



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

KUET

SESSIONAL REPORT

Department Of CSE Course No. CSE-2204

Experiment No. O1

Name of the Experiment 8086 Instruction Descriptions and Assembler Directives

Remarks



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8086 Instruction Descriptions and Assembler Directives

AAA

Meaning: ASCII Adjust for Addition

Example:

; Assume AL = 0011 0101, ASCII 5
; BL = 0011 1001, ASCII 9

ADD AL, BL ; Result: AL = 0110 1110 = 6EH, which is
; incorrect BCD

AAA ; Now, AL = 0000 0100, unpacked BCD 4
; CF = 1 indicates answer is 14 decimal

ADC, ADD

Meaning: ADC - Add with Carry - ADC Destination, Source
ADD - Add - ADD Destination, Source

Example:

ADD AL, 74H ; Add immediate number 74H to
; contents of AL. Result in AL
; Add contents of BL plus carry
status

ADC CL, BL ; to contents of CL
ADD DX, BX ; Add contents of BX to contents of DX
ADD DX,[SI] ; Add word from memory at
; offset [SI] in DS to contents of DX
ADC AL, PRICES[BX]; Add byte from effective address
; PRICES[BX] plus carry status
; to contents of AL
ADD PRICES[BX], AL; Add contents of AL to contents
; of memory location at effective
; address PRICES[BX]

AND

Meaning: AND Corresponding Bits of Two Operands -
AND Destination, Source

Example:

AND CX, [SI] ; AND word in DS at offset [SI]
; with word in CX register
; Result in CX register
AND BH, CL ; AND byte in CL with byte in BH
; Result in BH
AND BX, 00FFH ; 00FFH, Masks upper byte, leaves
; lower byte unchanged

CALL

Meaning: Call a Procedure

Example:

CALL BX ; An indirect within-segment near or
; intrasegment call. BX contains the
; offset of the first instruction of the
; procedure. Replaces contents of IP
; with contents of register BX.

CBW

Meaning: Converted Signed Byte to Signed Word

Example:

CBW ; AX = 00000000 10011011 = -155 decimal
; Convert signed byte in AL to signed word
; in AX
; Result : AX = 11111111 10011011 = -155 decimal

CLC

Meaning: Clear the Carry Flag (CF)

Example:

CLC

CLD

Meaning: Clear Direction Flag

Example: CLD ; clear direction flag so that the
; string pointers autoincrement
; after each string operation.

CLI

Meaning: Clear Interrupt Flag

Example:

CLI

CMP

Meaning: Compare Byte or Word - CMP Destination, Source

Example:

CMP AL, 01H ; Compare immediate number 01H
; with byte in AL

CMP BH, CL ; Compare byte in CL with byte
; in BH

CMP CX, TEMP_MIN ; Comare word in DS at
; displacement TEMP-MIN with
; word in CX

④ CMPS/CMPSB/CMPSW

Meaning: Compare String Bytes or String Words

Example:

REPE CMPSB : Repeat the comparision of string
; bytes until end of string or
; until compared bytes are not
; equal .

④ CWD

Meaning: Convert Signed Word to Signed Doubleword

Example:

CWD ; DX = 00000000 00000000
; AX = 11110000 11000111 = -3897 decimal
; Convert signed word in AX to signed
; doubleword in DX : AX
; Result : DX = 11111111 11111111
; AX = 11110000 11000111 = -3897 decimal

④ DAA

Meaning: Decimal Adjust AL after BCD addition

Example:

; AL = 0101 1001 = 59 BCD

; BL = 0011 0101 = 35 BCD

ADD AL, BL ; AL = 1000 1110 = 8 EH

; Add 0110 because $1110 > 9$

; AL = 1001 0100 = 94 BCD

④ DEC

Meaning: Decrement Destination Register or memory
- DEC Destination

Example:

DEC CL ; Subtract 1 from contents of CL register

⑤ DIV

Meaning: Unsigned Divide - DIV Source

Example:

DIV CX ; Divide doubleword in DX and AX by word
; in CX, Quotient in AX, remainder in DX

DIV BL ; Divide word in AX by byte in BL,
Quotient in AL, remainder in AH.

