PIC MICRO-CONTROLLER

Birzeit University

Information Technology Faculty

Computer Systems Engineering Department

Abstract

This experiment aims at understanding and practicing the main programming concepts of PIC Microcontroller. MPLAB IDE will be introduced as the used programming tool to achieve the aim of the experiments.

PART I Theoretical and Technical Introduction

In this Experiment PIC16F877A will be used. You are required to read the data sheet of PIC16F877 /PIC16F877A and the help manual of MPLAB IDE V7.31 then do the tasks of this experiment using PIC Simulator.

PART II Pre-Lab

(This part should be handed on to the teaching assistant in your Lab)

Hand-on the HEX files and show their operations on the PIC Simulator.

PART III Practices

3.1 PRACTICE I: Programming

Step 1: Run the MPLAB IDE V7.31+ software.

Step 2: Write the sample file "**ledf.c**" as follows:

- Open a new file : **File -> New**
- Write the program as shown in (Figure 1) then save it as **ledf.c** somewhere in a folder with your name

C:\Documents and Settings\bzuadmin\Desktop\Exp7\ledf.c

```
//PIC 16F877A Program
#include <pic.h>
//delay function pause
void pause (int delay);
int i, j;
void main(void)          //main function
{
  TRISD = 0X00;          //all bits are output
  PORTD = 0b00000000;    //initialization
  while(1)
  {
    PORTD = 0b10000000;
    pause(20);
    PORTD = 0b01000000;
    pause(17);
    PORTD = 0b00100000;
    pause(12);
    PORTD = 0b00010000;
    pause(5);
  }
}
void pause (int delay)
{
 for (i=0; i<delay; i++)
    for(j=0; j<20; j++) ;
}
```

Figure 1 ledf.c

Step 3: Click on **Configure** -> **Select Device** then choose PIC 16F877/PIC 16F877A as shown in (Figure 2) then press OK.

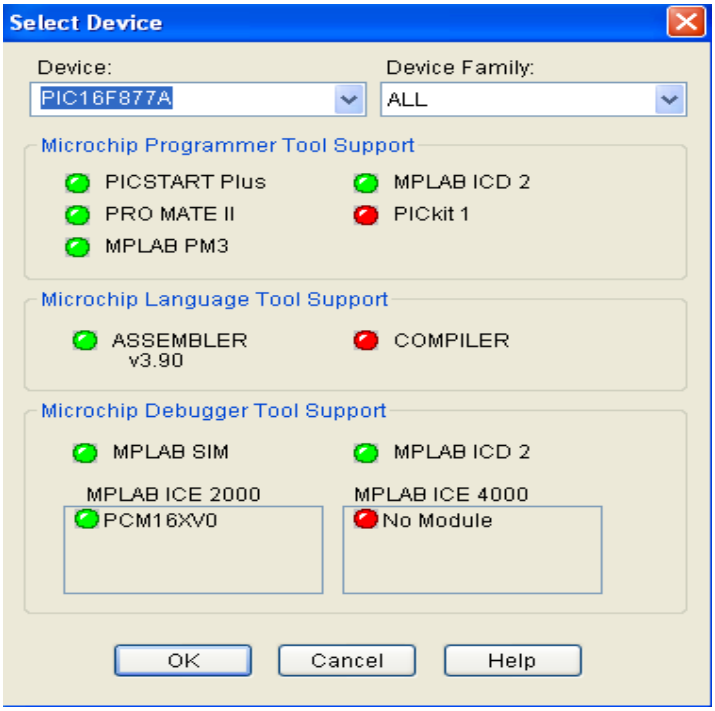


Figure 2 Selecting Device

Step 4: Now to create a project, click **Project** -> **Project Wizard** then click "Next", the window in (Figure 3)will appear

