UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

FACULTAD DE INGENIERÍA

MATERIA

- Laboratorio de Microcomputadoras
- Grupo:04

PRÁCTICA 01:
Introducción General al Microcontrolador PIC16F877

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SEMESTRE 2022-1

FECHA DE ENTREGA:

- **28/09/2021**

Objetivo:

Tener una introducción con todo lo referente al ensamblador, el simulador, instrucciones de un microcontrolador y la ejecución de programas en tiempo de simulación.

Introducción

Durante esta práctica se analizó a profundidad al microcontrolador PIC16F877. Se desglosaron sus características, así mismo vimos los registros que están disponibles, memoria del programa, memoria de datos y los tipos de instrucciones, que pueden ser de 3 tipos diferentes; orientadas a registro, al manejo de bits y orientadas al manejo de constantes e instrucciones de control. Comprendimos los dos tipos de direccionamiento de memoria, este puede ser directo o indirecto.

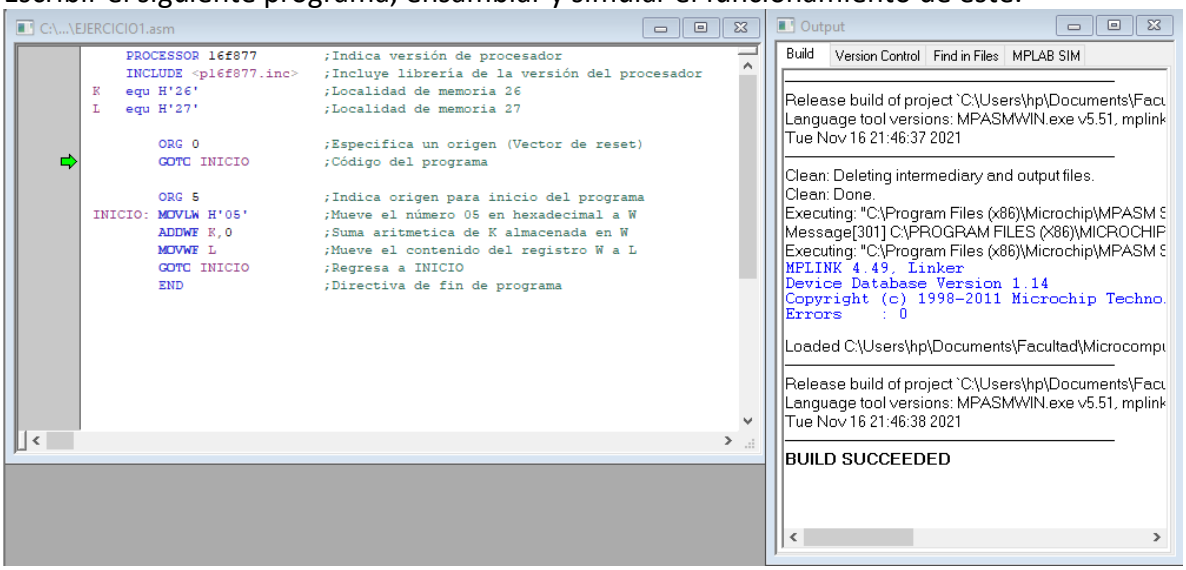
Durante esta práctica se hizo uso de MPLAB que es un ambiente de desarrollo integrado, con el cual podemos escribir, ensamblar y simular un programa. Se nos mostró la forma de hacer la configuración de nuestro programa, así como la forma de ensamblarlo y simularlo, ya sea una simulación de instrucción por instrucción o bien de forma continua.

Desarrollo:

Se realizaron los siguientes 5 ejercicios.

Ejercicio 1

Escribir el siguiente programa, ensamblar y simular el funcionamiento de este.



