Çankaya University

Electronic and Communication Engineering Department

ECE 336

Project

Name Surname: Aleyna Karapınar

Number : 201614032

Band Members: Fatmanur Özel 201614042

Berna Demirel 201614018

DIGITAL IC TESTER

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AIM OF THE PROJECT

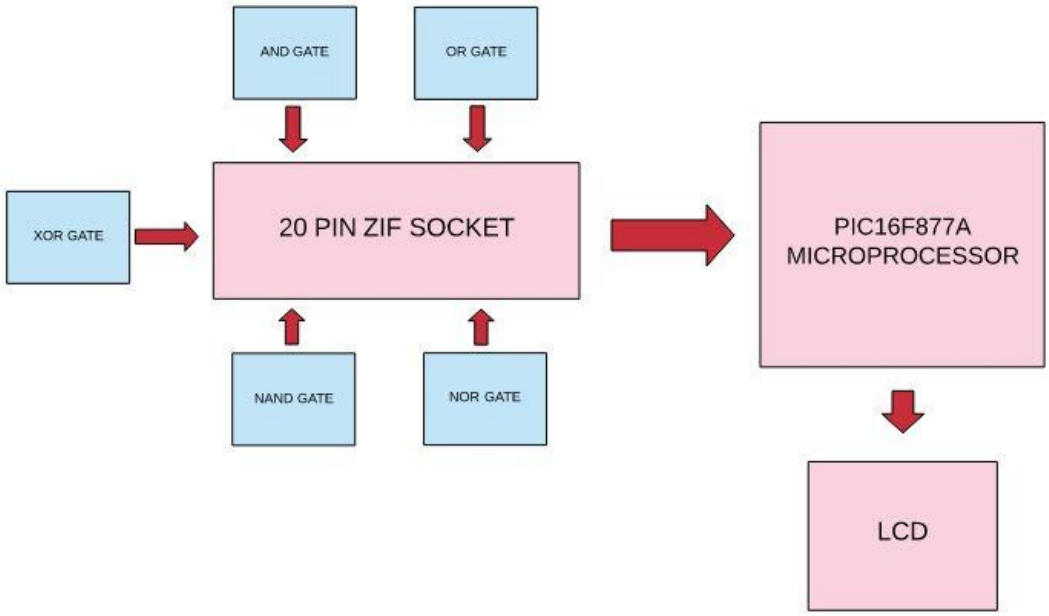
Last semester, my bandmate Fatma and I worked as assistants in the Digital Systems Lab at our school. We found that it took a lot of testing to see if the digital IC's were broken. It was difficult for both the students and us to control the circuits installed with broken IC's. For this purpose, we decided to test the OR Gate(74xx32),AND Gate(74xx08), NOR Gate(74xx02), NAND Gate(74xx00) and XOR Gate(74xx86) in a short time and make a digital IC tester that will tell you its name and if it is corrupted. Thus, the logic gates will be tested in a short time and the waste of time will be avoided.

Bill of Materials (BOM) List

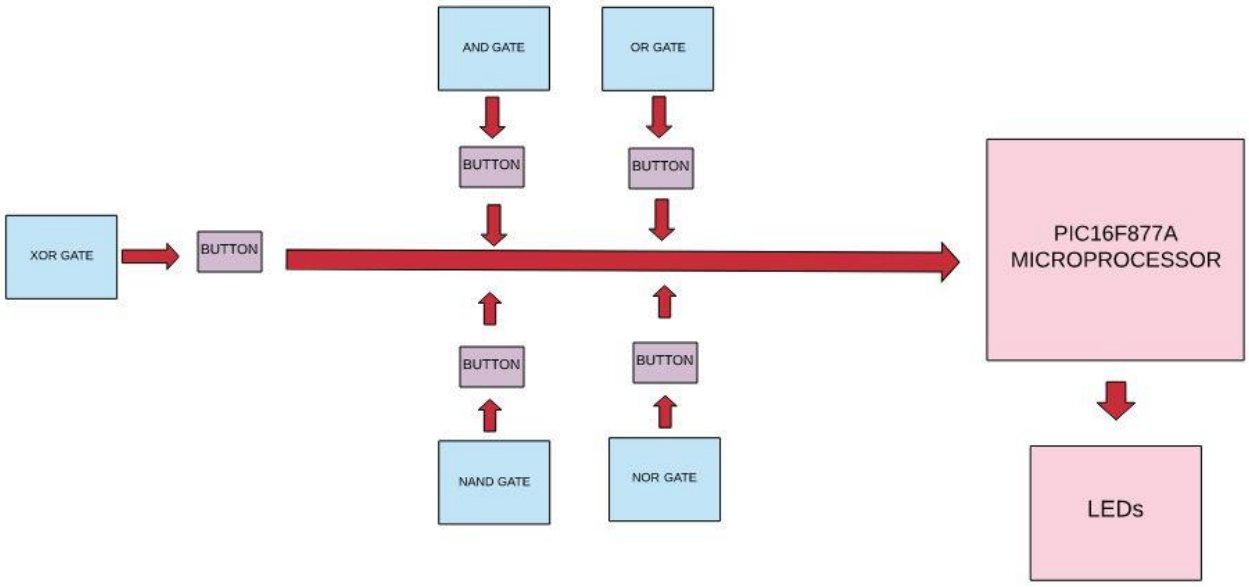
- PIC16F877A
- BUTTONS
- 20 PIN ZIF SOCKET
- LCD
- BUZZER
- KEY-PAD
- LED's
- CABLE's
- 74xx08
- 74xx32
- 74xx86
- 74xx02
- 74xx00