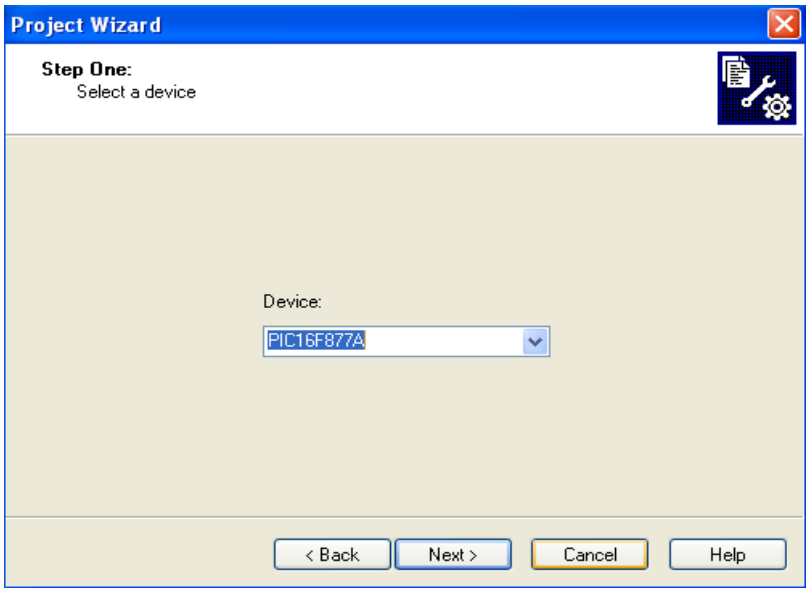


Figure 3 Project Wizard Window

Step 5: Click "Next", you will see a window to select the compilation and linking tools you want to use, choose the options as shown in (Figure 4) , then click next

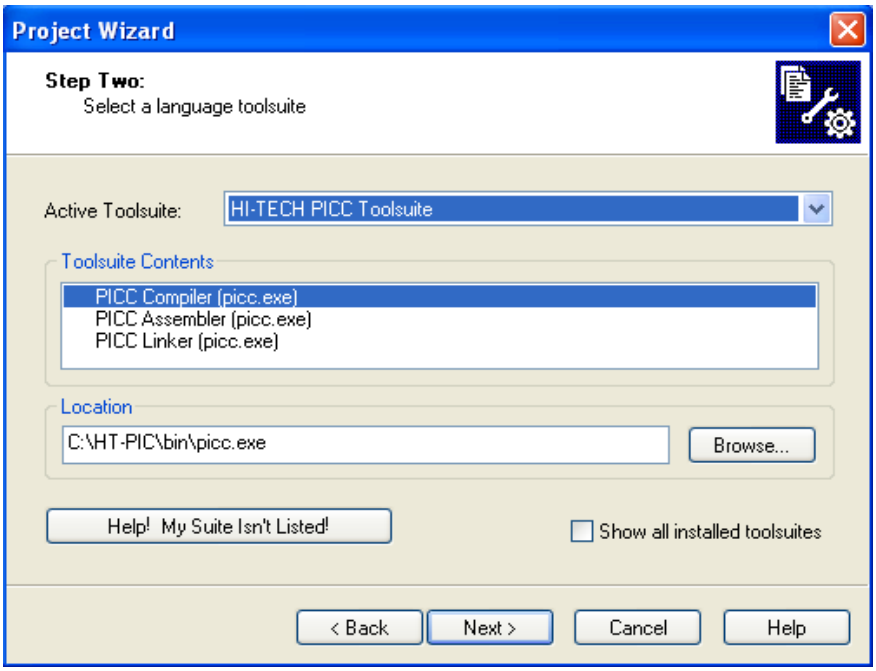


Figure 4 Project Wizard Step 2

Step 6: After that you will see a window that asks you to name your project and to decide the project directory, so name it and decide your directory such that it will be your created folder then click next.

P.S. the name of your project will be the name of the hex file produced.

Step 7: The next step is to add any existing files to your project, so add **"ledf.c"** , click next as shown in (Figure 5). (**P.S.** usually this step is optional, you may create an empty project and then add a new files with your code)