Al ejecutar el código podemos observar en los registros que en la dirección de memoria 26 se le asigna un valor el cual posteriormente se suma con el valor de la dirección 27. Posteriormente a la dirección 27 se le asigna un valor de 05

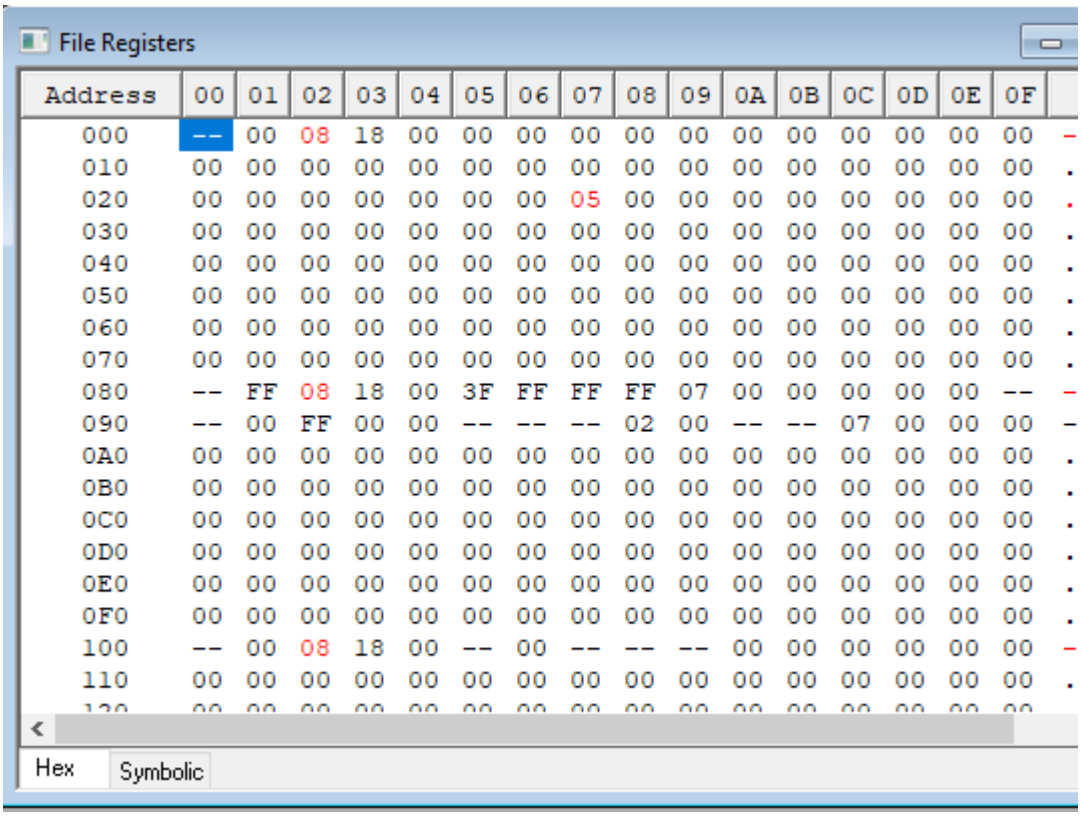
File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	
000	--	00	05	08	00	00	00	00	00	00	00	00	00	00	00	00	-....
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
080	--	FF	05	08	00	3F	FF	FF	FF	07	00	00	00	00	00	--	-....
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00	-....
0A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
100	--	00	05	08	00	--	00	--	--	--	00	00	00	00	00	00	-....
110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	A
000	--	00	07	0B	00	00	00	00	00	00	00	00	00	00	00	00	-.....
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
020	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
080	--	FF	07	0B	00	3F	FF	FF	FF	07	00	00	00	00	00	--	-....?..
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00	-....---
0A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
0F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....
100	--	00	07	0B	00	--	00	--	--	--	00	00	00	00	00	00	-....-.-
110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.....

