FR. Conceicao Rodrigues College of Engineering
Department of Computer Engineering

1. Addition of Two 8/16/32 bit numbers

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 1– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	**Practical Skill & Applied Knowledge (2)**	**Output (3)**	**Postlab (3)**	**Total (10)**	**Sign**

2. Aim & Objective of Experiment

TO ADD TWO 8/16/32 BIT NUMBERS

Objective : Program involves storing the two 8-bit no in memory locations and adding them taking into consideration the carry generated. The objective of this program is to give an overview of arithmetic instructions of 8086 for 8-bit operands

3. Software Required

TASM Assembler

Prepared by : Prof. Heenakausar Pendhari

4 . Brief Theoretical Description

Pre-Requisites: 1. Instructions of microprocessor 8086
2. Addressing mode of microprocessor 8086.
3. Knowledge of TASM directories.

Theory: The addressing modes used in program are:

1) Direct addressing mode: in this mode address of operand is directly specified in the instruction. This address is offset address of the segment being indicated by an instruction.

E.g. MOV AL,[2000h]
EA = DS x 10H + 2000H

2) Register Addressing Mode: In this mode operand are specified using registers. Instructions are shorter but operations cannot be identified looking at instruction.
E.g. MOV CL, DL

3) Based Indexed Addressing Mode: The operand address is calculated using base register and index register.

E.g. MOV DX, [BX + SI] moves word from address pointed by BX + SI in data segment to DX.

EA = DS x 10H + BX + SI

4) Base indexed plus displacement: In this mode address of operand is calculated using base register , index register and displacement.
E.g. MOV CX, [BX+DI+10h]

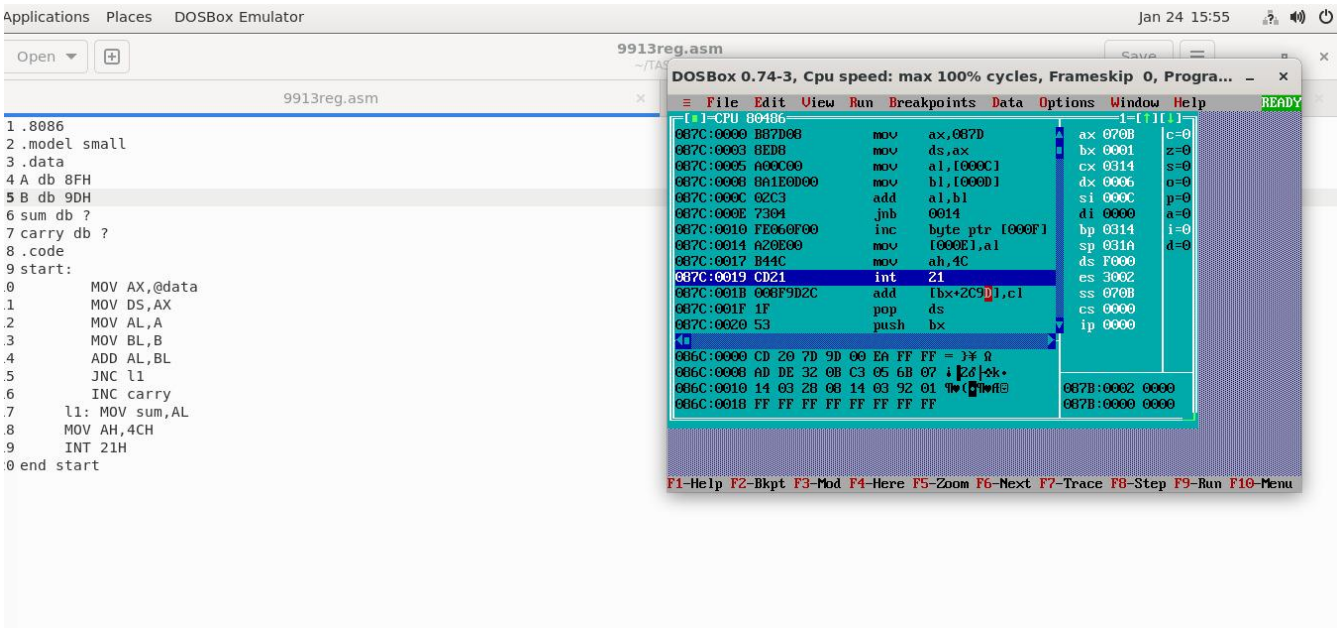
This moves a word from address pointed by BX + DI +10h of segment to CX.

5. Algorithm:

1. Initialize the data segment.
2. Store two 8/16 -bit numbers in memory locations.
3. Move the 1st number in any one of the general purpose register.
4. Move the 2nd number in any other general purpose register.
5. Add the 2 numbers.
6. Store the result in memory location.
7. Check for carry flag. If carry flag is set then store '1' as MSB of result.
8. Stop

6. Conclusion:

8 bit addition:-



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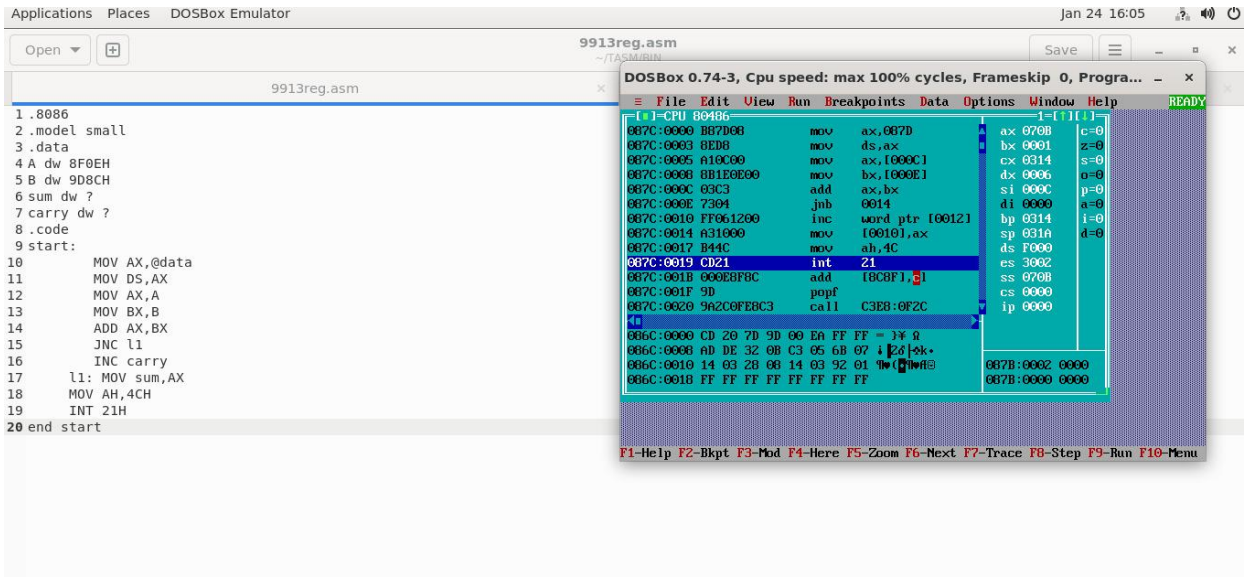
16 bit addition:-



Postlab:

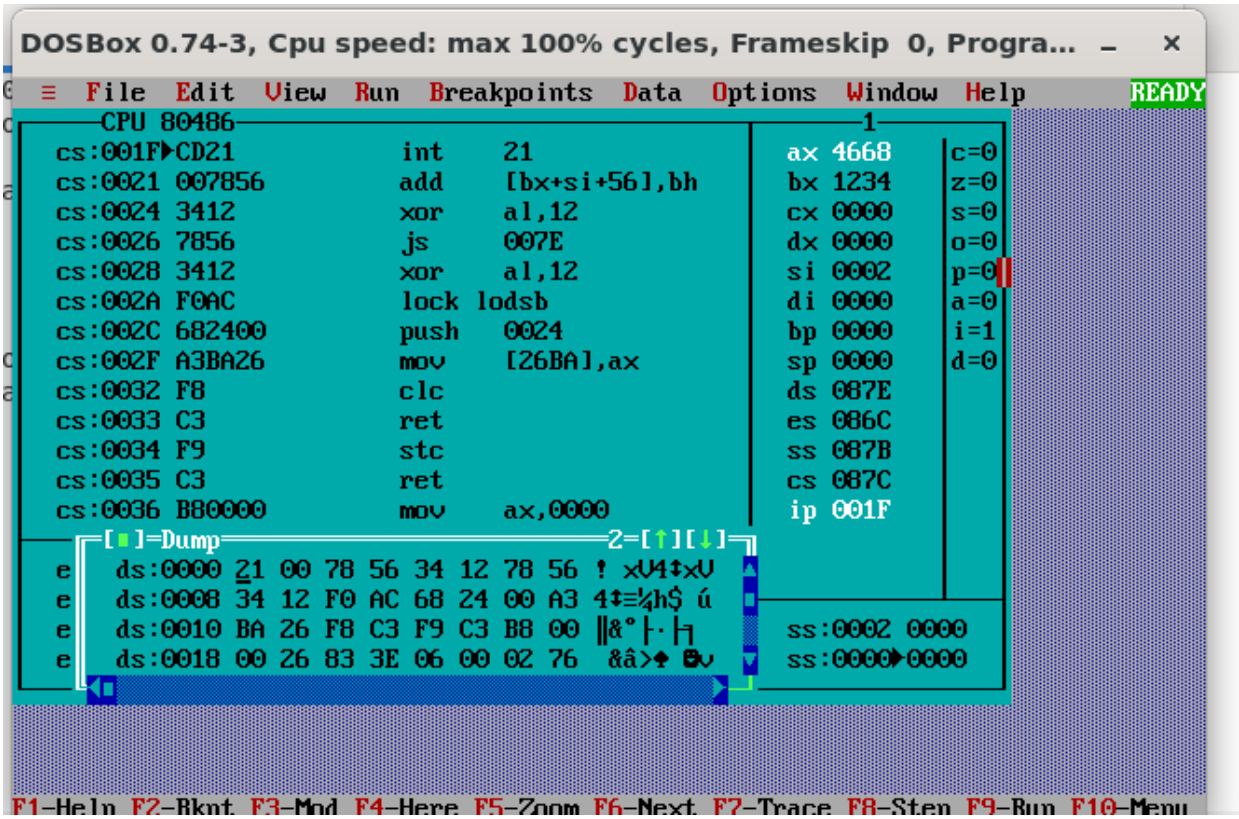
1. Write a program for addition of two 32 bit numbers ,execute and take the screen shots of the results.

```
.8086
.model small
.data
   num1 dd 12345678H
   num2 dd 12345678H
   suml dw ?
```

