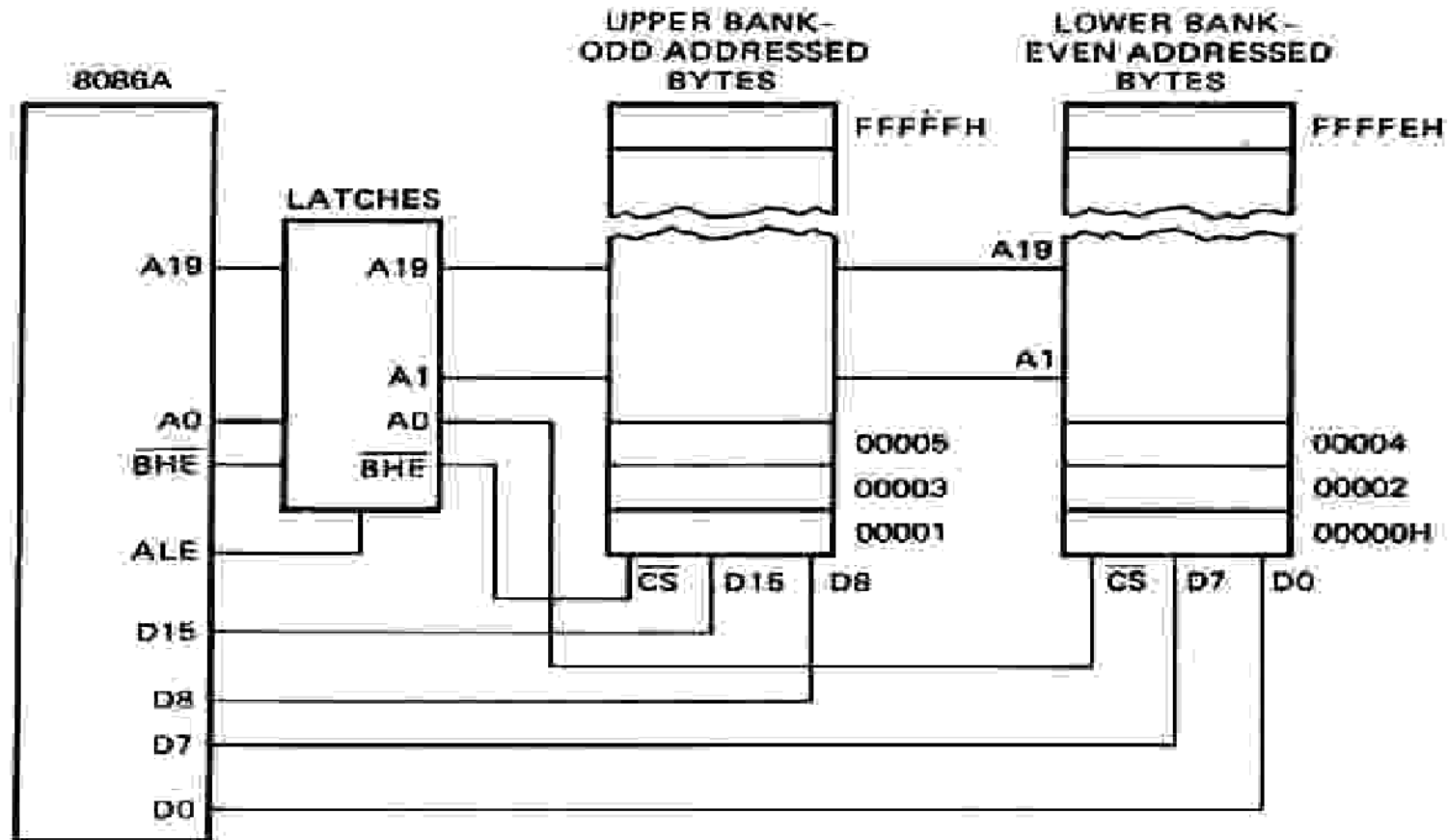
# The Data Segment



Data is usually fetched with respect to the DS register.  
The effective address (EA) is the offset.  
The EA depends on the addressing mode.



# 8086 memory Organization



(a)

ADDRESS	DATA TYPE	BHE	A0	BUS CYCLES	DATA LINES USED
0000	BYTE	1	0	ONE	D0-D7
0000	WORD	0	0	ONE	D0-D15
0001	BYTE	0	1	ONE	D8-D15
0001	WORD	0	1	FIRST	D0-D8
		1	0	SECOND	D8-D15

**Even addresses are on the low half of the data bus (D0-D7).**

**Odd addresses are on the upper half of the data bus (D8-D15).**

**A0 = 0 when data is on the low half of the data bus.**

**BHE' = 0 when data is on the upper half of the data bus.**