Hex Symbolic

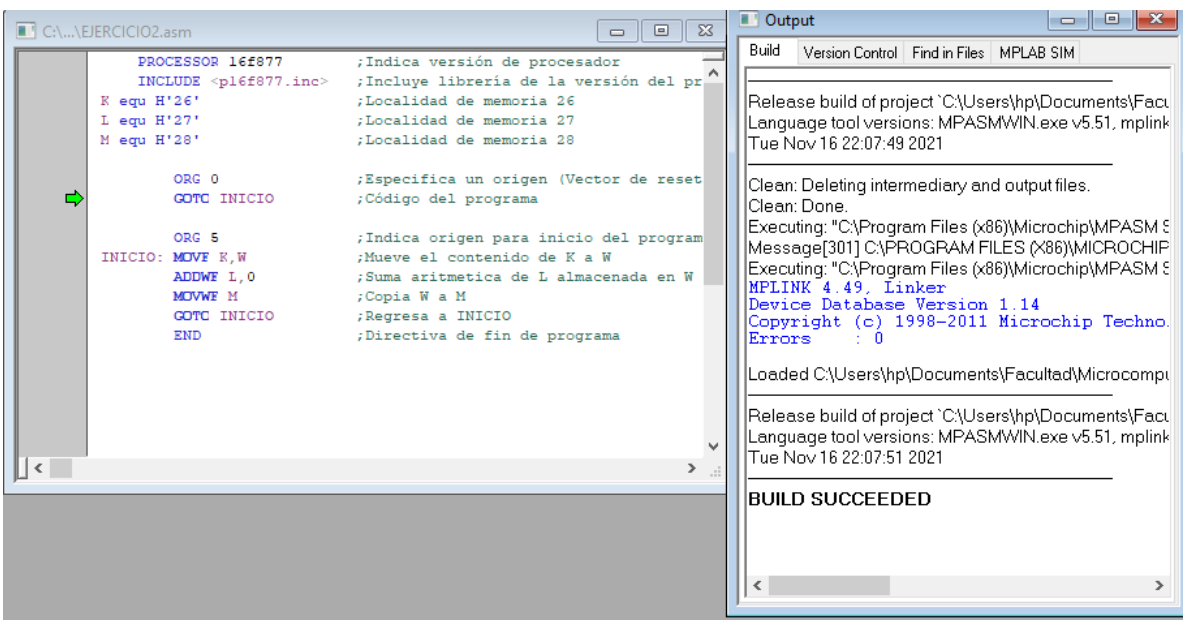


File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	
000	--	00	08	18	00	00	00	00	00	00	00	00	00	00	00	00	-
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
020	00	00	00	00	00	00	00	05	00	00	00	00	00	00	00	00	.
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
080	--	FF	08	18	00	3F	FF	FF	FF	07	00	00	00	00	00	--	-
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00	-
0A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
0B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
0C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
0E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
0F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.
100	--	00	08	18	00	--	00	--	--	--	00	00	00	00	00	00	-
110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	.

Hex Symbolic

Ejercicio 2



C:\...\EJERCICIO2.asm

```
    PROCESSOR 16f877        ;Indica versión de procesador
    INCLUDE <p16f877.inc>   ;Incluye librería de la versión del pr
K equ H'26'                 ;Localidad de memoria 26
L equ H'27'                 ;Localidad de memoria 27
M equ H'28'                 ;Localidad de memoria 28

        ORG 0               ;Especifica un origen (Vector de reset
        GOTO INICIO         ;Código del programa

        ORG 5               ;Indica origen para inicio del program
INICIO: MOVF K,W            ;Mueve el contenido de K a W
        ADDWF L,0           ;Suma aritmetica de L almacenada en W
        MOVWF M             ;Copia W a M
        GOTO INICIO         ;Regresa a INICIO
        END                 ;Directiva de fin de programa
```

Output

Build | Version Control | Find in Files | MPLAB SIM

```
Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Tue Nov 16 22:07:49 2021

Clean: Deleting intermediary and output files.
Clean: Done.
Executing: "C:\Program Files (x86)\Microchip\MPASM S
Message[301] C:\PROGRAM FILES (X86)\MICROCHIP
Executing: "C:\Program Files (x86)\Microchip\MPASM S
MPLINK 4.49, Linker
Device Database Version 1.14
Copyright (c) 1998-2011 Microchip Techno.
Errors    : 0

Loaded C:\Users\hp\Documents\Facultad\Microcompu

Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Tue Nov 16 22:07:51 2021

BUILD SUCCEEDED
```

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	00	1B	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	00	00	00	00	00	00	03	06	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
080	--	FF	00	1B	00	3F	FF	FF	FF	07	00	00	00	00	00	--
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00
0A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
0F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
100	--	00	00	1B	00	--	00	--	--	--	00	00	00	00	00	00
110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
130	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Hex Symbolic

Aquí podemos observar que en la dirección 28 se almacena la suma entre la dirección 26 y 27, esta suma no genera ningún acarreo, como podemos ver en la parte inferior de la imagen la c es minúscula lo cual nos indica que es 0

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	ASCII
000	--	00	05	18	00	00	00	00	00	00	00	00	00	00	00	00	-..... .....
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
020	00	00	00	00	00	00	03	06	09	00	00	00	00	00	00	00	....
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
080	--	FF	05	18	00	3F	FF	FF	FF	07	00	00	00	00	00	--	-....?.. .....-
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00	-....--- ..--....