Prepared by : Prof. Heenakausar Pendhari

```
    sumh dw ?
.code
start:
    MOV AX, @data
    MOV DS, AX
    LEA SI, num1
    MOV AX, [SI]
    MOV BX, [SI+04H]
    ADC AX, BX
    MOV suml, AX

    MOV AX, [SI+02H]
    MOV BX, [SI+06H]
    ADC AX, BX
    MOV sumh, AX
    MOV AH, 46H
    INT 21H
    end start
```



2. Write a program to Subtract two 16 bit numbers.

```
.8086
.model small
.data
   A dw 2456H
   B dw 3280H
   subt dw ?
   burrow dw ?
.code
start:
```

MOV AX, @data

MOV DS, AX

MOV AX, A

MOV BX, B

SBB BX, AX

JNC skip

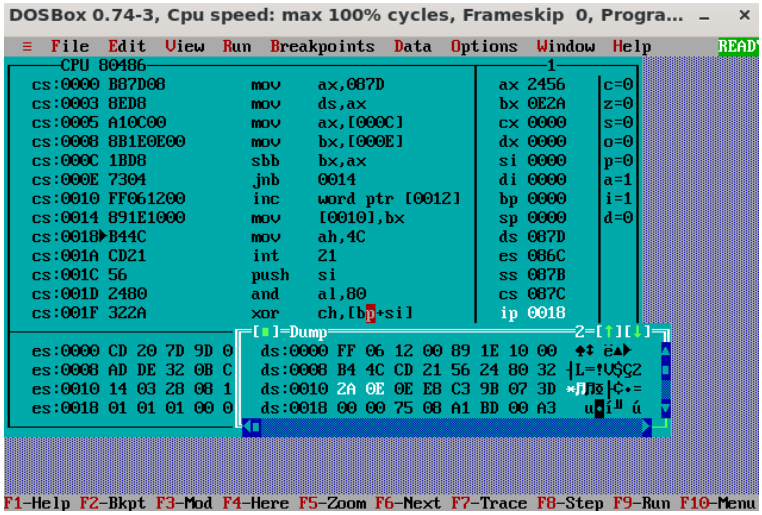
INC burrow

skip: MOV subt, BX

MOV AH, 4CH

INT 21H

end start



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2. Multiplication of Two 8/16/32 bit numbers

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 2– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	**Practical Skill & Applied Knowledge (2)**	**Output (3)**	**Postlab (3)**	**Total (10)**	**Sign**

2. Aim & Objective of Experiment

TO MULTIPLY TWO 8/16/32 BIT NUMBERS

Objective : Program involves storing the two 8/16/32 bit numbers in memory locations and multiplying them the objective of this program is to give an overview of arithmetic instructions of 8086 for 32 bit operation

3. Software Required

TASM Assembler

Prepared by: Prof. Heenakausar Pendhari

4 . Brief Theoretical Description

Pre-Requisites: 1. Instructions of microprocessor 8086
2. Addressing mode of microprocessor 8086.
3. Flag register of microprocessor 8086
4. Knowledge of TASM directories.

Theory: MUL instruction This instruction multiplies byte/word present in source with AL/AX.

a) When two 8 bit numbers are multiplied a 16 bit product is made available in AX register where AH stores higher byte and AL stores lower byte of the product.

e.g. MUL BL

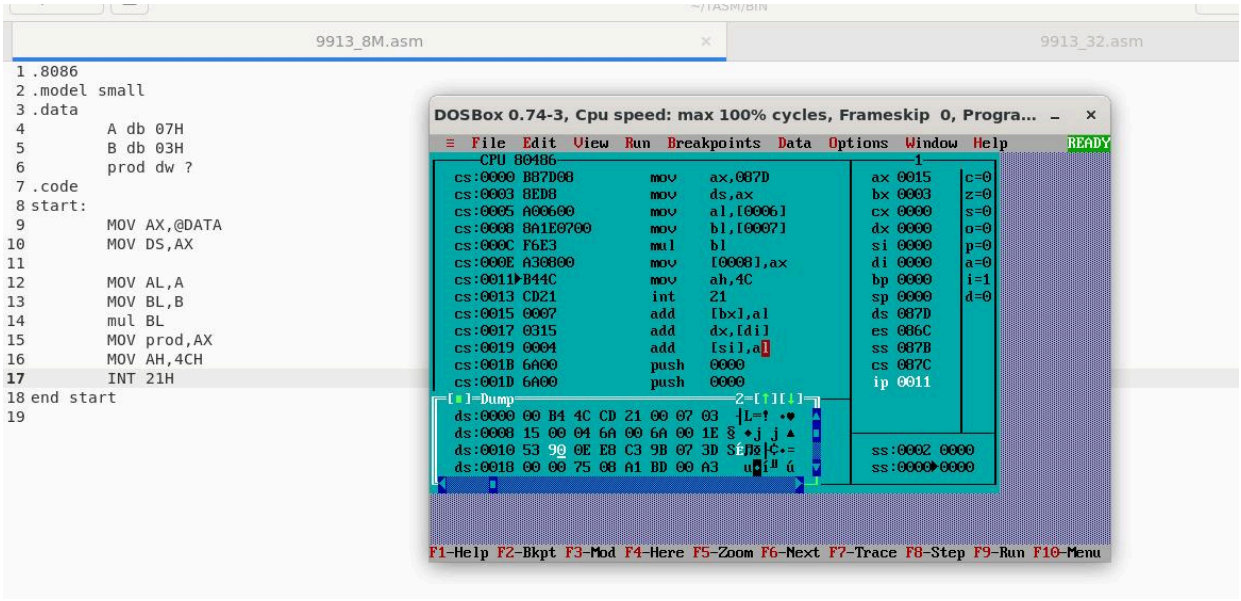
b) When two 16 bit numbers are multiplied a 32 bit product is made available in DX and AX register pair. DX has higher word and AX has lower word of the product.

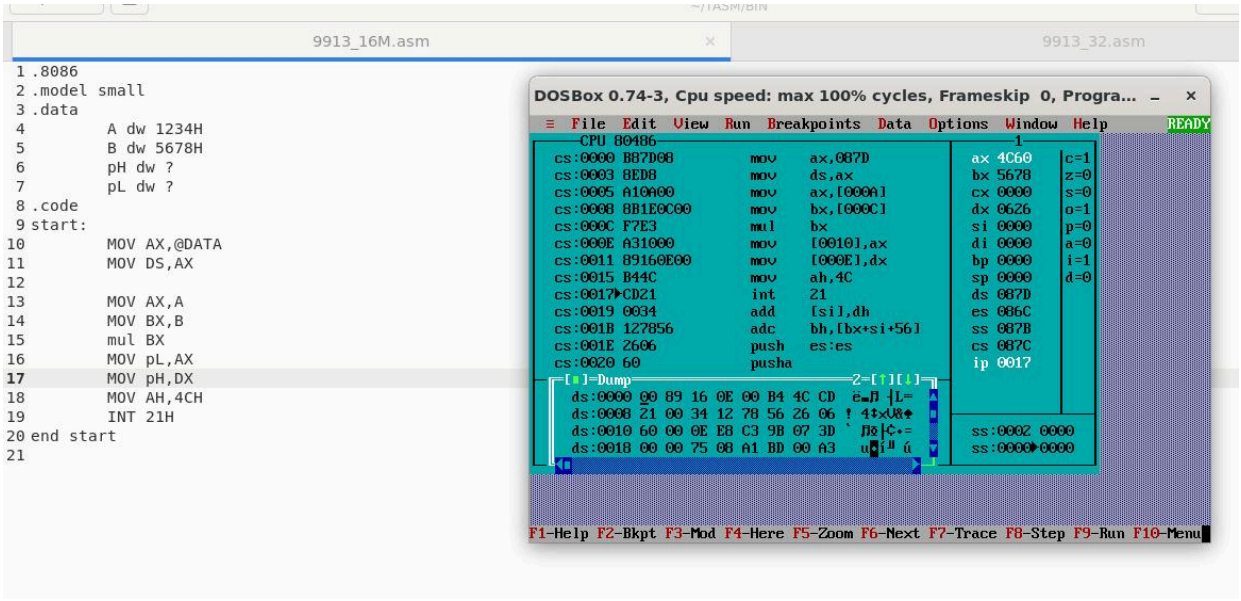
e.g. MUL BX

5. Algorithm:

1. Initialize the data segment.
2. Store two 8/16/32 bit numbers in memory locations.
3. Move the 1st number in any TWO general purpose register.
4. Move the 2nd number in any other TWO general purpose register
5. Multiply the 2 numbers.
6. Store the result in memory location.
7. Stop.