ESC

Meaning: Escape

HLT

Meaning: Halt Processing

IDIV

Meaning: Divide by signed Byte or Word - IDIV
Source

Example:

TDIV BL ; signed word in AX / signed byte
; in BL

TDIV BP ; signed doubleword in AX and AX /
; signed word

IMUL

Meaning: Multiply Signed Numbers - IMUL Source

Example:

IMUL BH ; Singed byte in AL times signed byte
; in BH. Result in AX

IMUL AX ; AX times AX, Result in DX and AX.

IN

Meaning: Copy Data from a Port - IN Accumulator, Port

Example:

IN AL, 0C8H ; Input a byte from port 0C8H to AL
IN AX, 34H ; Input a word from port 34H to AX

A_TO_D EQU 4AH

IN AX, A_TO_D ; Input a word from port 4AH to AX

INC

Meaning: Increment - INC Destination

Example:

INC BL ; Add 1 to contents of BL register

INT

Meaning: Interrupt Program Execution - INT Type

Example:

INT 35 ; New IP from 0008CH, new CS
; from 0008EH

INTO

Meaning: Interrupt in Overflow

Example:

INTO ; Call interrupt procedure if OF=1

IRET

Meaning: Interrupt Return

Example:

JA/JNBE

Meaning : JA - Jump if Above

JNBE - Jump if Not Below or Equal

Example :

CMP AX, 9371H ; Compare by subtracting 9371H
; from AX

JA RUN-PRESS ; Jump to label RUN-PRESS
; if AX above 9371H

CMP AX, 9371H

JA-RUN=

JNBE RUN-PRESS ; Jump to label RUN-PRESS
; if AX not below or equal to
; 9371H

JAE/JNB/JNC

Meaning: JAE - Jump if Above or equal

JNB - Jump if Not Below

JNC - Jump if Not Carry

Example:

CMP AX, 4371H

JAE RUN_PRESS

CMP AX, 471H

JNB RUN_PRESS

ADD AL, BL ; Add two bytes. If result within
JNC OK ; acceptable range, continue

JB/JC/JNAE

Meaning: JB - Jump if Below

JC - Jump if Carry

JNAE - Jump if Not Above or Equal

Example:

CMP AX, 4371H

JB RUN_PRESS

ADD BX, CX ; Add two words and jump to
JC ERROR_FIX ; label ERROR_FIX if CF=1

CMP AX, 4371H

JNAE RUNPRESS

JBE/JNA

Meaning: JBE - Jump if Below or Equal
JNA - Jump if Not Above

Example:

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CMP AX,4371H  
JBE RUN-PRESS  
CMP AX,4371H  
JNA RUN-PRESS
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JCXZ

Meaning: Jump if the CX Register is Zero

Example:

JCXZ SKIP_LOOP; If CX=0, skip the process

JE/JZ

Meaning: JE - Jump if Equal
JZ - Jump if Zero

Example:

NXT: CMP BX,DX ; Compare (BX-DX)

JE DONE ; Jump to DONE if BX=DX

SUB AL,30H

JZ START-MACHINE ; Jump to label if result of subtraction was 0

JG/JNLE

Meaning: JG - Jump if Greater

JNLE - Jump if Not Less than or Equal

Example:

CMP BL, 39H

BL JG NEXT-1 ; Jump to label if BL more positive than 39H

CMP BL, 39H

JNLE NEXT-1

JL/JNGE

Meaning: JL - Jump if Less Than

JNGE - Jump if Greater Than or Equal

Example:

CMP BL, 39H

JL AGAIN

CMP BL, 39H

JNGE AGAIN

JLE / JNG

Meaning: JLE - Jump if Less Than or Equal
JNG - Jump if Not Greater

Example:

CMP BL, 39H

JLE NXT_1

CMP BL, 39H

JNG PRINTER

JMP

Meaning: Unconditional Jump to Specified Destination

Example:

JMP BX ; Replace the contents of IP with
; the contents of BX. BX must be
; first be loaded with the offset
; of the destination instruction
; in CS. It is a near jump.
; It is also referred to as an
; indirect jump.