F877A pc:0x5 W:0x9 z dc c 20 MHz bank 0 WR

Ahora si tomamos otro valor como por ejemplo FF en las direcciones 26 y 27 podemos observar que la C en la parte inferior de la pantalla se vuelve mayúscula lo cual nos indica que es igual a 1

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	ASCII
000	--	00	08	0B	00	00	00	00	00	00	00	00	00	00	00	00	-..... .....
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
020	00	00	00	00	00	00	FF	FF	FE	00	00	00	00	00	00	00	....
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
080	--	FF	08	0B	00	3F	FF	FF	FF	07	00	00	00	00	00	--	-....?.. .....-
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00	-....--- ..--....

877A | pc:0x8 | W:0xfe | z DC C | 20 MHz | bank 0 | Ln 14, Col 1 | INS | WR

Ejercicio 3

Modificación del ejercicio previo. Los datos operados se encuentran en las localidades J y K, el resultado es almacenado en direcciones reservadas para el acarreo y el resultado

C:\...\EJERCICIO3.asm

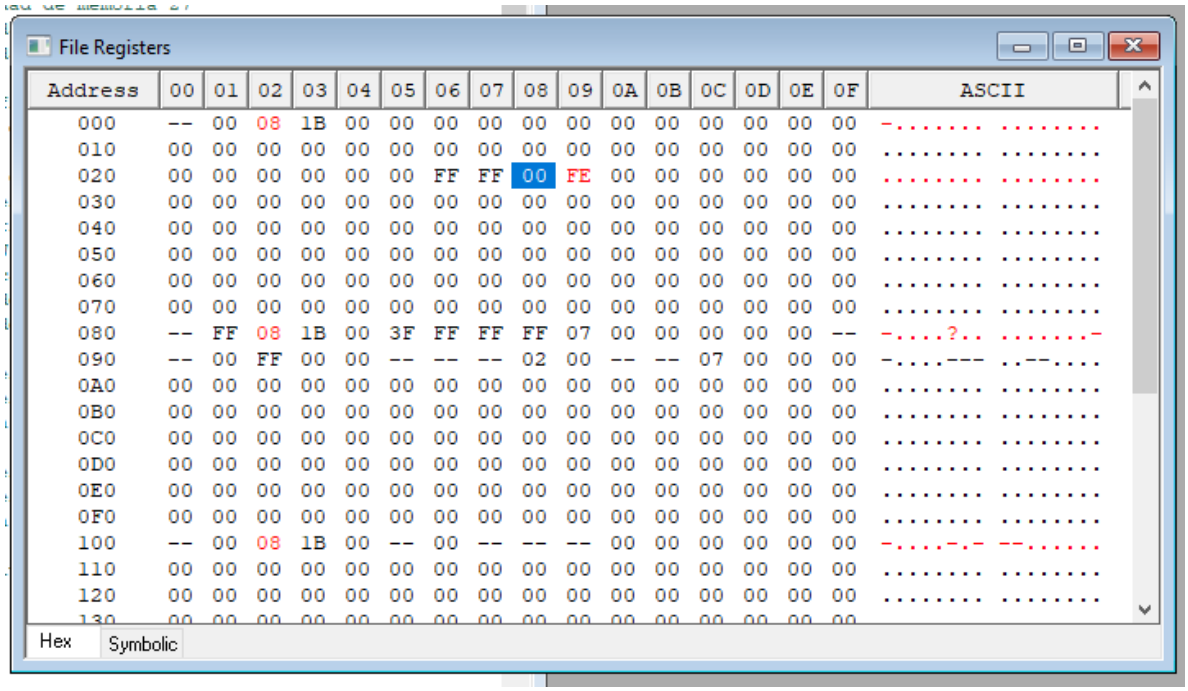
```
    PROCESSOR 16f877          ;Indica versión de procesador
    INCLUDE <p16f877.inc>     ;Incluye libreria de la versión del procesador
J equ H'26'                   ;Localidad de memoria 26
K equ H'27'                   ;Localidad de memoria 27
C1 equ H'28'                  ;Localidad de memoria 28
R1 equ H'29'                  ;Localidad de memoria 29

        ORG 0                 ;Especifica un origen (Vector de reset)
        GOTO INICIO           ;Código del programa

        ORG 5                 ;Indica origen para inicio del programa
INICIO: MOVF J,W              ;Mueve el contenido de J a w
        ADDWF K,0             ;Suma aritmetica de K almacenada en W
        MOVWF R1              ;Copia W a M
        BTFSS STATUS, 0       ;Verifica la bandera de status de Carry
        GOTO TRUE             ;Si bandera de Carry es igual a 1
        GOTO FALSE            ;Si bandera de Carry es igual a 0

TRUE:   MOVLW H'00'           ;Mueve el número 00 a W
        MOVWF C1              ;Mueve el contenido del registor W a C1
        GOTO INICIO           ;Regresa e INICIO

FALSE:  MOVLW H'00'           ;Mueve el número 00 a W
        MOVWF C1              ;Mueve el contenido del registor W a C1
        GOTO INICIO           ;Regresa e INICIO

        END                   ;Directiva de fin de programa
```