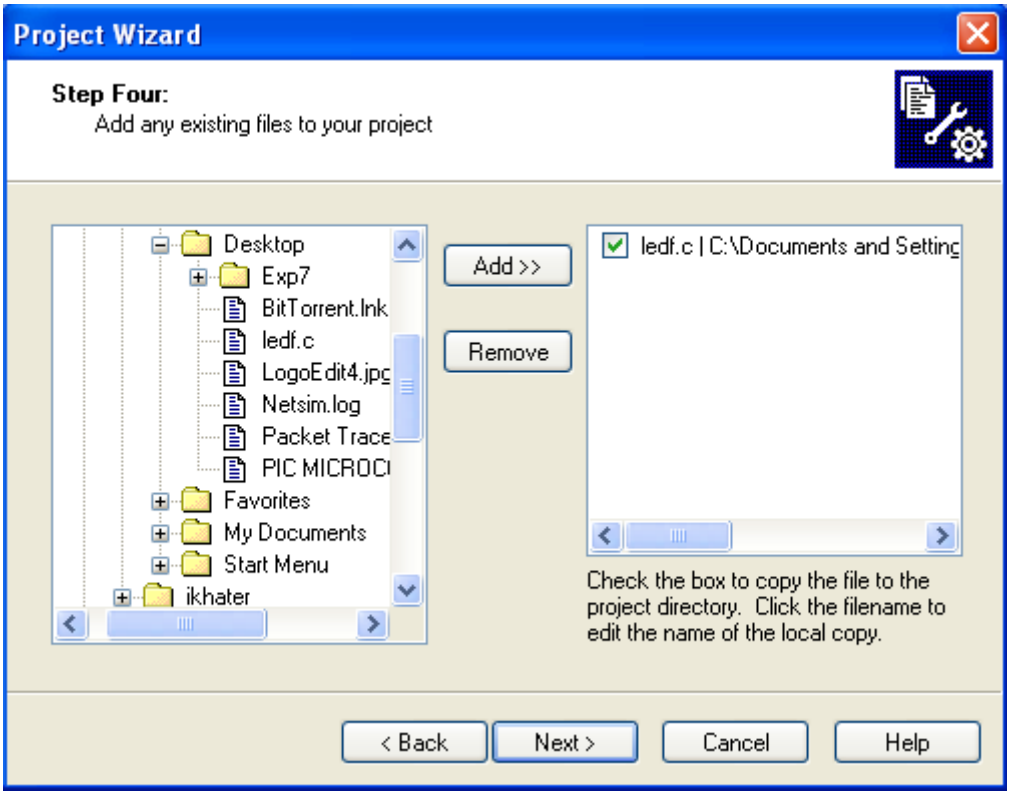
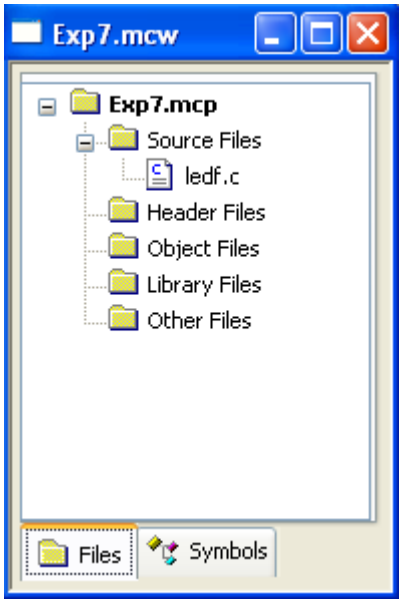


Figure 5 Project Wizard Step 4

Step 8: Click finish, Notice in the project view window to the right.

Double click the file name "**ledf.c**", this will view the file code for you.

Step 9: To compile and build your project go to **Project -> Make** or simply click on the item circled in (Figure 6).



