**TUTORIAL 3 (Embedded Systems 60603)**

**Assembly Language Program**

1. State the purpose of the following tools:

(In Assembly for PIC)

i) Simulator  
a computer program that allows the user to observe an operation through simulation without actually performing that operation.

ii) Editor  
a computer program that serve the purpose of text editing for programming purpose, normally comes with autocomplete, code snippets, text highlighting, file management and more.

iii) Assembler  
a computer program that translates assembly to object file (.o) or machine language format

iv) Linker

a computer program that takes one or more object files generated by compiler and combines them into single executable file, library file or another object file

v) Compiler

computer software that transforms computer code written in one programming language (the source language) into another computer language (the target language).

1. Write an asm program to add the numbers stored in locations 31H, 45H, and 47H and store the result in location 22H. (Verify using PIC Simulator).

|  |
| --- |
| LOC1 EQU 0X31  LOC2 EQU 0X45  LOC3 EQU 0X47  RESULT EQU 0X22  MOVF LOC1, 0  ADDWF LOC2, 0  ADDWF LOC3, 0  MOVWF RESULT |

3. The addresses for each of the instructions of a program are shown in the table below. Simulate the program and record down the values of related registers at the end of each instruction. (Use PIC16 Simulator).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Address (ROM)** | **OP CODE** | **Assembly  instruction** | **WREG** | **10h** | **PC** |
|  |  | SUM EQU 0x10 |  |  |  |
| 00000 | 3025 | MOVLW 0x25 | 37 |  |  |
| 00001 | 3E34 | ADDLW 34 | 89 |  |  |
| 00002 | 3E11 | ADDLW 0x11 | 106 |  |  |
| 00003 | 3E12 | ADDLW D’18’ | 124 |  |  |
| 00004 | 3E1C | ADDLW 1Ch | 152 |  |  |
| 00005 | 3E06 | ADDLW b’00000110’ | 158 |  |  |
| 00006 | 0090 | MOVWF SUM | 158 | 158 |  |
| 00007 | 2807 | HERE GOTO HERE |  |  |  |

4. Write an assembly language program to swap 0x10 in location 0x31with 0x20 in location 0x11. and verify using PIC Simulator.

|  |
| --- |
| LOC1 EQU 0x31  LOC2 EQU 0x11  TEMP EQU 0x12  MOVLW 0x10  MOVWF LOC1  MOVLW 0x20  MOVWF LOC2  CLRW  MOVF LOC1, 0  MOVWF TEMP  MOVF LOC2, 0  MOVWF LOC1  MOVF TEMP, 0  MOVWF LOC2 |

5. Write assembly language programs to do the following operations without loop: (Write status register value)

1. 3 x 5

|  |  |
| --- | --- |
|  | WREG |
| MOVLW 0X05  ADDLW 0X05  ADDLW 0X05 | 5  10  15 |

1. 42 – 9 – 7

|  |  |  |
| --- | --- | --- |
|  | WREG | 0x20 |
| MOVLW 0X04  ADDLW 0X04  ADDLW 0X04  ADDLW 0X04  MOVWF 0X20  CLRW  MOVLW 0X09  SUBLW 0X20  MOVWF 0X20  CLRW  MOVLW 0X07  SUBLW 0X20 | 4  8  12  16  16  0  9  16 – 9 = 7  7  0  7  0 | 16  16  16  16  7  7  7  7 |

1. 0xA + 0Xc

|  |  |
| --- | --- |
| MOVLW 0X0A  ADDLW 0X0C | 10  10+12 = 22 |