6. Conclusion:





7. Postlab:

1. Write a program to Multiply two 32 bit number.

Prepared by: Prof. Heenakausar Pendhari

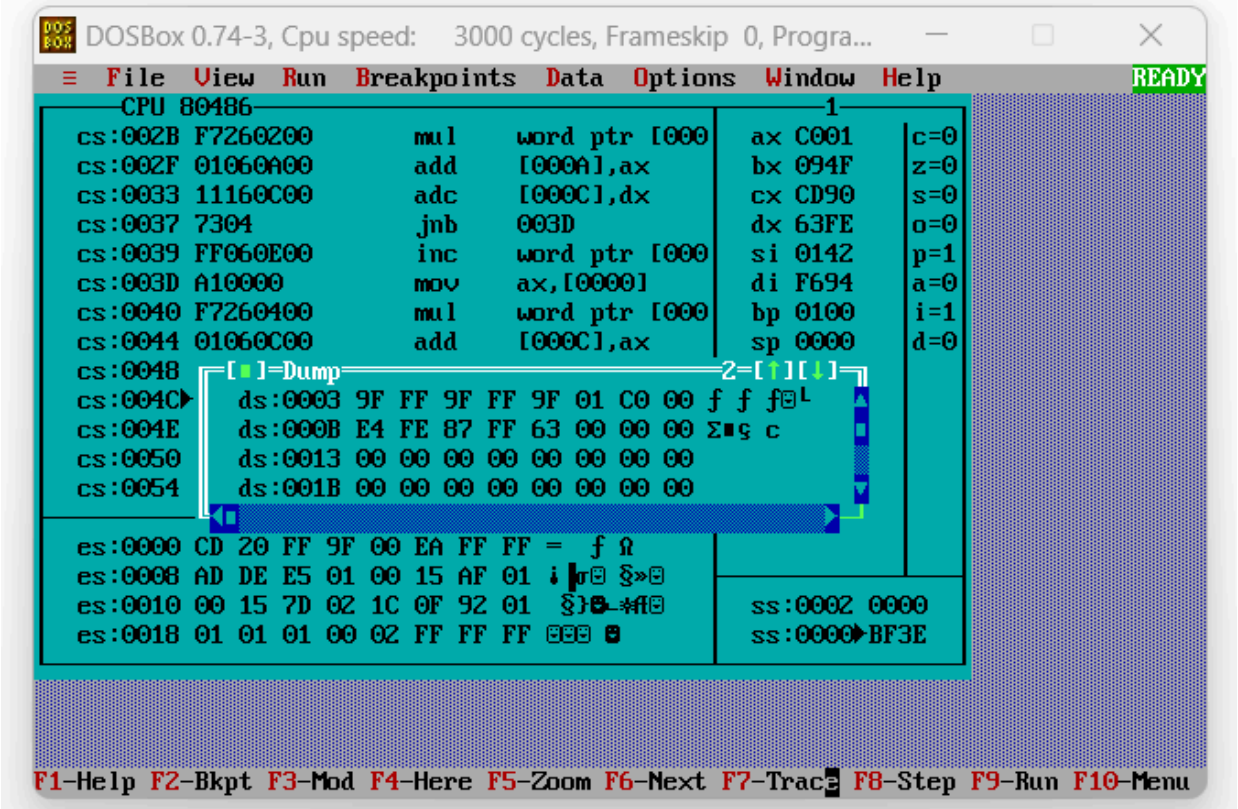
```
.8086
.model small
.data
  num1h dw 9FFFH
  num1l dw 9FFFH
  num2h dw 9FFFH
  num2l dw 9FFFH
  resultll dw 0000H
  resultlh dw 0000H
  resulthl dw 0000H
  resulthh dw 0000H
.code
  start:
    MOV AX, @data
    MOV DS, AX

    MOV AX, num1l
    MUL num2l
    MOV resultll, AX; 16bit llsb.1
    MOV resultlh, DX; 16bit lhsb.1

    MOV AX, num1h;
    MUL num2l;
    ADD resultlh, AX; 16bit lhsb + lsb.2 can gen carry
    ADC resulthl, DX; 16bit hlsb, if there is a carry for hl add it alongside. 1
    JNC skip1; ignore the carry addition if there is not carry generated
    INC resulthh; if there was a carry generated in the above addition the add it in the highest 16bit
    skip1:

    MOV AX, num2h;
    MUL num1l;
    ADD resultlh, AX;  16bit lhsb + lsb.3 can gen carry
    ADC resulthl, DX; 16bit hlsb + hsb, if there is a carry for hl add it alongside. 2 can gen carry
    JNC skip2; ignore the carry addition if there is not carry generated
    INC resulthh; if there was a carry generated in the above addition the add it in the highest 16bit
    skip2:
    MOV AX, num1h;
    MUL num2h;
    ADD resulthl, AX; 16bit hlsb.3 can gen carry
    ADC resulthh, DX; move the 16 bit hsb in BX. 1

    MOV AH, 4CH
    INT 21H
  end start
```



2. What are the different types of addressing modes of 8086

   The 8086 microprocessor supports a wide range of addressing modes

i) Immediate:

- Operand is embedded directly within the instruction itself.
- Useful for small, constant values.
- Example: `MOV AX, 10` (Move the immediate value 10 into the AX register)

ii) Register:

- Operand resides in one of the 8086's internal registers (AX, BX, CX, DX, etc.).
- Fastest and most efficient for accessing register data.
- Example: `ADD AX, BX` (Add the value in BX to the value in AX)

iii) Direct:

- Operand's memory address is specified directly within the instruction.
- Requires 16 bits for addressing within the same segment.

- Example: `MOV BX, [1000h]` (Move the value from memory location 1000h to the BX register)

iv) Register Indirect:

Address of the operand is stored in one of the register (BX, SI, DI).

Useful for accessing data stored in memory locations whose addresses are dynamic or calculated during program execution.

Example: `MOV AX, [BX]` (Move the value from the memory location whose address is stored in BX to the AX register)

3. Briefly Explain The Pointers And Index Group of Registers.?

In the 8086 microprocessor, pointers and index registers are two special groups of registers used primarily for memory addressing and manipulation.

i) Pointers

Purpose: Store memory addresses that "point" to specific locations within a segment.

Key Registers:

IP (Instruction Pointer): Holds the offset address of the next instruction to be fetched by the Execution Unit (EU) from the Code Segment (CS).

SP (Stack Pointer): Points to the top of the stack within the Stack Segment (SS). The stack is used for storing temporary data, function parameters, and return addresses.

BP (Base Pointer): Often used to point to the base of a data structure or array within the Data Segment (DS).

ii)Index

Purpose: Primarily used for holding offsets in various addressing modes, making it easier to access elements within an array or data structure.

Key Registers:

SI (Source Index): Often used to hold the offset of the source operand in string operations or memory blocks.

DI (Destination Index): Frequently used to hold the offset of the destination address in string operations or memory blocks.

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3. TO IMPLEMENT BLOCK TRANSFER

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 3– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	Practical Skill & Applied Knowledge (2)	Output (3)	Postlab (3)	Total (10)	Sign

2. Aim & Objective of Experiment

Aim: Write a program to transfer a block of data from one location to another.

Objective : Program involves transferring source string from a particular location in source segment (Data Segment) to the desired location in destination segment (Extra Segment). The objective of this program is to give an overview of the String instructions of 8086.

3. Software Required

TASM Simulator

4. Pre-Requisites:

1. Knowledge of TASM directives.
2. Knowledge of String Instructions of 8086.

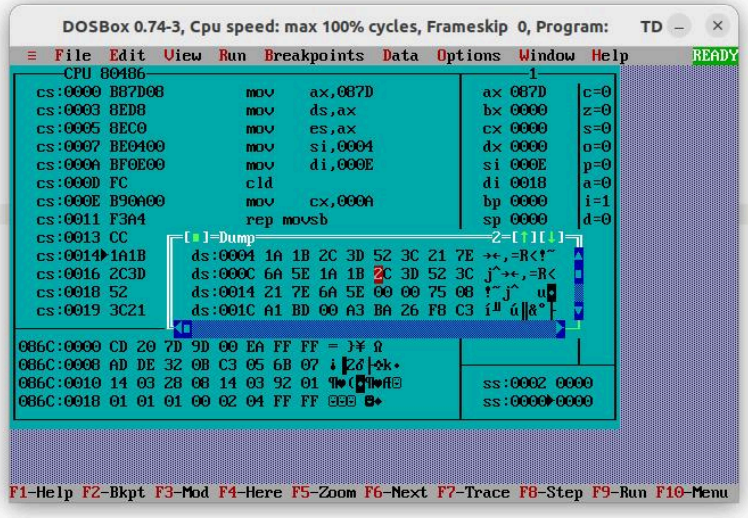
5. Algorithm:

1. Initialize the data segment.
2. Store the source string in consecutive memory location
3. Initialize the extra segment.
4. Allocate consecutive memory locations for transfer.
5. Load the effective address of source string in SI register.
6. Load the effective address of destination string in DI register.
7. Initialize the Direction flag for Auto increment or Auto Decrement.
8. Store number of bytes to be transferred in any of the general Purpose registers.
9. Transfer the source string using appropriate string instructions (MOVSB / MOVSW)
10. Decrement count
11. Check if count = 0.If yes then stop else repeat steps 9 - 11.
12. Stop

6. Conclusion:

Open — Block.asm — ~/TASM/BIN — Save

```
1 .8086
2 .model small
3 .data
4         loc1 db 1AH,1BH,2CH,3DH,52H,3CH,21H,7EH,6AH,5EH
5         loc2 db ?
6 .code
7 start:
8         MOV AX,@DAtA
9         MOV DS,AX
10        MOV ES,AX
11
12        LEA SI, loc1
13        LEA DI, loc2
14        CLD
15        MOV CX, 000AH
16    REP MOVSB
17        INT 03H
18 end start
```



Postlab:

1. What is the advantage of segmentation?
   In the context of microprocessors, segmentation refers to a technique used to **divide the program's memory space into smaller, more manageable sections**. This technique offers several advantages:

i) Improved Memory Management: By dividing memory into segments, the microprocessor can track and protect different parts of the program more effectively. This prevents one program section from accidentally overwriting another, enhancing program stability and security.

ii) Increased Efficiency: Segmentation allows the microprocessor to translate logical addresses (used by the program) to physical addresses (used by memory) more efficiently. This is because the segment table helps map logical segment addresses to physical memory locations, reducing the number of memory accesses needed.