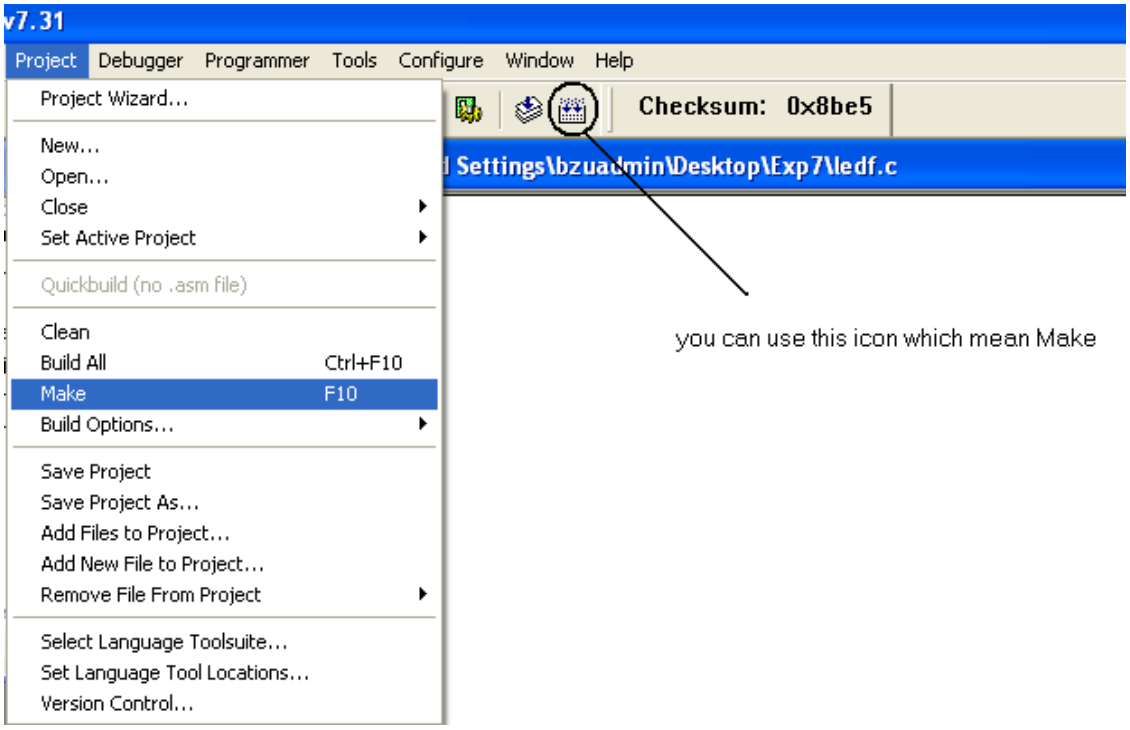


Figure 6 Project Make Button in the Main Toolbar

Step 10: Now if there are no errors in your code you will see the window in () which shows you that your build succeeded, and so the **HEX** file generated (Try to read the information given in this window).

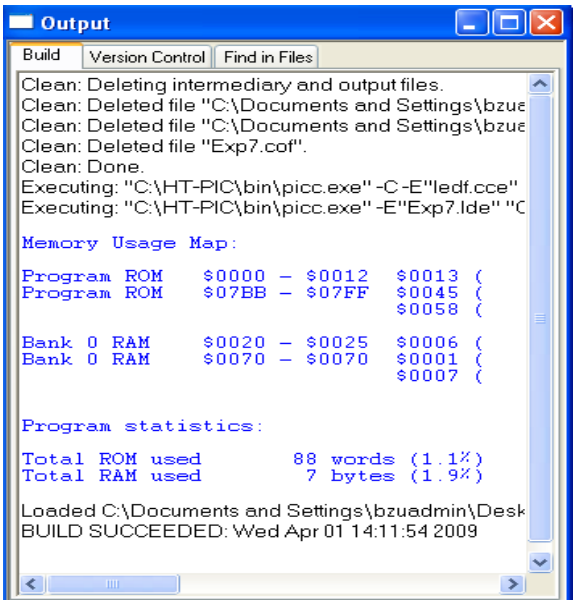


Figure 7 Building Results

Step 11: Find the HEX file generated in your folder.

This file contains the machine code for the PIC. Before we get this file run on the PIC we need to make sure that it works as needed using simulator. To do so follow the following steps:

Step 1: Open the **"PIC simulator IDE"**

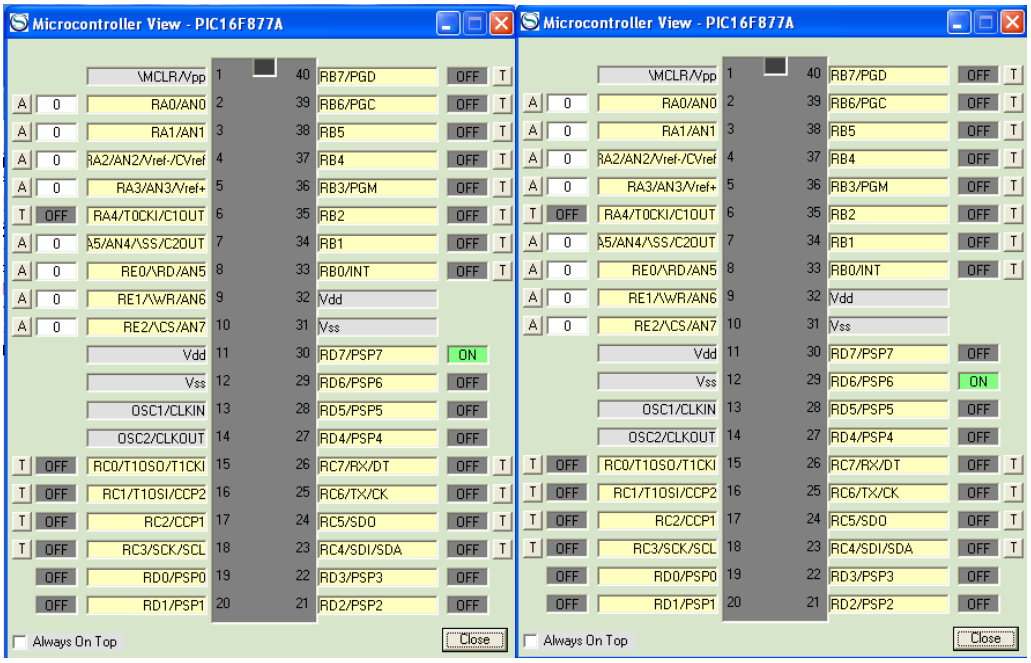
Step 2: click **Options -> Select Microcontroller**, choose our PIC then click select.

