Flow Control Instructions

Course Title: Computer Organization & Architecture

Dr. Nazib Abdun Nasir
Assistant Professor
CS, AIUB
nazib.nasir@aiub.edu

This lecture has not been taught yet and the slides are not finalized. It is highly recommended to go through all the slides as it contain important concept required for assembly programming and that will be useful in the MID final exam. Practice at home.

Lab Outline

1. Decision making and repeating statement
2. Level

Jump

- Jump instructions transfers control to another program
- The transfers can be unconditional or
- Depends on a particular combination of status flags settings

Unconditional Jump

- **Does not depend on any condition**
- **Syntax**
- Jump destination_level
- Example : jmp level1

Conditional Jump Conti…

- **Depends on a particular combination of status flags settings**

- **Syntax**
- Jump destination_level
- Example : **jnz** level1

Conditional Jump

- There are three types of conditional jumps
  - Signed Conditional Jumps
  - Unsigned Conditional Jumps
  - Single-Flag Jumps

Signed Conditional Jump

JG or JNLE	• Jump if Greater than • Jump if Not Less than or Equal to	ZF = 0 and SF = OF
JGE or JNL	• Jump if Greater than or Equal to • Jump if Not less than	SF = OF
JL or JNGE	• Jump if less than • Jump if not greater than or equal	SF<>OF
JLE or JNG	• Jump if less than or Equal • Jump if not greater than	ZF = 1 or SF<> OF

Unsigned Conditional Jump

JA or JNBE	• Jump if Above • Jump if Not Below or Equal to	ZF = 0 and CF = 0
JAE or JNB	• Jump if Above or Equal to • Jump if Not Below	CF = 0
JB or JNAE	• Jump if Below • Jump if not Above or Equal	CF = 1
JBE or JNA	• Jump if Below or Equal • Jump if Not Above	CF=1 or ZF = 1

Single-Flag Conditional Jump

JE or JZ	• Jump if Equal • Jump if equal to Zero	ZF = 1
JNE or JNZ	• Jump if Not Equal • Jump if Not Zero	ZF = 0

JC	• Jump if Carry	CF = 1
		CF = 0

JNC	• Jump if no Carry	CF=0
JO	• Jump if Overflow	CF=1 or ZF = 1
JNO	• Jump if No Overflow	OF=1
JS	Jump if Sign Negative	SF = 1
JNS	Jump if Non-Negative Sign	SF =0
JP/JPE	Jump if Parity Even	PF=1
JNP/JPO	Jump if parity Odd	PF=1

Label

- **Jump** instruction has a general format **jxx label** where **label** is a facility offered by the assembler

- **Labels are used with jump and loop statements to refer another instruction**

- Labels are needed to refer another instruction

Label

- These labels are converted by the assembler to exact address where the program is to continue.
  - Labels must start with a letter and can contain thereafter letters, numbers and underscores (_).
  - Spaces and punctuation marks are not permitted
  - Avoid using keywords in labels
  - Once_again, Next, Name34, this_37 are permitted as labels
  - 3rdday, tues+wed and semi;colons are not permitted as labels.

Label

Example

```
Jmp Exit


 Exit:
    Mov ah, 4ch
    Int 21h
```

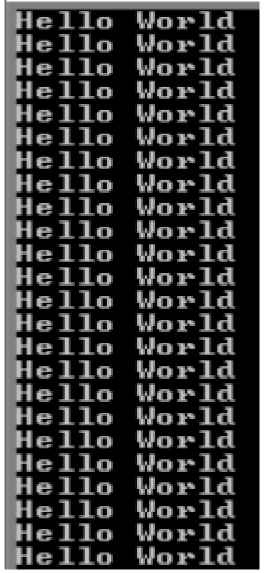
Lab Tasks

Task: 1

- Write an assembly program that non-stop prints Hello World.
  Hints: Use unconditional **jmp** and **label** instructions.