2. Explain the significance of REP Prefix

   The REP (Repeat) prefix is an x86 instruction prefix that is used to repeat certain string and memory operations. It plays a crucial role in repetitive operations where the same operation needs to be performed multiple times on a sequence of data. The significance of the REP prefix lies in its ability to simplify and optimize repetitive string operations in x86 assembly language.

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4. ARRANGING NUMBER IN ASCENDING / DESCENDING ORDER.

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 4– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	Practical Skill & Applied Knowledge (2)	Output (3)	Postlab (3)	Total (10)	Sign

2. Aim & Objective of Experiment

Arrange the given numbers in Ascending/ Descending order.

Objective : Program involves sorting an array in ascending order using Bubble sort algorithm. The objective of this program is to give an overview of the Compare and Jump instructions. Use of Indirect Addressing mode for array addressing is expected

3. Software Required

TASM Assembler

Prepared by : Prof. Heenakausar Pendhari

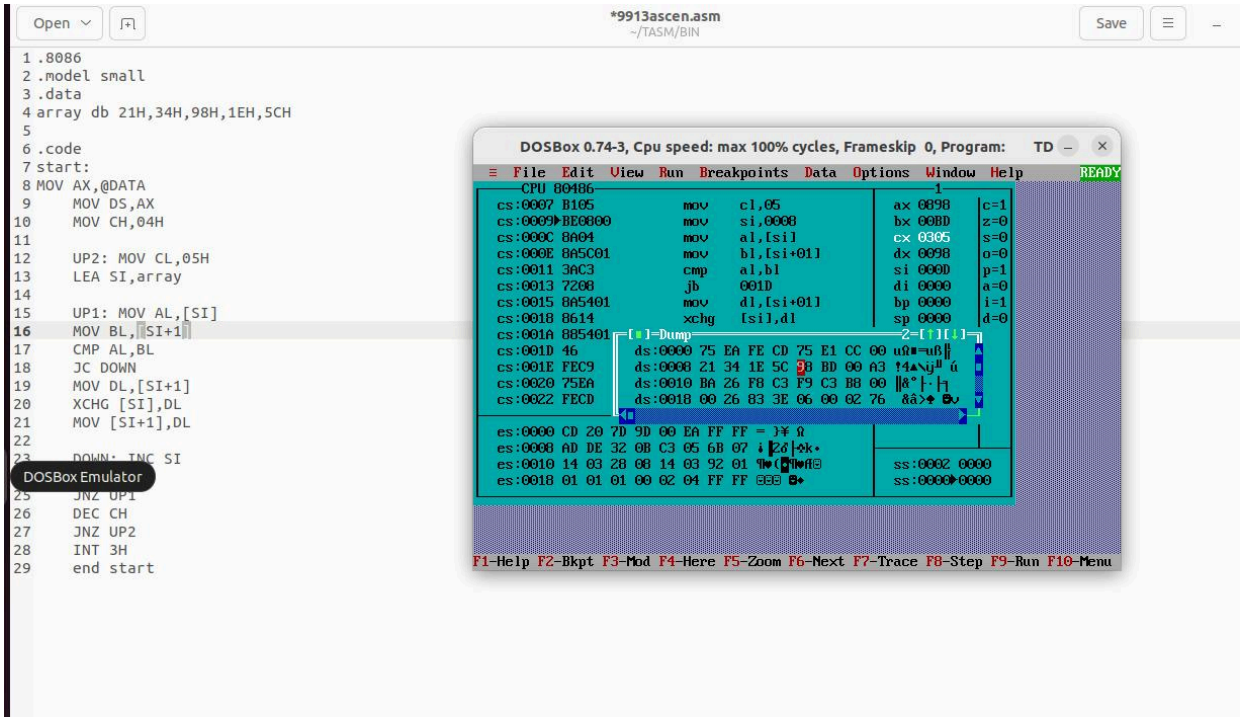
4 . Brief Theoretical Description

Pre-Requisites: 1. Knowledge of TASM directories.
2. Knowledge of CMP and Jump Instructions of 8086.

5. Algorithm:

1. Initialize the data segment.
2. Initialize the array to be sorted.
3. Store the count of numbers in a register.
4. Store count-1 in another register.
5. Load the effective address of array in any general purpose register.
6. Load the first element of the array in a register.
7. Compare with the next element of the array.
8. Check for carry flag.
9. If carry=0 first number > second number. Swap the 2 numbers.
10. Increment to the contents of the SI register so that it points to the next element of the array.
11. Decrement (count-1) by 1.
12. Check if (count-1) =0. If no then repeat steps 7 to 11.
13. Decrement count by 1.
14. Check if count = 0.If no then repeat steps 6 through
    Stop.

6. Conclusion:



Postlab:

1. **Compare JMP and CMP instruction**

JMP and CMP are both assembly language instructions used in various processor architectures, but they serve different purposes:

JMP (Jump):

- Function: Performs an unconditional jump to a specific memory address.expand_more
- Effect: Transfers program execution control to the instruction located at the specified address.expand_more
- No comparison involved: JMP doesn't perform any comparison; it simply jumps regardless of the processor's state.exclamation

Prepared by : Prof. Heenakausar Pendhari

- Example: `JMP 0x1000` would jump to the instruction located at memory address 0x1000.

CMP (Compare):

- Function: Compares two operands (values).
- Effect: Does not modify the operands themselves.expand_more Instead, it sets the flags register in the processor based on the comparison result (equal, greater than, less than, etc.).expand_more
- Used for conditional execution: The CMP instruction is usually followed by a conditional jump instruction (e.g., JE - jump if equal, JNE - jump if not equal, etc.) to alter program flow based on the comparison outcome.expand_more
- Example: `CMP register1, register2` would compare the values in register1 and register2, setting the flags register accordingly.expand_more You might then follow this with `JE label` to jump to a specific label (`label`) if the values were equal.

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5.TO COUNT EVEN AND ODD NUMBERS FROM AN ARRAY OF 10 NUMBERS.

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 5– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timelin e (2)	**Practical Skill & Applied Knowledge (2)**	**Output (3)**	**Postlab (3)**	**Total (10)**	**Sign**

2. Aim & Objective of Experiment

Arrange the given numbers in Ascending/ Descending order.

Objective : Program involves counting even and odd numbers from a given array. The objective of this program is to give an overview of the string instructions of 8086

3. Software Required

TASM Assembler

4 . Brief Theoretical Description

Pre-Requisites: 1. Knowledge of TASM directories.
2. Knowledge of CMP and Jump Instructions of 8086.

Theory: A string is a series of bytes stored sequentially in the memory. string
Instruction operates on such 'strings'. The SRC element is taken from the data segment using and SI register. The destination element is in extra segment pointed by DI register. These registers are incremented or decremented after each operation depending upon the direction flag in flag register.
Some of the instructions useful for program are,

1) CLC - the instruction clears the carry flag.
2) RCR destination, count- Right shifts the bits of destination. LSB is shifted into CF. CF goes to MSB. Bits Are shifted counts no of times.
3) JC: jump to specified location.
4) INC/DEC destination: add/subtract 1 from the specified destination.
5) JMP label: The control is shifted to an instruction to which label is attached.
6) JNZ label: The control is shifted to an instruction to which label is attached if ZF = 0

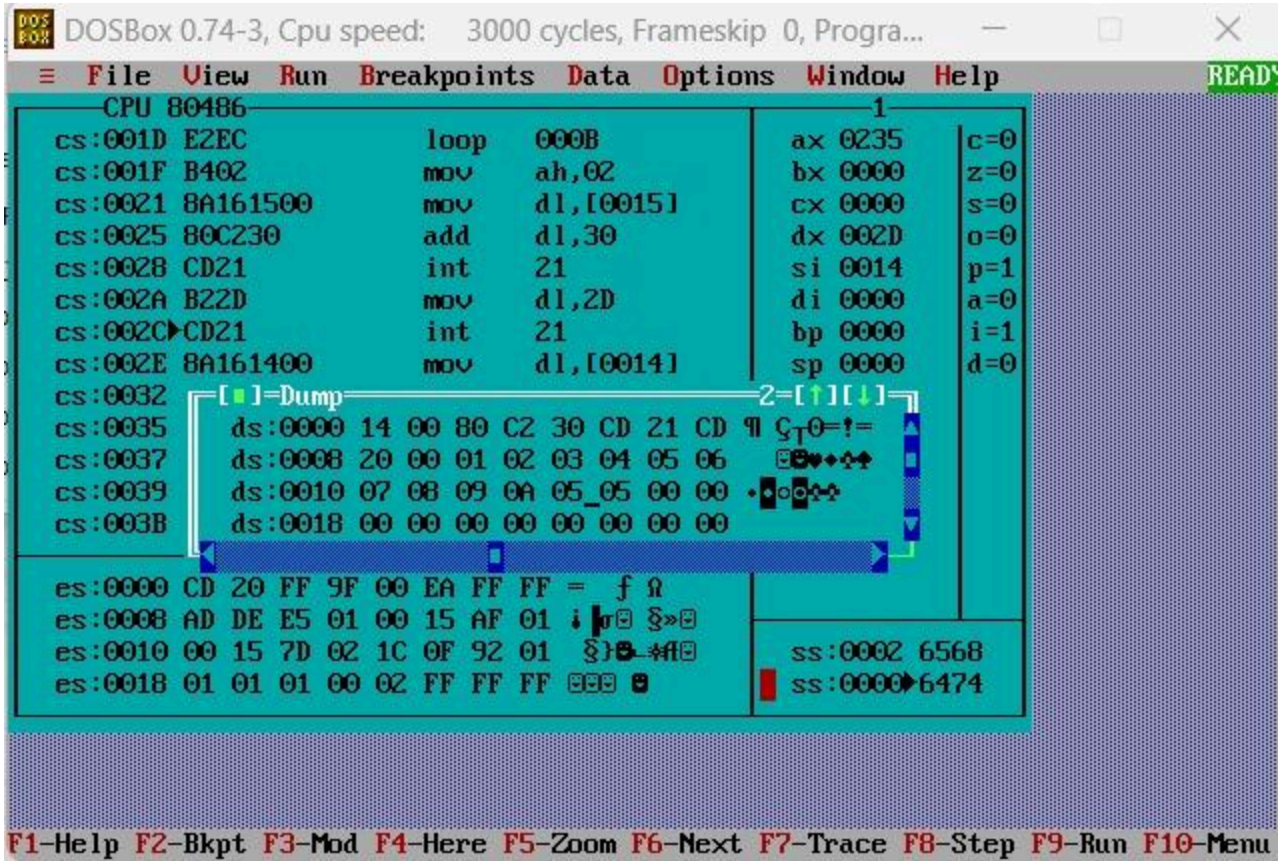
5. Algorithm:

1. . Initialize the data segment.
2. Initialize the array.
3. Load the effective address of an array in any index register.
4. Load total number of elements of the array in any register.
5. Initialize any two registers as counter for even and odd numbers to zero.
6. Load first element of an array in any general purpose register.
7. Shift/rotate the contents of loaded register to right.
8. If CF=1 increment counter for odd numbers otherwise increment counter of even numbers.
9. Store the value of even and odd counter register to two memory locations.
10. Stop.

6. Conclusion:

evodd.asm

```
.model small

.data
    array db 01H, 02H, 03H, 04H, 05H, 06H, 07H, 08H, 09H, 0AH
    odd_no db 0
    even_no db 0

.code
start:
    MOV AX, @data
    MOV DS, AX

    LEA SI, array
    MOV CX, 000AH

check:
    MOV AL, [SI]

    TEST AL, 1
    JNZ odd

    INC even_no
    JMP next

odd:
    INC odd_no

next:
    INC SI
    LOOP check

    MOV AH, 02H
    MOV DL, [even_no]
    ADD DL, 30H
    INT 21H

    MOV DL, '-'
    INT 21H

    MOV DL, [odd_no]
    ADD DL, 30H
    INT 21H

    INT 20H
end start
```



7. **Postlab:**

1. **Explain CMPSB/CMPSW , LODS/STOS instructions**

CMPSB (Compare String Byte)

- Purpose: Compare the byte at the current position in one string with the byte at the same position in another string.
- Example Use: Compare characters in two strings.

CMPSW (Compare String Word)

- Purpose: Similar to CMPSB, but compares two words (16 bits) instead of bytes.
- Example Use: Compare 16-bit values in two strings.

LODS (Load String)

- Purpose: Load a byte or a word from the memory into a register (AL or AX) and advance the source index (SI).
- Example Use: Retrieve a character or value from a string.

STOS (Store String)

- Purpose: Store a byte or a word from a register (AL or AX) into the memory at the destination index (DI) and advance DI.
- Example Use: Put a character or value into a string.

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6. Matrix Addition/ Multiplication.

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 6– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline **(2)**	**Practical Skill & Applied Knowledge (2)**	**Output** **(3)**	**Postlab** **(3)**	**Total (10)**	**Sign**

2. Aim & Objective of Experiment

Perform Addition & Multiplication of 3 X 3 Matrix

Objective : The objective is to Add & multiply 3 X 3 matrix

3. Software Required

TASM Assembler

Prepared by : Prof. Heenakausar Pendhari

4 . Brief Theoretical Description

Pre-Requisites: 1. Knowledge of TASM directives.
2. Knowledge of DOS interrupts.
3. Knowledge of string instruction and MACRO

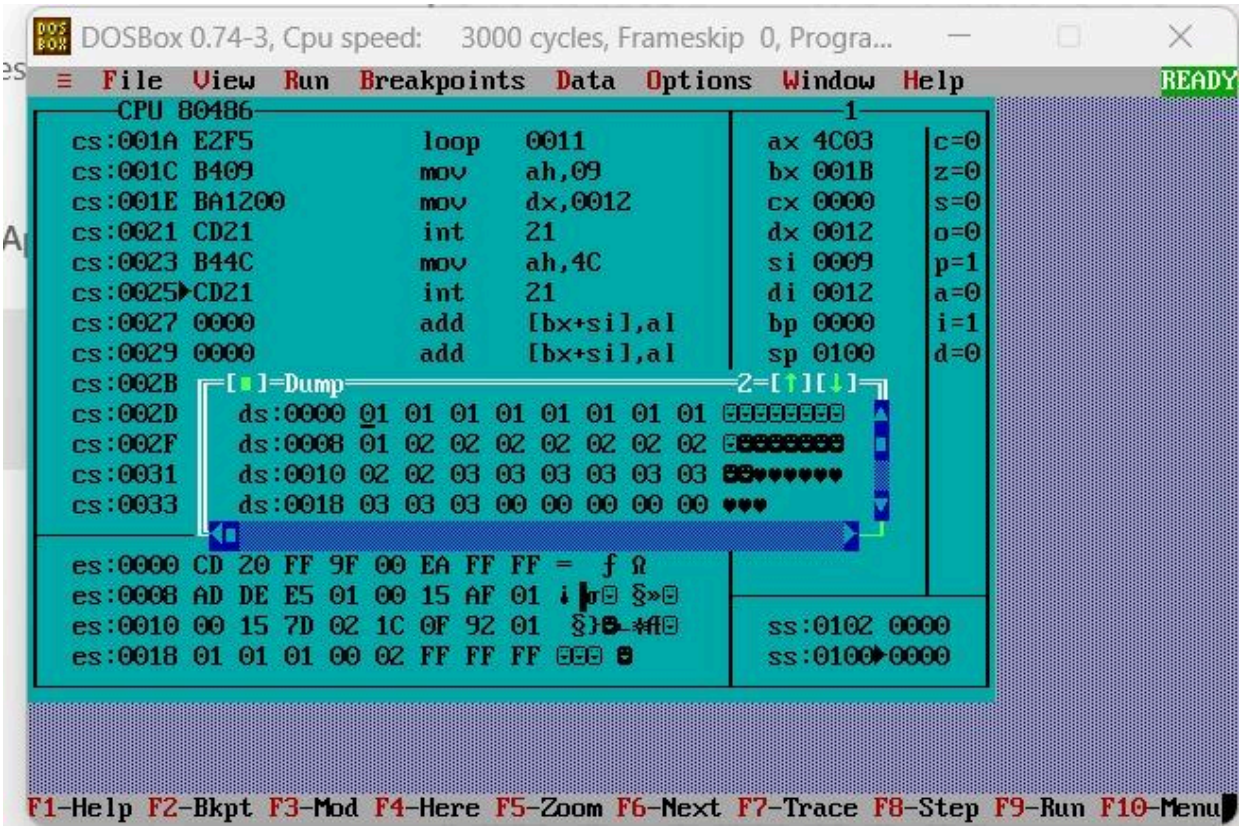
5. Algorithm:

1. Initialize the data segment.
2.Initialize counter = 9
3. Initialize pointer DI to matrix 1.
4. Initialize pointer BX to matrix 2.
5. Initialize pointer SI to result matrix 3.
6. Get the number from matrix 1.
7. Add number from matrix 1 with matrix 2 number.
8. Save the carry if any.
9. Save the result in result matrix 3.
10. Increment DI, BX, and SI to point to next element.
11. Decrement count.
12.Check if count = 0,if not go to step VI else go to step XIII
13. Display the result.
14. Stop.

Matrix addition:-

matadd.asm

```
.model small
.stack 100h

.data
matrix1 db 1, 1, 1, 1, 1, 1, 1, 1, 1
matrix2 db 2, 2, 2, 2, 2, 2, 2, 2, 2
result_add db 0, 0, 0, 0, 0, 0, 0, 0, 0

.code
start:
    mov ax, @data
    mov ds, ax

    mov cx, 9 ; Number of elements in the matrices (3x3)

    lea si, matrix1
    lea di, matrix2
    lea bx, result_add

    addition_loop:
        mov al, [si]
        add al, [di]
        mov [bx], al

        inc si
        inc di
        inc bx

        loop addition_loop

    mov ah, 09h
    lea dx, result_add
    int 21h

    mov ah, 4ch
    int 21h

end start
```