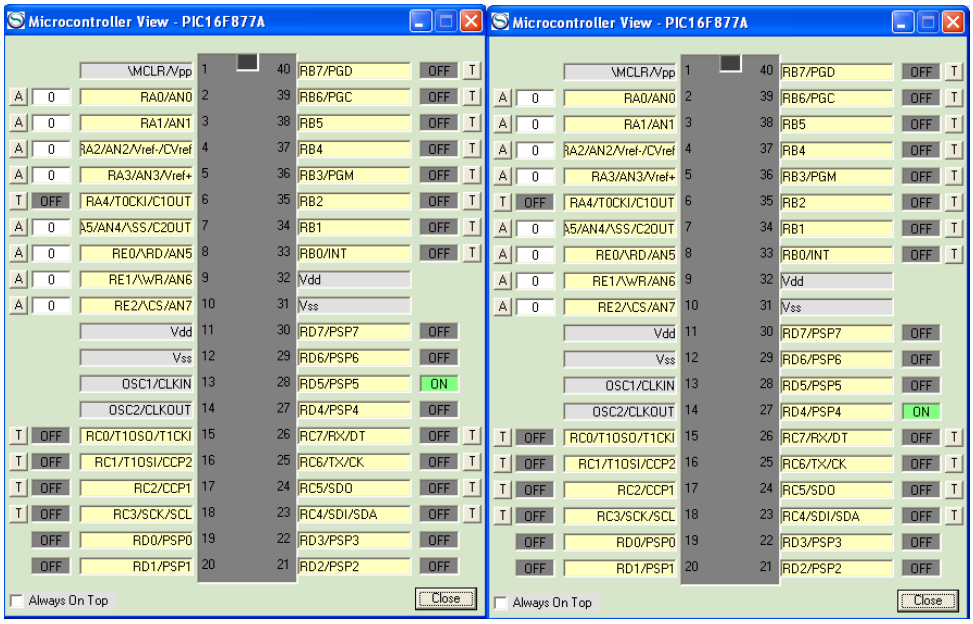
Step 3: Again in **Options** select change clock frequency then enter 4.0MHz then press Ok.

Step 4: Click **File** -> **Clear Memory**, after that choose **Load Program**, then load your hex file

Step 5: Click **Rate** and choose fast or extremely fast option.

Step 6: Click **Tools** then select microcontroller view then press simulate start then you will see the following.





TASKS:

1. Check on the simulator how does the output matches the code you wrote.

3.2 PRACTICE II: Download HEX File to PIC Microcontroller

P.S. There is so many tools used to download the HEX file to the PIC, Actually, here on of these tool is presented, but you are free to use the one you mostly like.

Step 1: Open the program **meProg** or **IC-Prog.**

Step 2: Select the device you want to use from the drop list, your device will be (16F877A) as shown in (Figure 8).