JNE/JNZ

Meaning: JNE - Jump If Not Equal
JNZ - Jump if Not Zero

Example:

NXT: IN AL, OF8H ; Read data value from port

CMP AL, 72

JNE NXT

IN AL, OF9H ; Read next port when AL=72

MOV BX, 2734H ; Load BX as counter

NXT_1 : ADD AX, 0002H ; Add counter factor to AX

DEC BX

JNZ NXT_1 ; Repeat until BX=0

JNO

Meaning: Jump if No Overflow

Example:

ADD AL, BL

JNO DONE ; Process done if no overflow

MOV AL, 00H ; Else load error code in AL

DONE: OUT 24H, AL ; Send result to display

JNP/JPO

Meaning: JNP - Jump if No Parity
JPO - Jump if Parity Odd

Example:

IN AL, OF8H

OR AL, AL ; Set flags

JPO ERROR1 ; Even parity expected, send
; error message if parity found odd

JNS

Meaning: Jump if Not signed (Jump if Positive)

Example:

DEC AL

JNS REDO ; Re Jump to label REDO if counter
; has not decremented to FFH

JO

Meaning: Jump if overflow

Example:

ADD AL, BL

JO ERROR ; Jump to label ERROR if overflow
; from add

JP / JPE

Meaning: JP - Jump if Parity
JPE - Jump if Parity Even

Example:

IN AL, F8H

OR AL, AL

JPE ERROR2 ; Odd parity expected, send
; error message if parity
; found even

JS

Meaning: Jump if Signed (Jump if Negative)

Example:

ADD BL, DH

JS TOO-COLD ; Jump to label TOO-COLD if
; result of addition is a
; negative number.

LEA

Meaning: Load Effective Address - LEA Register,
Source

Example:

LEA BX, PRICES ; Load BX with offset of
PRICES in DS

② LODS/LODSB/LODSW

Meaning: Load String Byte into AL or
Load String Word into AX

Example:

CLD

MOV SI, OFFSET SOURCE_STRING
; points SI at start of string

LODS SOURCE_STRING ; Copy byte or word
from string to AL or AX

③ LOOP

Meaning: Jump to specified Label if CX≠0
after autodereference - LOOP Label

Example:

MOV BX, OFFSET PRICES

MOV CX, 40

NEXT: MOV AL, [BX]

ADD AL, 07 OH

DAA

MOV [BX], AL

INC BX

LOOP NEXT ; Repeat until all elements adjusted

④ LOOPE / LOOPZ

Meaning: Loop while CX ≠ 0 and ZF = 1

Example:

MOV BX, OFFSET ARRAY

DEC BX

MOV CX, 100

NEXT: INC BX

CMP [BX], OFFH

LOOPE NEXT

⑤ LOOPNE / LOOPNZ

Meaning: Loop while CX ≠ 0 and ZF = 0

Example:

MOV BX, OFFSET ARRAY

DEC BX

MOV CX, 100

NEXT: INC BX

CMP [BX], OFFH

LOOPE NEXT

MOV

Meaning: Copy a Word or Byte - MOV
• Destination, Source

Example:

MOV AX, BX ; Copy contents of register BX
; to AX

MOVS/MOVSB/MOVSW

Meaning: Move String Byte or String Word -
MOVS Destination String Name, Source
String Name

Example:

MOV SI, OFFSET SOURCE_STRING

MOV DI, OFFSET DESTINATION_STRING

CLD

MOV CX, 0AH

REP MOVSB ; Decrement CX and copy
; string bytes until CX=0

MUL

Meaning: Multiply Unsigned Bytes or Words -
MUL Source

Example:

MUL BH ; AL times BH, Result in AX

MUL CX ; AX times CX, Result high word in DX

NEG

Meaning: Form 2's Complement - NEG Destination

Example:

NEG AL ; Replace number in AL with its
; 2's complement

NEG BX ; Replace word in BX with its
2's complement.

