Loops in 8086 Assembly Language

A loop in 8086 assembly is a programming construct that executes a sequence of instructions multiple times. The 8086 processor provides several methods to implement loops, with the most common being the LOOP instruction. The LOOP instruction depend on CX register as a counter. The loop instruction control transfer always up side where write specific label or paragraph name. In the 8086 processor, the CX register usually controls looping. The processor decreases the value of CX automatically each time the loop runs.

Syntax:

LOOP label_Name:

How it works:

1. CX is automatically used by loop instructions
2. Decrements CX by 1 automatically
3. If CX ≠ 0, jumps to the specified label or paragraph name
4. If CX = 0, continues to the next instruction
5. Maximum loop count: 65535 (FFFFH)

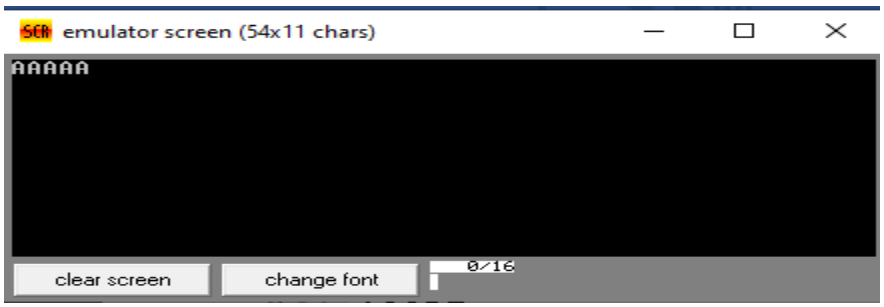
Example 1: Basic LOOP (Print A Character 5 times)

```
.MODEL SMALL
.STACK 100H
.DATA
.CODE
MAIN PROC

   MOV CX, 5              ; Set counter to 5

LOOP_START:
   MOV AH, 02h            ;  02h DOS function/service  for print  one  character to 'A'
   MOV DL,'A'
   INT 21H                ; Execute  02h function /service of Print one ASCII character
    LOOP LOOP_START       ; Decrement CX and loop if not zero

   MOV AH, 4CH            ; Exit program
   INT 21H
MAIN ENDP
```



Example 2: Basic LOOP (Print " Pakistan " String 8 times)

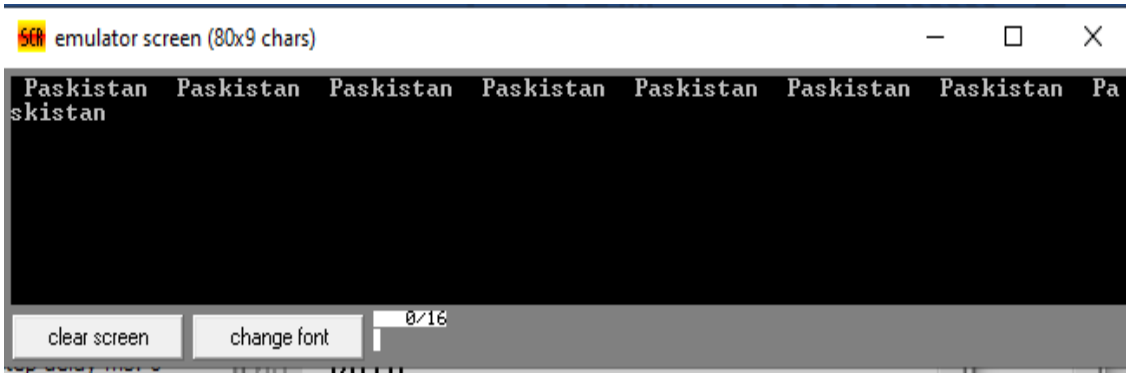
```
.MODEL SMALL
.STACK 100H
.DATA
        Text1  dw " Paskistan $ "

.CODE
MAIN PROC
   MOV AX, @DATA
   MOV DS, AX

  MOV CX, 8              ; Set counter to 8

Print_String:
   MOV AH, 9h             ; 09h  DOS function /service to print string
   MOV DX, offset Text1
   INT 21H                ;  Execute  09h dos function /service
     LOOP Print_String    ;  Decrement CX and loop if not zero

   MOV AH, 4CH            ; Exit program
   INT 21H
MAIN ENDP
END MAIN
```

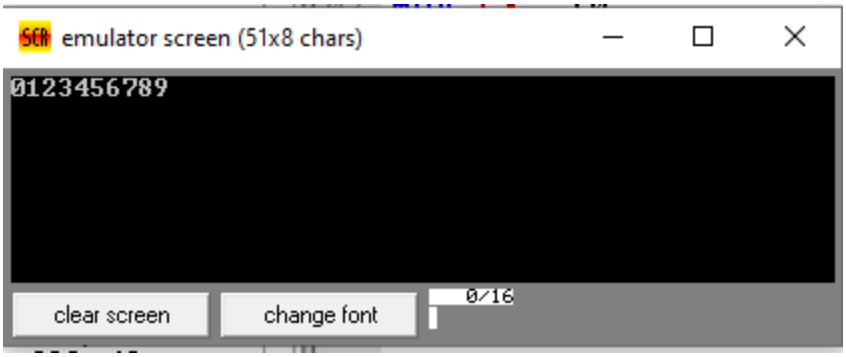


Example 3: Basic LOOP (Print Linear series from 0 to 9 numbers)

```
.MODEL SMALL
.STACK 100H
.DATA
.CODE
MAIN PROC

   MOV CX, 10            ; Set counter to 10
   MOV  BL,0
Linear_Series:
    MOV AH, 2h           ; 02h DOS function to print one character
    MOV DL,BL
    ADD DL,30H           ;  add 30h value in DL register.
    INT 21H              ; Execute 02h function /service of Print one ASCII character
    INC BL               ; Increment 1 by 1 in BL register
     LOOP Linear_Series  ; Decrement CX and loop if not zero

    MOV AH, 4CH          ; Exit program
    INT 21H
MAIN ENDP
```