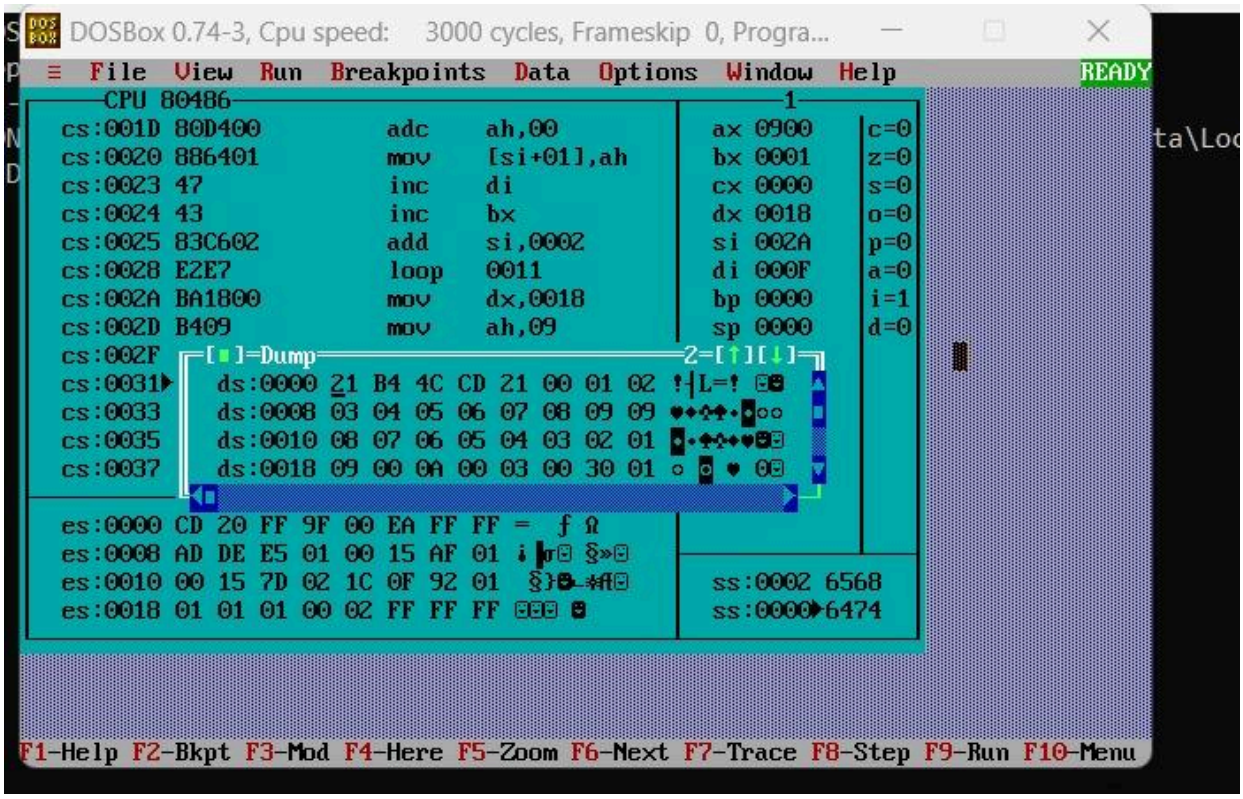


Postlab:

1. **Write a program to Multiply 3 X 3 Matrix.**

matmul.asm

```
.model small
.data
matrix1 db 1, 2, 3, 4, 5, 6, 7, 8, 9
matrix2 db 9, 8, 7, 6, 5, 4, 3, 2, 1
result_mult db 9 dup(?)

.code
start:
    mov ax, @data
    mov ds, ax

    mov di, offset matrix1
    mov cx, 9
    mov bx, offset matrix2
    mov si, offset result_mult

multiplication_loop:
    mov al, [di]
    mov ah, 0
    mov bl, [bx]
    mul bl
    add al, [si]
    mov [si], al
    adc ah, 0
    mov [si + 1], ah

    inc di
    inc bx
    add si, 2

    loop multiplication_loop

    mov dx, offset result_mult
    mov ah, 09h
    int 21h

    mov ah, 4Ch
    int 21h

end start
```



Prepared by : Prof. Heenakausar Pendhari

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7. DISPLAY A TO Z ON SCREEN.

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 7– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	Practical Skill & Applied Knowledge (2)	Output (3)	Postlab (3)	Total (10)	Sign

2. Aim & Objective of Experiment

7(A) DISPLAY A TO Z ON SCREEN

Objective : To store A to Z Alphabets on an array and display them on user screen.

3. Software Required

TASM Assembler

4 . Brief Theoretical Description

Pre-Requisites: 1. Knowledge of TASM directives.
2. Knowledge of DOS interrupts.
3. Knowledge of string instruction and MACRO

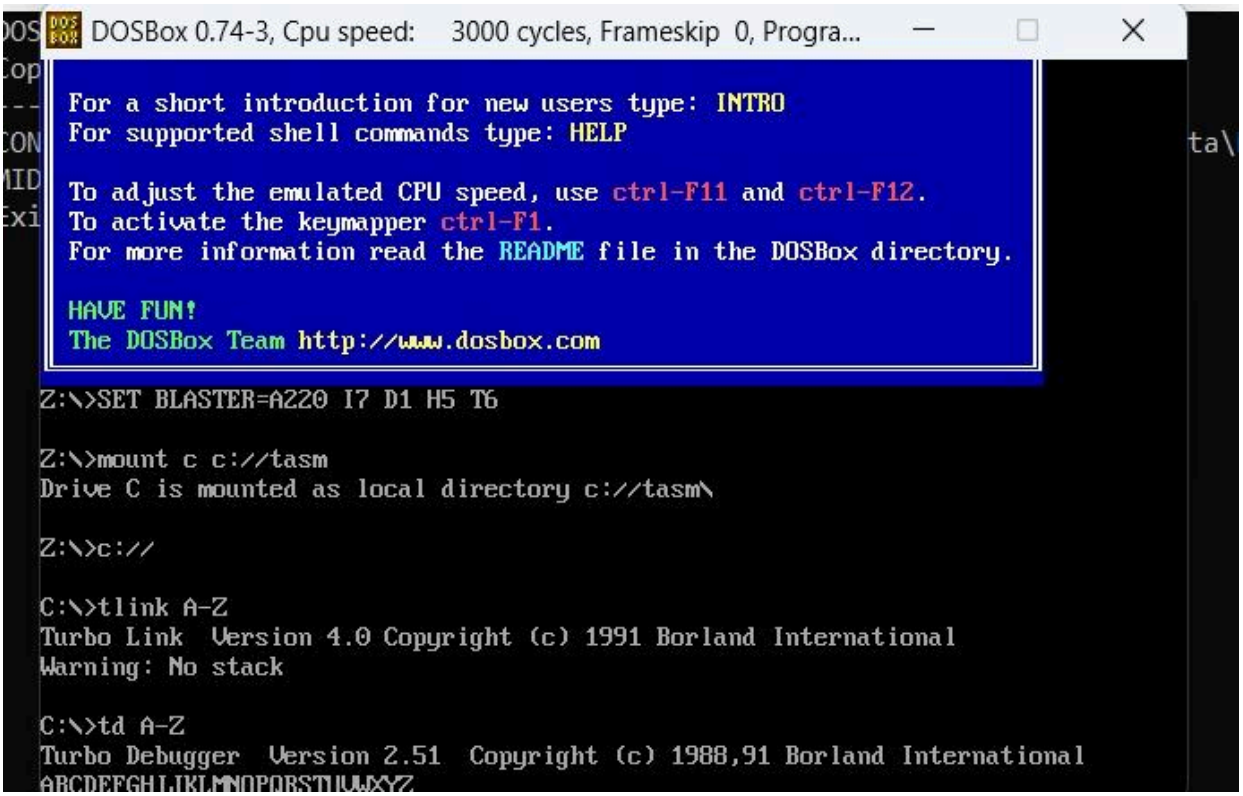
5. Algorithm:

1. Initialize the data segment.
2. Store all Alphabets in array.
3. Initialize counter to 1AH.
4. Load starting Address of array in to SI.
5. Get each character in DL.
6. Display Character on user screen.
7. Increment SI.
8. Decrement counter.
9. Repeat step 5 to 8 until count becomes Zero.
10. Stop

32mul.asm | matadd.asm | MATADD.OBJ | matmul.asm | A-Z.

A-Z.asm

```
1   .model small
2   .data
3
4   .code
5   start:
6       MOV AX, @data
7       MOV DS, AX
8
9       MOV CX, 26   ; Number of characters from 'A' to 'Z'
10      MOV DL, 'A'  ; Start with 'A'
11
12  display_loop:
13      MOV AH, 02H   ; Function to display character
14      INT 21H
15
16      INC DL        ; Move to the next character
17      LOOP display_loop
18
19      INT 20H       ; Exit the program
20
21  end start
22
```



7(B)

DISPLAY CHARACTER FROM KEYBOARD UNTIL 0 IS ENTERED.

Objective: To Read Character from Keyboard and display on screen until 0 is pressed.

Theory: Instructions used in program are:

MOV AH,08H
INT 21H
Read Input From Keyboard without echo and store at AL.
MOV AH,02H
INT 21H
Display Character on screen. Character should be in DL register.

Algorithm:

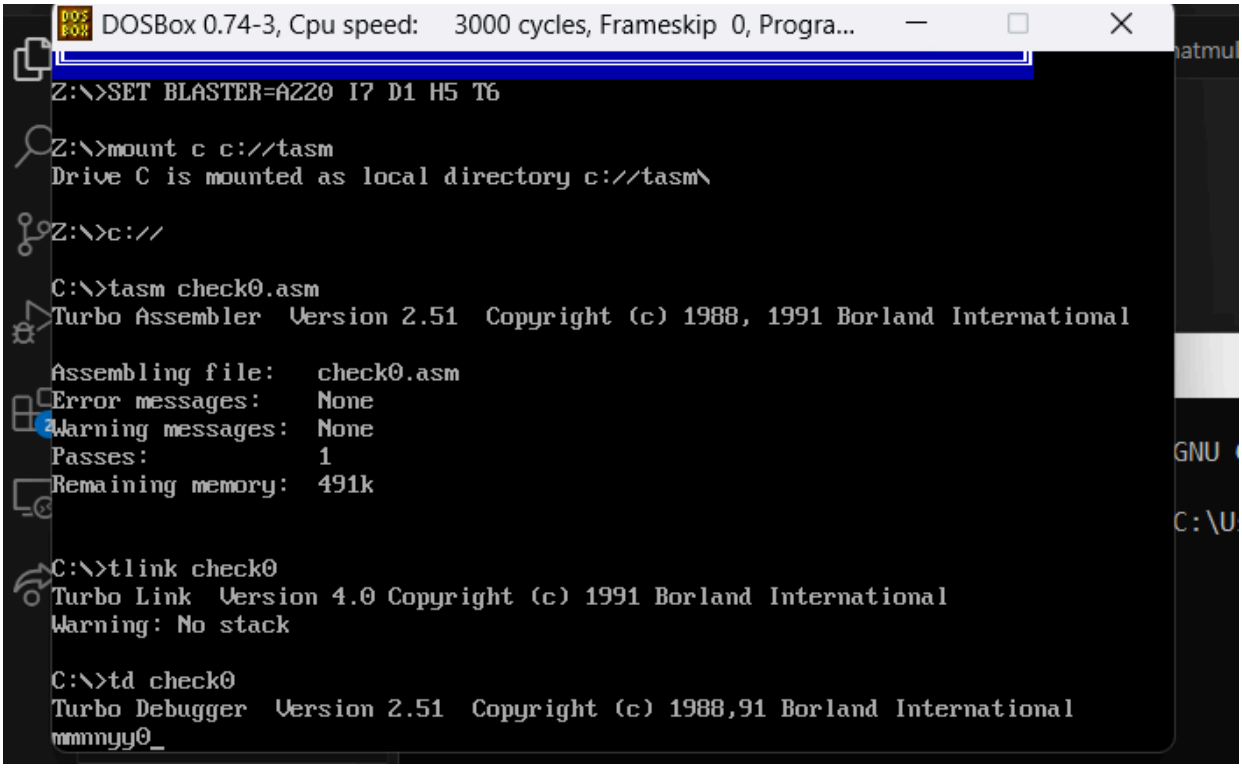
1. Initialize the data segment.
2. Read input from keyboard.
3. Compare input with ASCII value of ZERO.
4. If result is 0, go to step 7.
5. Move content of AL to DL, to display it on screen.
6. Display character on screen.
7. Stop

32mul.asm | matadd.asm | MATADD.OBJ | matmul.asm | A-Z.asm

check0.asm

```
.8086
.model small
.data

.code
start:
    MOV AX, @data
    MOV DS, AX

read_loop:
    MOV AH, 01H   ; Function to read a character from the keyboard
    INT 21H

    CMP AL, '0'   ; Check if the entered character is '0'
    JE end_program ; If '0', jump to end_program

    MOV DL, AL
    MOV AH, 02H   ; Function to display character
    INT 21H

    JMP read_loop ; Repeat the loop to read more characters

end_program:
    MOV AH, 4CH   ; Terminate program
    INT 21H

end start
```

Prepared by : Prof. Heenakausar Pendhari


DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Progra...
Z:\>SET BLASTER=A220 I7 D1 H5 T6
Z:\>mount c c://tasm
Drive C is mounted as local directory c://tasm\
Z:\>c://
C:\>tasm check0.asm
Turbo Assembler Version 2.51 Copyright (c) 1988, 1991 Borland International
Assembling file: check0.asm
Error messages: None
Warning messages: None
Passes: 1
Remaining memory: 491k
C:\>tlink check0
Turbo Link Version 4.0 Copyright (c) 1991 Borland International
Warning: No stack
C:\>td check0
Turbo Debugger Version 2.51 Copyright (c) 1988,91 Borland International
mmmyy0_

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8. PASSWORD VERIFICATION.

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 8– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	**Practical Skill & Applied Knowledge (2)**	**Output (3)**	**Postlab (3)**	**Total (10)**	**Sign**

2. Aim & Objective of Experiment

PASSWORD VERIFICATION

Objective : The objective is to make use of string instruction and MACRO, to check whether the entered password by the user is correct or not..

3. Software Required

TASM Assembler

Prepared by : Prof. Heenakausar Pendhari

4 . Brief Theoretical Description

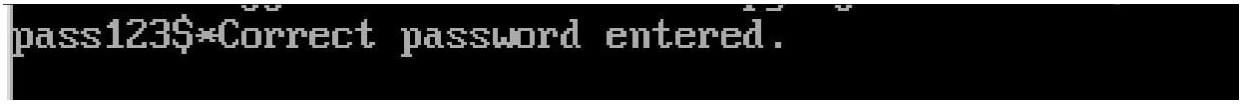
Pre-Requisites: 1. Knowledge of TASM directives.
2. Knowledge of DOS interrupts.
3. Knowledge of string instruction and MACRO

5. Algorithm:

1. Store Initial password into Array.
2. Write Macro for printing output message.
3. Write Macro to display '*'.
4. Initialize the data segment.
5. Set the counter value=no. of character present in password.
6. Load Effective address of stored password in BX.
7. Take input from the keyboard.
8. Compare input with the password string.
9. If zero=0, both value are equal. Go to step 10.
.If zero is not equal to 0.Go to step 15.
10. display '*' Macro.
11. Increment BX.
12. Decrement counter by 1.
13. Check if counter=0.If not, Repeat step 7 to 12.
14. Display Macro message for correct password, Go to step 16.
15. Display '*' macro and Macro message for wrong password.
16. End

pass.asm

```
.8086
.model small

.data
    password db 'pass123$'
    user     db 8 dup ('$')
    msg_right db 'Correct password entered.$'
    msg_wrong db 'Wrong password entered.$'
    input_buffer db 8 dup ('$')

.code
print_star MACRO
    MOV DL, '*'
    MOV AH, 02H
    INT 21H
ENDM

print_msg MACRO msg
    MOV AH, 09H
    LEA DX, msg
    INT 21H
ENDM

start:
    MOV AX, @data
    MOV DS, AX
    MOV ES, AX

    MOV CX, 8H
    LEA BX, password
    LEA DI, user

input_loop:
    MOV AH, 01H
    INT 21H
    MOV [DI], AL
    INC DI
    MOV DL, AL
    MOV AH, 02H
    INT 21H
    DEC CX
    JNZ input_loop

check_password:
    LEA SI, user
    LEA DI, password
    MOV CX, 8H
    cld
    repe cmpsb
    jz correct_password
    jmp wrong_password

correct_password:
    print_star
    print_msg msg_right
    jmp end_program

wrong_password:
    print_star
    print_msg msg_wrong
    jmp end_program

end_program:
    int 20H

end start
```


pass123$*Correct password entered.

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9. TO CHECK IF THE ENTERED STRING IS PALINDROME OR NOT

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 9– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**2**	**Chapter Title**	**Instruction Set and Programming**
Experiment Type	**Software**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	Practical Skill & Applied Knowledge (2)	Output (3)	Postlab (3)	Total (10)	Sign

2. Aim & Objective of Experiment

CHECK IF THE ENTERED STRING IS PALINDROME OR NOT

Objective : Read a string from user and check whether it is palindrome or not and display appropriate message.

3. Software Required

TASM Assembler

4 . Brief Theoretical Description

Pre-Requisites: 1. Knowledge of TASM directives.
2. Knowledge of DOS interrupts.
3. Knowledge of string instruction and MACRO

String instruction/ data transfer

a) LEA register, Source - Loads effective address (offset Address) of source in given register.
e.g. LEA BX, Total;

b) STOSB/STOSW (Store string) – It is used to store AL (or AX) into a memory location pointed by ES:DI. DI is incremented or decremented after transfer depending upon DF.

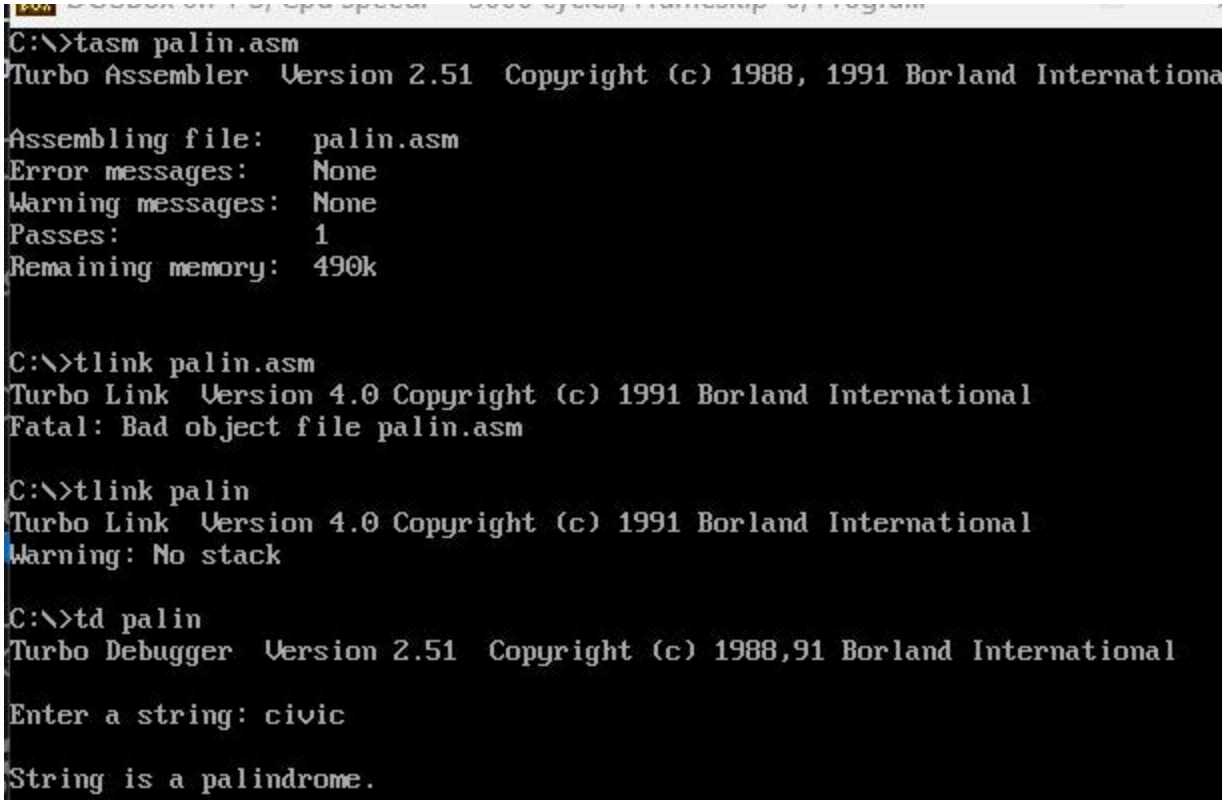
c) LODSB/LODSW: Used to copy the contents of memory location pointed by DS: SI and store it in AL registers. SI is incremented /decremented after transfer depending upon DF.