NOP

Meaning: Perform No Operation

NOT

Meaning: Invert Each Bit of Operand -
NOT Destination

Example:

NOT BX ; Complement contents of BX Register

OR

Meaning: Logically OR Corresponding Bits of Two Operands - OR Destination, Source

Example:

OR AH, CL ; CL ORed with AH, Result in AH
; CL not changed

OUT

Meaning: Output a Byte or Word to a Port -
OUT Port, Accumulator AL or AX

Example:

MOV DX, OFFF8H

OUT DX, AL ; Copy contents of AL to port FFF8H

POP

Meaning: POP Destination

Example:

POP DX ; Copy a word from top of stack to DX
; Increment SP by 2

POPF

Meaning: POP Word from Top of Stack to Flag Register

PUSH

Meaning: PUSH Source

Example:

PUSH BX ; Decrement SP by 2, copy BX to stack

PUSHF

Meaning: Push Flag Register on the Stack

RCL

Meaning: Rotate Operand Around to the Left through CF - RCL Destination, Count

Example:

RCL DX, 1 ; Word in DX 1 bit left. MSB to CF, CF to LSB

RCR

Meaning: Rotate Operand Around to the Right through CF - RCR Destination, Count

Example:

RCR BX, 1 ; Word in BX right 1 bit CF to MSB, LSB to CF

REP/ REPE/ REPZ/ REPNE / REPNZ

meaning: (Prefix) Repeat String Instruction
until Specified Conditions Exist

Example:

REPE CMPSB ; Compare string bytes until
; end of string or until string
; bytes not equal.

REPNE SCASW ; Scan a string of words until
; a word in the string matches
; the word in AX or until
; all of the string has been
; scanned.

RET

Meaning: Return Execution from Procedure to
Calling Program

ROR

Meaning: Rotate All Bits of Operand Right,
LSB to MSB - ROR Destination, Count

Example:

ROR BL,1 : Rotate all bits in BL right 1 bit position
; LSB to MSB and to CF

ROL

Meaning: Rotate All Bits of Operand Left, MSB to LSB - ROL Destination, Count

Example:

ROL AX, 1 ; Word in AX 1 bit position left,
; MSB to LSB and CF

SAL/SHL

Meaning: Shift Operand Bits Left, Put Zero in
LSB(s) - SAL/SHL Destination, Count

Example:

SAL BX, 1 ; Shift word in BX 1 bit position
left, 0 in LSB

SAR

Meaning: Shift Operand Bits Right, New MSB =
old MSB - SAR Destination, Count

Example:

SAR DI, 1 ; Shift word in DI one po bit
; position right,
; new MSB = old MSB

② SBB, SUB

Meaning: SBB - Subtract with Borrow - SBB

Destination, Source

SUB - Subtract - SUB Destination,
Source

Example :

SUB CX, BX ; CX-BX, Result in CX

SBB CH, AL ; subtract contents of AL and
; contents of CF from contents
; of CH. Result in CH

③ SCAS/SCASB/SCASW

Meaning: Scan a String Byte or a String
Word

Example:

MOV DI, OFFSET TEXT-STRING

MOV AL, 0DH

MOV AX, 80

CLD

REPE SCAS TEXT-STRING ; compare byte in
; string with byte in AL

SHR

meaning: Shift operand bits Right, Put zero in MSB(s) - SHR Destination, Count

Example:

SHR BP,1; shift word in BP one bit position
; right, 0 in MSB

STC

meaning: Set the Carry Flag to a 1

STD

Meaning: Set the Direction Flag to a 1

STI

Meaning: Set Interrupt Flag (IF)

STOS/STOSB/STOSW

meaning: store Byte or Word in String

Example:

MOV DI, OFFSET TARGET_STRING STOS
TARGET_STRING

MOV DJ, OFFSET . TARGET_STRING

STOSB ; Tells assembler to replace byte
; in string with byte from AL

TEST

Meaning: AND Operands to Update Flags -
TEST Destination, Source

Example:

TEST AL, BH ; AND BH with AL, no result
; stored. Update PF, SF, ZF

WAIT

Meaning: Wait for Test Signal or Interrupt
Signal

XCHG

Meaning: XCHG Destination, Source

Example:

XCHG AX, DX ; Exchange word in AX with
; word in DX

XOR

Meaning: Exclusive OR Corresponding Bits of
Two Operands - XOR Destination, Source

Example:

XOR CL, BH ; Byte in BH Exclusive-ORed with
; Byte in CL, Result in CL.
; BH not changed.