Output

Build | Version Control | Find in Files | MPLAB SIM

```
Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Tue Nov 16 23:41:26 2021

Clean: Deleting intermediary and output files.
Clean: Done.
Executing: "C:\Program Files (x86)\Microchip\MPASM S
Message[301] C:\PROGRAM FILES (X86)\MICROCHIP
Executing: "C:\Program Files (x86)\Microchip\MPASM S
MPLINK 4.49, Linker
Device Database Version 1.14
Copyright (c) 1998-2011 Microchip Techno.
Errors    : 0

Loaded C:\Users\hp\Documents\Facultad\Microcompu

Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Tue Nov 16 23:41:28 2021

BUILD SUCCEEDED
```

Se asigna el valor de FF en ambas direcciones, el resultado lo podemos observar en la dirección 29



File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	ASCII
000	--	00	08	1B	00	00	00	00	00	00	00	00	00	00	00	00	-..... .....
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
020	00	00	00	00	00	00	FF	FF	00	FE	00	00	00	00	00	00	....
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
040	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
050	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
060	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
070	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
080	--	FF	08	1B	00	3F	FF	FF	FF	07	00	00	00	00	00	--	-....?.. .....-
090	--	00	FF	00	00	--	--	--	02	00	--	--	07	00	00	00	-....--- ..--....
0A0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
0B0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
0C0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
0D0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
0E0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
0F0	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
100	--	00	08	1B	00	--	00	--	--	--	00	00	00	00	00	00	-....-.- --.....
110	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
120	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	....
130	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	

Hex Symbolic

Ejercicio 4

Secuencia:

H´01´
H´02´
H´04´
H´08´
H´10´
H´20´
H´40´
H´80´

Donde H´01´ indica que el dato esta dado en hexadecimal.

En caso e seleccionar el registro cuya dirección es 0X20

DIR	20	20	20	20	20	20	20	20
DATO	**01**	**02**	**04**	**08**	**10**	**20**	**40**	**80**

Nota: La secuencia indicada, deberá mostrarse en una misma dirección de memoria.