5. Algorithm:

1. Start.
2. Initialize Data segment (DS).
3. Initialize Extra segment (ES).
4. Ask user to enter a string.
5. Read each character of a string using function value 01h or 08h.
6. Store individual character read in a string S.
7. Make SI register point to first element of a string and DI resister to point to last element of a string.
8. Initialize count register to number of comparisons required.
9. Move contents pointed by SI to AL.
10. Compare character in AL with character pointed by DI.
11. If there is a mismatch (ZF=0) display a message “Not a palindrome” and stop.
12. If two characters are matching then increment SI, decrement DI, decrement count register.
13. If count register becomes zero display a message “String is palindrome” and stop.

palin.asm

```
.8086
.model small

print macro msg
    push ax
    mov ah, 09h
    lea dx, msg
    int 21h
    pop ax
endm

.data
    get db 10,13, "Enter a string: $"
    yes db 10,13, "String is a palindrome.$"
    no db 10,13, "String is not a palindrome.$"

    inp db 20 dup(' ')
    rev db 20 dup(' ')

.code
start:
    mov ax, @data
    mov ds, ax
    mov es, ax

    lea si, inp
    lea di, rev
    mov cx, 0000h

    print get

back:
    mov ah, 01h
    int 21h

    cmp al, 13
    jz next

    mov [si], al
    inc si
    inc cx
    jmp back

next:
    mov bl, cl

back1:
    dec si
    mov al, [si]
    mov [di], al
    inc di
    loop back1

    mov cl, bl

    lea si, inp
    lea di, rev

    repe cmpsb

    jz next1

    print no
    jmp exit

next1:
    print yes

exit:
    mov ah, 4ch
    int 21h

end start

```



Postlab:

Q1. Give the difference between Macro and procedure.

Macros:

- Execution: Occurs at assembly time, providing a form of text replacement.
- Parameterization: Highly flexible, allows passing parameters for reuse.
- Scope: Local to the source file where they are defined.
- Usage: Primarily for code expansion, especially for repetitive or boilerplate code.

Procedures:

- Execution: Occurs at runtime with a function call and return.
- Parameterization: Also supports parameter passing, but in a more structured manner.
- Scope: Can be global, allowing use across multiple files.
- Usage: Primarily for organizing code into reusable and modular functions or subroutines.

Q2.How many bytes are pushed onto the stack by a far CALL instruction? What do they represent?

A far CALL instruction in x86 assembly language pushes either 2 or 4 bytes onto the stack, depending on whether it uses a near or far addressing mode. These bytes represent the return address for control to resume after the called subroutine or function completes.

Near Addressing Mode:

- If a near address is used in the far 'CALL' instruction, the return address pushed onto the stack is the offset of the instruction following the 'CALL'.
- In this case, 2 bytes are pushed onto the stack.

Far Addressing Mode:

- If a far address is used in the far 'CALL' instruction, the return address pushed onto the stack consists of two parts:
    - The offset of the instruction following the 'CAll' (2 bytes).
    - The segment of the instruction following the 'CALL' (2 bytes).
- In this case, 4 bytes are pushed onto the stack.

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lab 10

1. Course, Subject & Experiment Details

Academic Year	**2023-24**	**Estimated Time**	**Experiment No. 1– 02 Hours**
Course & Semester	**S.E. (Comps) – Sem. IV**	**Subject Name**	**Microprocessor**
Chapter No.	**-**	**Chapter Title**	**-**
Experiment Type	**Software& Hardware**	**Subject Code**	**CSC405**

Rubrics

Timeline (2)	**Practical Skill & Applied Knowledge (2)**	**Output (3)**	**Postlab (3)**	**Total (10)**	**Sign**

Dynalog India Ltd.
Dyna-86>R
AX=0000 BX=0000 CX=0000 DX=0000 SP=06FF BP=0000 SI=0000
DI=0000 CS=0000 DS=0000 SS=0000 ES=0000 IP=0700 FL=0000
Dyna-86>AX. . . .

0000:1011
Dyna-86>A 1000

0000:1000

Dyna-86>
Dyna-86>A 1000
0000:1000 MOV AX, 55
0000:1003 MOV BX,55

```
0000:1006 ADD AX, BX
0000:1008 INT 3
0000:1009
Dyna-86>G 1000

Break at FFFF:1009
Dyna-86>R
AX=00AA BX=0055 CX=0000 DX=0000 SP=06FD BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1009 FL=F006 Dyna-
86>A 1000
0000:1000 MOV AX,F0

0000:1003
Dyna-86>A 1000
0000:1000  MOV AX,F0\. .

0000:1003
Dyna-86>A 1000
0000:1000  MOV AX,F0
0000:1003  MOV BX,AA
0000:1006  SUB AX,BX
0000:1008 INT 3
0000:1009
Dyna-86>G1000

Break at FFFF:1009
Dyna-86>R
AX=0046 BX=00AA CX=0000 DX=0000 SP=06FB BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1009 FL=F012 Dyna-
86>A 1000
0000:1000  MOV AX,02
0000:1003  MOV BX,05
0000:1006 MUL BX
0000:1008 INT 3
0000:1009
Dyna-86>G 1000

Break at FFFF:1009
Dyna-86>
Dyna-86>R
AX=000A BX=0005 CX=0000 DX=0000 SP=06F9 BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1009 FL=F046
Dyna-86>A 1200
0000:1200  MOV AX,FE
0000:1203  MOV BX,02
0000:1206 DIV BX
```

```
0000:1208 INT 03
0000:1209
Dyna-86>G1200

Break at FFFF:1209
Dyna-86>
Dyna-86>R
AX=007F BX=0002 CX=0000 DX=0000 SP=06F7 BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1209 FL=F047
Dyna-86>A 1000
0000:1000  MOV AX,0F
0000:1003  MOV BX,F0
0000:1006 OR AX,BX
0000:1008 INT 3
0000:1009
Dyna-86>G 1000

Break at FFFF:1009
Dyna-86>R
AX=00FF BX=00F0 CX=0000 DX=0000 SP=06F5 BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1009 FL=F006
Dyna-86>A 1000
0000:1000 MOC. .V A
Error ! Invalid operand or Addressing mode
0000:1000
Dyna-86>A 1000
0000:1000  MOV AX,55
0000:1003  MOV BX,AA
0000:1006  AND AX,BX
0000:1008 INT 3
0000:1009
Dyna-86>G1000

Break at FFFF:1009
Dyna-86>R
AX=0000 BX=00AA CX=0000 DX=0000 SP=06F3 BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1009 FL=F046
Dyna-86>A1. .
0000:1009
Dyna-86>A 1000
0000:1000  MOV AX, 03
0000:1003  MOV BX,05
0000:1006  XOR AX,BX
0000:1008 INT 3
0000:1009
Dyna-86>G 1000
```

```
Break at FFFF:1009
Dyna-86>R
AX=0006 BX=0005 CX=0000 DX=0000 SP=06F1 BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1009 FL=F006
Dyna-86>
Dyna-86>
Dyna-86>A 1000
0000:1000 MOV AX,55
0000:1003 NOT AX
0000:1005 INT 03
0000:1006
Dyna-86>G 1000

Break at FFFF:1006
Dyna-86>R
AX=FFAA  BX=0005  CX=0000  DX=0000  SP=06EF  BP=0000  SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=1006 FL=F006 Dyna-
86>A 1000
0000:1000  MOV AX, FF
0000:1003  MOV BX, 00
0000:1006  INC BX
0000:1007  DEC AX
0000:1008  JNZ 1006
0000:100A INT 3
0000:100B
Dyna-86>G 1000

Break at FFFF:100B
Dyna-86>R
AX=0000 BX=00FF CX=0000 DX=0000 SP=06ED BP=0000 SI=0000
DI=0000 CS=FFFF DS=0000 SS=0000 ES=0000 IP=100B FL=F046
Dyna-86>A 1000
0000:1000  MOV AX,80
0000:1003  OUT 33,AX
0000:1005  MOV AX,55
0000:1008  OUT 30,AX
0000:100A MOV AX,AA
0000:100D  OUT 31,AX
0000:100F  MOV AX,0F
0000:1012  OUT 32,AX
0000:1014 INT 3

0000:1015
Dyna-86>G 1000
```

```
Break at FFFF:1015
Dyna-86>A 1000
0000:1000 MOV AX,80

0000:1003
Dyna-86>A 1000
0000:1000  MOV AX,80
0000:1003  OUT 33,AX
0000:1005
Dyna-86>
Dyna-86>A 1000
0000:1000  MOV AX,80
0000:1003  OUT 33,AX
0000:1005  MOV AX,57
0000:1008  OUT 30,AX
0000:100A MOV AX,BB
0000:100D OUT 31,AX

0000:100F
Dyna-86>A 1000
0000:1000  MOV AX,80
0000:1003  OUT 33,AX
0000:1005  MOV AX,56
0000:1008  OUT 30,AX
0000:100A  MOV AX,1C
0000:100D  OUT 31,AX
0000:100F  MOV AX,FF
0000:1012  OUT 32,AX
0000:1014 INT 3
0000:1015
Dyna-86>G1000

Break at FFFF:1015
Dyna-86>
```