Loop Instructions Family

The 8086 provides several loop instructions:

Instruction	Description	Condition
LOOP	Decrement CX and loop if CX ≠ 0	CX ≠ 0
LOOPE/LOOPZ	Loop if CX ≠ 0 and ZF = 1	CX ≠ 0 AND ZF = 1
LOOPNE/LOOPNZ	Loop if CX ≠ 0 and ZF = 0	CX ≠ 0 AND ZF = 0

Summary

1. Loops in 8086 assembly are fundamental for repetitive tasks:
2. LOOP instruction: Simple counter-based loops using CX
3. Conditional jumps: More flexible loop conditions
4. Nested loops: Require stack for counter preservation
5. Loop variants: LOOPE/LOOPNE for conditional looping
6. JCXZ: Efficient zero-check before entering loops

Understanding loops is crucial for array processing, string manipulation, and implementing algorithms in assembly language.

Unconditional jump

In the 8086 microprocessor, an unconditional jump is an instruction that always transfers program control to a specified anywhere target address, regardless of any conditions or flags. When this instruction executes, the Instruction Pointer (IP) and sometimes the Code Segment (CS) register are modified to point to the new location, and the CPU continues fetching and executing instructions from that address.

Syntax

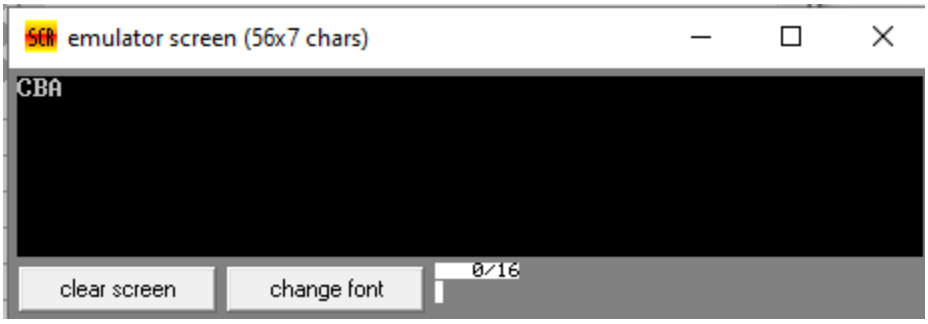
Jmp Label_Name/Pragraph_Name

Example

```
; Unconditional jump to flow of program control from one point to another point
.MODEL SMALL
.STACK 100H
.DATA
.CODE
MAIN PROC
            JMP DISPLAY_C:    ; flow of control program jump from here to DISPLAY_C
        DISPLAY_A:
            MOV AH,02H        ; 02h DOS function to print only  one character
            MOV DX,'A'
            INT 21H           ; Execute 02h function /service of Print one ASCII character

            INT 20H
        DISPLAY_B:
            MOV AH,02H        ; 02h DOS function to print one character
            MOV DX,'B'
            INT 21H           ; Execute 02h function /service of Print one ASCII character
              JMP DISPLAY_A   ; flow of control program jump from here to DISPLAY_A
        DISPLAY_C:
            MOV AH,02H        ; 02h DOS function to print one character
            MOV DX,'C'
            INT 21H           ; Execute 02h function /service of Print one ASCII character
               JMP DISPLAY_B  ; flow of control program jump from here to DISPLAY_B
MAIN ENDP

END MAIN
```



Types of Unconditional Jumps in 8086

1. Short Jump (Relative Jump)
   - Range: -128 to +127 bytes from the current instruction
   - Opcode: EB (for 8-bit displacement)
2. Near Jump (Intra-segment Jump)
   - Range: Within the same code segment (±32KB range)
   - Updates only: Instruction Pointer (IP)
   - Opcode: E9 (for 16-bit displacement)
3. Far Jump (Inter-segment Jump)
   - Range: To a different code segment
   - Updates both: CS and IP registers
   - Opcode: EA

Summery or Key Points

1. No condition checking: The jump is taken 100% of the time
2. Different ranges: Short (±128 bytes), Near (±32KB), Far (anywhere in memory)
3. IP and CS changes: Near jumps change only IP, Far jumps change both CS and IP
4. Unconditional jumps are used for:
5. Creating loops (combined with conditional jumps)
6. Implementing switch/case structures
7. Jumping to subroutines (though CALL is usually preferred)
8. Error handling and interrupt service routines

The unconditional jump is fundamental for altering program flow and creating non-sequential execution paths in assembly language programs.

Exercise

Theory Questions.

1. What is loop in computer programming perspectives?
2. How loop instruction work only explain.
3. Define unconditional jump.

Practical Questions.

1. Write assembly code to display odd and even series from 1 to 10 using loop instruction.

Objective and MCQs:

1. Which opcode of short jump.
   a) EA
   b) E9
   c) EB
   d) AB

2. Type of Near jumps change only _____register.
   a) DX
   b) CX
   c) IP
   d) AX

3. The processor decreases the value of from ____ register automatically each time the loop runs.
   4. BX
   5. AX
   6. DX
   7. CX

4. Type of Far jumps change _____ and _____register.
   5. AL , BL
   6. CS , BL
   7. CS, IP
   8. IP , DS

5. An unconditional jump is an instruction that always transfers program control to a specified target address.
   a) Always top
   b) Always bottom
   c) Anywhere
   d) Only top