C:\...\EJERCICIO4.asm

```
        PROCESSOR 16f877          ;Indica versión de procesador
        INCLUDE <p16f877.inc>     ;Incluye librería de la versión del procesador
DIR equ H'27'                     ;Localidad de memoria 26
DIRA equ H'20'                    ;Localidad de memoria 27

        ORG 0                     ;Especifica un origen (Vector de reset)
        GOTO INICIO               ;Código del programa

        ORG 5                     ;Indica origen para inicio del programa
INICIO: MOVLW H'07'               ;Mueve el numero 07 a W
        MOVWF DIRA                ;Se copia W a DIRA
        MOVLW H'01'               ;Mueve el número 01 a W
        MOVWF DIR                 ;Copia W a DIR
        GOTO DOBLE                ;Salta a DOBLE

DOBLE:  ADDWF DIR, W              ;Suma aritmetica almacenada en W
        MOVWF DIR                 ;Mueve el contenido del registor W a DIR
        DECF DIRA                 ;Se hace un decremento en DIRA
        BTFSC STATUS,2            ;Verifica la bandera de status de DIRA
        GOTO INICIO               ;Regresa e INICIO
        GOTO DOBLE                ;Regresa al inicio por si quedan más registros por contar
        END
```

Output

Build | Version Control | Find in Files | MPLAB SIM

```
Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Wed Nov 17 09:40:24 2021

Clean: Deleting intermediary and output files.
Clean: Done.
Executing: "C:\Program Files (x86)\Microchip\MPASM S
Message[301] C:\PROGRAM FILES (X86)\MICROCHIP
Message[305] C:\USERS\HP\DOCUMENTS\FACULT.
Executing: "C:\Program Files (x86)\Microchip\MPASM S
MPLINK 4.49, Linker
Device Database Version 1.14
Copyright (c) 1998-2011 Microchip Techno.
Errors    : 0

Loaded C:\Users\hp\Documents\Facultad\Microcompu

Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Wed Nov 17 09:40:25 2021

BUILD SUCCEEDED
```

En la dirección 27 es en donde veremos reflejados los cambios de los valores.

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0B	18	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	07	00	00	00	00	00	00	01	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0A	18	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	06	00	00	00	00	00	00	02	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0F	18	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	05	00	00	00	00	00	00	04	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0A	18	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	04	00	00	00	00	00	00	08	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0A	1A	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	03	00	00	00	00	00	00	10	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0F	18	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	02	00	00	00	00	00	00	20	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0D	18	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	01	00	00	00	00	00	00	40	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
000	--	00	0E	1C	00	00	00	00	00	00	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
020	00	00	00	00	00	00	00	80	00	00	00	00	00	00	00	00
030	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

Ejercicio 5

Desarrollar un programa que muestre la siguiente secuencia en valores decimales.

00-01-02-03-04-05-06-07-08-09-10-11-12-13-14-15-16-17-18-19-20

Nota: La secuencia indicada, deberá mostrarse en una misma dirección de memoria, tal como fue realizado en el ejercicio anterior.

C:\...\EJERCICIO5.asm

```
    PROCESSOR 16f877          ;Indica versión de procesador
    INCLUDE <p16f877.inc>     ;Incluye librería de la versión del procesa
DIR equ H'28'                 ;Localidad de memoria 28
DIR2 equ H'20'                ;Localidad de memoria 20

        ORG 0                 ;Especifica un origen (Vector de reset)
        GOTO INICIO           ;Código del programa

        ORG 5                 ;Indica origen para inicio del programa
INICIO: MOVLW H'09'           ;Mueve el numero 09 a W
        MOVWF DIR2            ;Se copia W a DIR2
        MOVLW H'00'           ;Mueve el número 00 a W
        MOVWF DIR             ;Copia W a DIR
        GOTO CUENTA           ;Salta a CUENTA

CUENTA: MOVLW H'01'           ;Mueve el número 01 a W
        ADDWF DIR             ;Suma aritmetica de DIR almacenada en W
        DECF DIR2             ;Se decrementa DIR2
        BTFSC STATUS, 2       ;Se comprueba la bandera de status del cicl
        GOTO DIEZ             ;Salta a DIEZ
        GOTO CUENTA           ;Salta a cuenta

DIEZ:   MOVF DIR, W           ;Copia a W el valor de DIR
        SUBLW 19              ;Sustrae el valor 19 de W
        BTFSC STATUS,2        ;Verifca el status de la bandera por si el
        GOTO VEINTE           ;Si el valor es 19 entonces se finaliza con
        GOTO DIEZ2            ;Si no es 19 continua con el otro conteo

DIEZ2:  MOVLW H'10'           ;Mueve el número 10 a W
        MOVWF DIR             ;Copia W a DIR
        MOVLW H'09'           ;Copia el número 09 a W
        MOVWF DIR2            ;Copia W a DIR2
        GOTO CUENTA;          ;Regresa a cuenta
```

```
VEINTE: MOVLW H'20'          ;Copia el número 20 a W
        MOVWF DIR            ;Copia W a DIR
        GOTO INICIO
        END
```