Sample Output

```
Hello world
Hello world
Hello world
Hello world
Hello world
Hello world
---------------
Hello world
```



```
Hello World
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```

```
name "EX-01"
org 100h

jmp start       ; jump over data declaration

msg:    db      "Hello, World!", 0Dh,0Ah, 24h
start:  mov     dx, msg  ; load offset of msg into dx.
        mov     ah, 09h  ; print function is 9.
        int     21h      ; do it!
jmp start
```

Lab Tasks

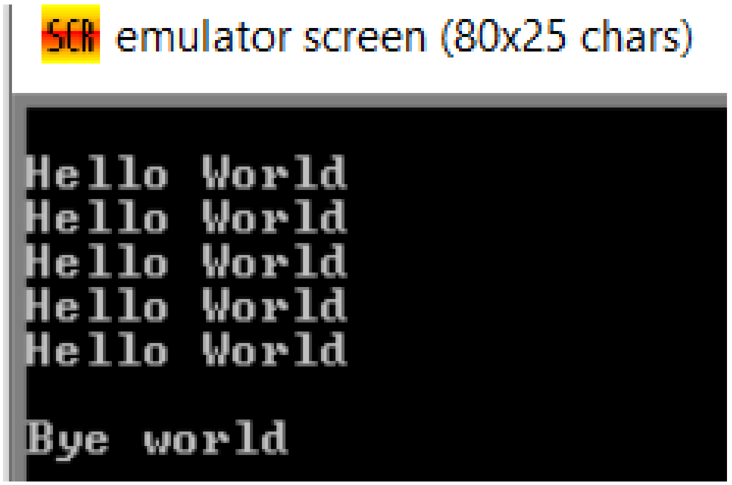
Task: 2

- Write an assembly program that prints Hello World five times and then prints Bye world. **Hints**: Use unconditional **CMP,** conditional **JE, JNE** instruction**.**

Sample Output

```
Hello world
Hello world
Hello world
Hello world
Hello world

Bye world
```



emulator screen (80x25 chars)

```
Hello World
Hello World
Hello World
Hello World
Hello World

Bye world
```

Lab Tasks

Task: 3

Read an integer from user. Check whether the number is positive or negative. Hints: **JMP, JL, JG** instructions

Sample output

```
Enter a number: 1
Positive

Enter a number: -1
Negative
```

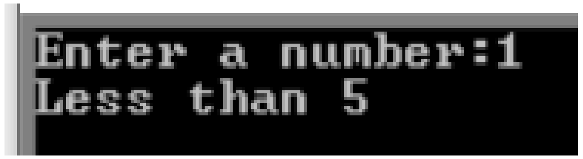
Lab Tasks

Task: 4

- Suppose that **CL** contains the value of **5**. Take an integer from user. Compare the value with **CL**. And show whether the user input is less than, greater than and equal to CL. **Hints:** use CMP, JL, JG, JE

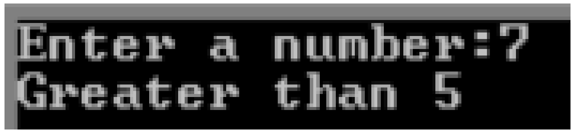
Sample output

Enter a number: 1
Less than 5



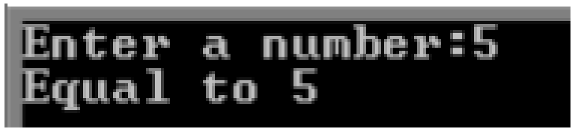
```
Enter a number:1
Less than 5
```

Enter a number: 7
Greater than 5



```
Enter a number:7
Greater than 5
```

Enter a number: 5
Equal to 5



```
Enter a number:5
Equal to 5
```

Lab Tasks

Task: 5

Write a program to check password using Assembly Programming.
Suppose the password is **mypassword**

Sample output

```
Enter your password: mypassword
Password Matched

Enter your password: password
Password Not Matched
```

Lab Tasks

Task: 6

Read a character and display it **50** times on the next line. **Hints**: use **DEC and JNZ** instructions and

Sample Output

```
Enter a character: d
ddddddddddddddddddddddddddddddddddddddddddddd
ddddd
```

Thank you.

Lab Tasks

Task: 7

Read two character and display it new line

Sample Output

```
AB
AB
```

Books

- Assembly Language Programing and Organization of the IBM PC

Ytha Yu
Charles Marut

References