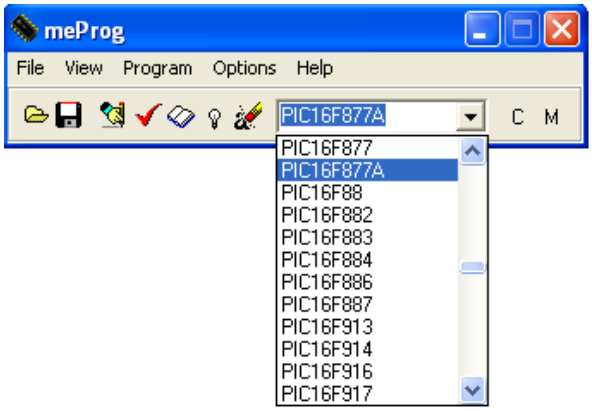


Figure 8 mePog Main Window

Step 3: Press **View** on the main menu and chose **Configuration**, a window will appear as shown in (Figure 9), chose the oscillator to XT (crystal), keep the other parameters values.

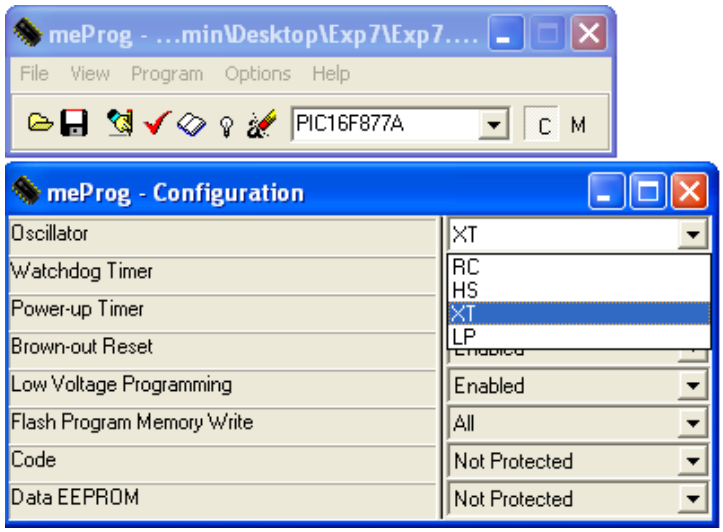


Figure 9 Configuration Dialog

Step 4: Set the PIC on the programmer.

Step 5: Press **Program** on the main menu and chose **Erase**, to erase the old program, and make the PIC ready for the new program.

Step 6: Finally press **Program**, then **Program** to install the selected hex file, as shown in (Figure 10).

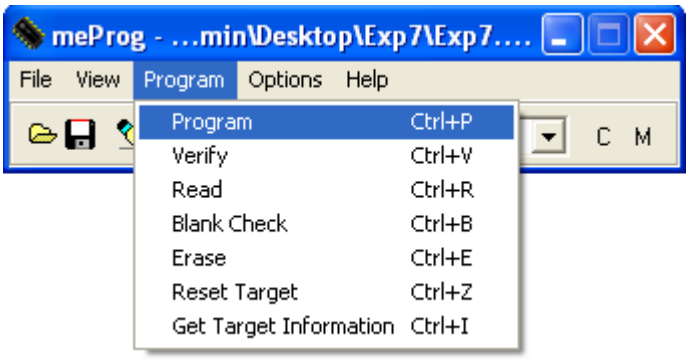
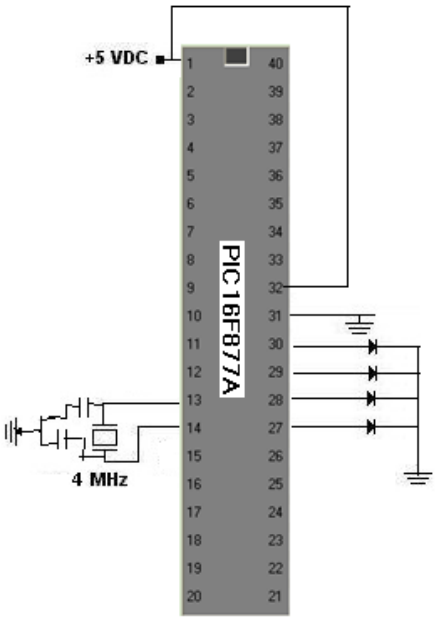


Figure 10 Installing the HEX file to the PIC ROM

3.3 PRACTICE III: Connecting the Circuit

On your breadboard connect the circuit as shown in the figure to the right and notice the result. (While connecting, keep the circuit disconnected from the power).



TASKS:

1. Implement a traffic light with reasonable delay.
2. Read a 4 bit using port D (most significant) and write the complement on port B (most significant).
3. Implement a 2*1 MUX.