Output

Build | Version Control | Find in Files | Gimpel PC-Lint/MISR

```
Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Wed Nov 17 15:23:41 2021

Clean: Deleting intermediary and output files.
Clean: Done.
Executing: "C:\Program Files (x86)\Microchip\MPASM S
Message[301] C:\PROGRAM FILES (X86)\MICROCHIP
Message[305] C:\USERS\HP\DOCUMENTS\FACULT.
Message[305] C:\USERS\HP\DOCUMENTS\FACULT.
Executing: "C:\Program Files (x86)\Microchip\MPASM S
MPLINK 4.49, Linker
Device Database Version 1.14
Copyright (c) 1998-2011 Microchip Techno.
Errors    : 0

Loaded C:\Users\hp\Documents\Facultad\Microcompu

Release build of project `C:\Users\hp\Documents\Facu
Language tool versions: MPASMWIN.exe v5.51, mplink
Wed Nov 17 15:23:43 2021

BUILD SUCCEEDED
```

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	09	1F	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	09	00	00	00	00	00	00	01	00	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0A	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	08	00	00	00	00	00	00	01	01	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0A	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	07	00	00	00	00	00	00	01	02	00
030	00	00	00	00	00	00	00	00	00	00
040	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0A	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	06	00	00	00	00	00	00	01	03	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0D	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	05	00	00	00	00	00	00	01	04	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0D	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	04	00	00	00	00	00	00	01	05	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0B	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	03	00	00	00	00	00	00	01	06	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	02	00	00	00	00	00	00	01	07	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	01	00	00	00	00	00	00	01	08	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	11	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	00	00	00	00	00	00	00	01	09	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	18	1B	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	00	00	00	00	00	00	00	01	10	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	08	00	00	00	00	00	00	01	11	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	07	00	00	00	00	00	00	01	12	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0C	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	07	00	00	00	00	00	00	01	13	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	05	00	00	00	00	00	00	01	14	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	04	00	00	00	00	00	00	01	15	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0F	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	03	00	00	00	00	00	00	01	16	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0C	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	03	00	00	00	00	00	00	01	17	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0A	18	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	01	00	00	00	00	00	00	01	18	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	13	1F	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	00	00	00	00	00	00	00	01	19	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	07	1F	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	09	00	00	00	00	00	00	01	20	00
030	00	00	00	00	00	00	00	00	00	00

File Registers

Address	00	01	02	03	04	05	06	07	08	09
000	--	00	0B	1F	00	00	00	00	00	00
010	00	00	00	00	00	00	00	00	00	00
020	09	00	00	00	00	00	00	01	00	00
030	00	00	00	00	00	00	00	00	00	00

Aquí podemos observar cómo regresamos al valor inicial que es 00 y se reinicia la cuenta.

Conclusiones:

Carreón Guzmán Mariana Ivette

En esta primera práctica pudimos ver un poco acerca del lenguaje ensamblador, así como descubrir un poco acerca de las herramientas de MPLAB, pudimos comprender las instrucciones más básicas del lenguaje ensamblador, lo cual nos permitió comprender el funcionamiento y cómo se realiza la ejecución de un programa así mismo pudimos observar cómo se van modificando los registros conforme se va ejecutando nuestro código. Con esto podemos ver que cada uno de los objetivos de la práctica fueron cumplidos y cubiertos por completo.

Rojas Méndez Gabriel

En esta práctica comenzamos a ver los conocimientos básicos necesarios para poder desarrollar un programa en lenguaje ensamblador, a lo largo de los ejercicios pudimos ver cómo se usan las instrucciones básicas del lenguaje ensamblador, así como poder ver en tiempo real cómo se van modificando los registros durante la ejecución de nuestro programa. Por otra parte, pudimos empezar a familiarizarnos con MPLAB y las herramientas con las que cuenta para poder simular nuestro código.