Block diagram of design (For Real life And For Proteus Simulation)

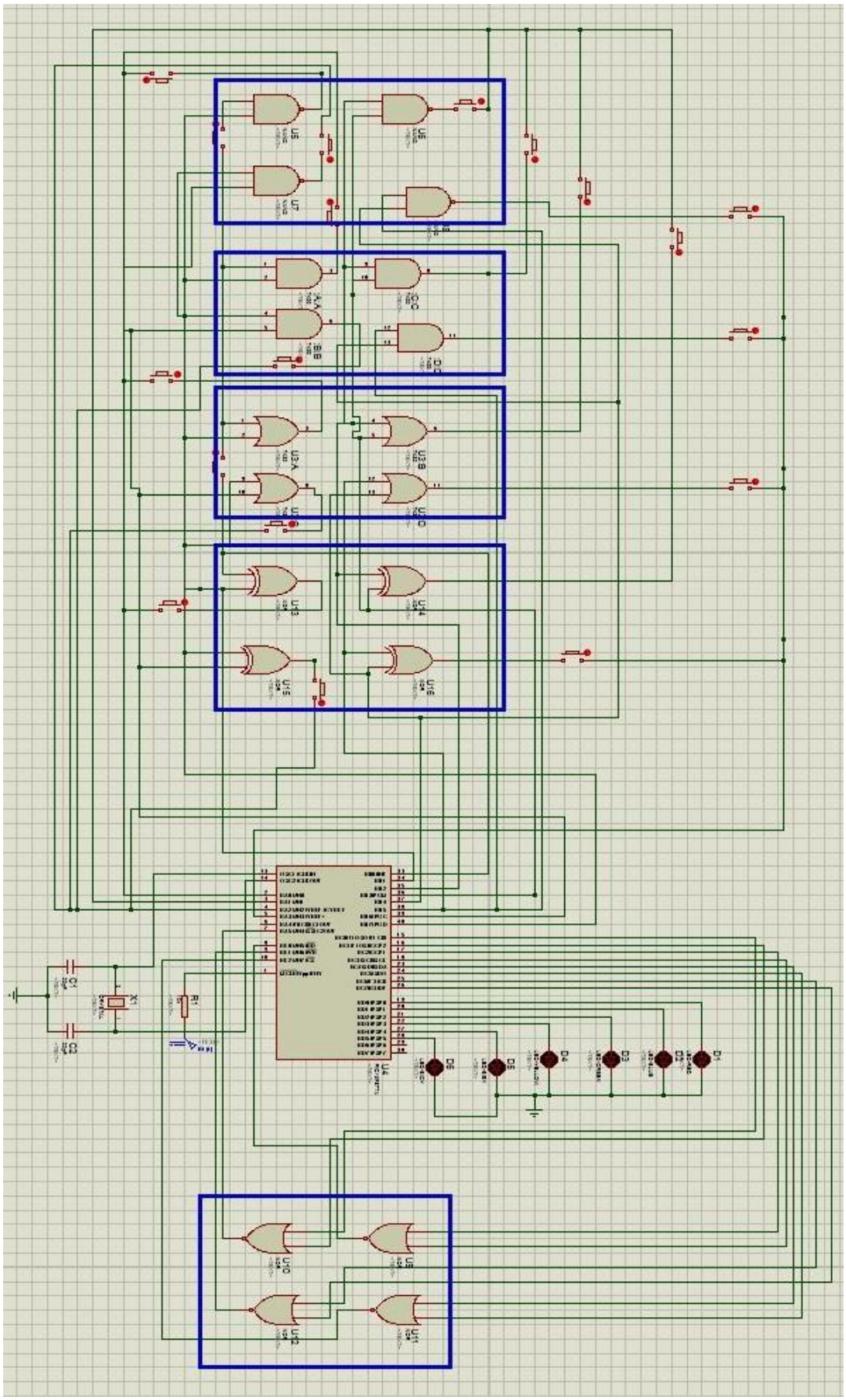
For Real Life



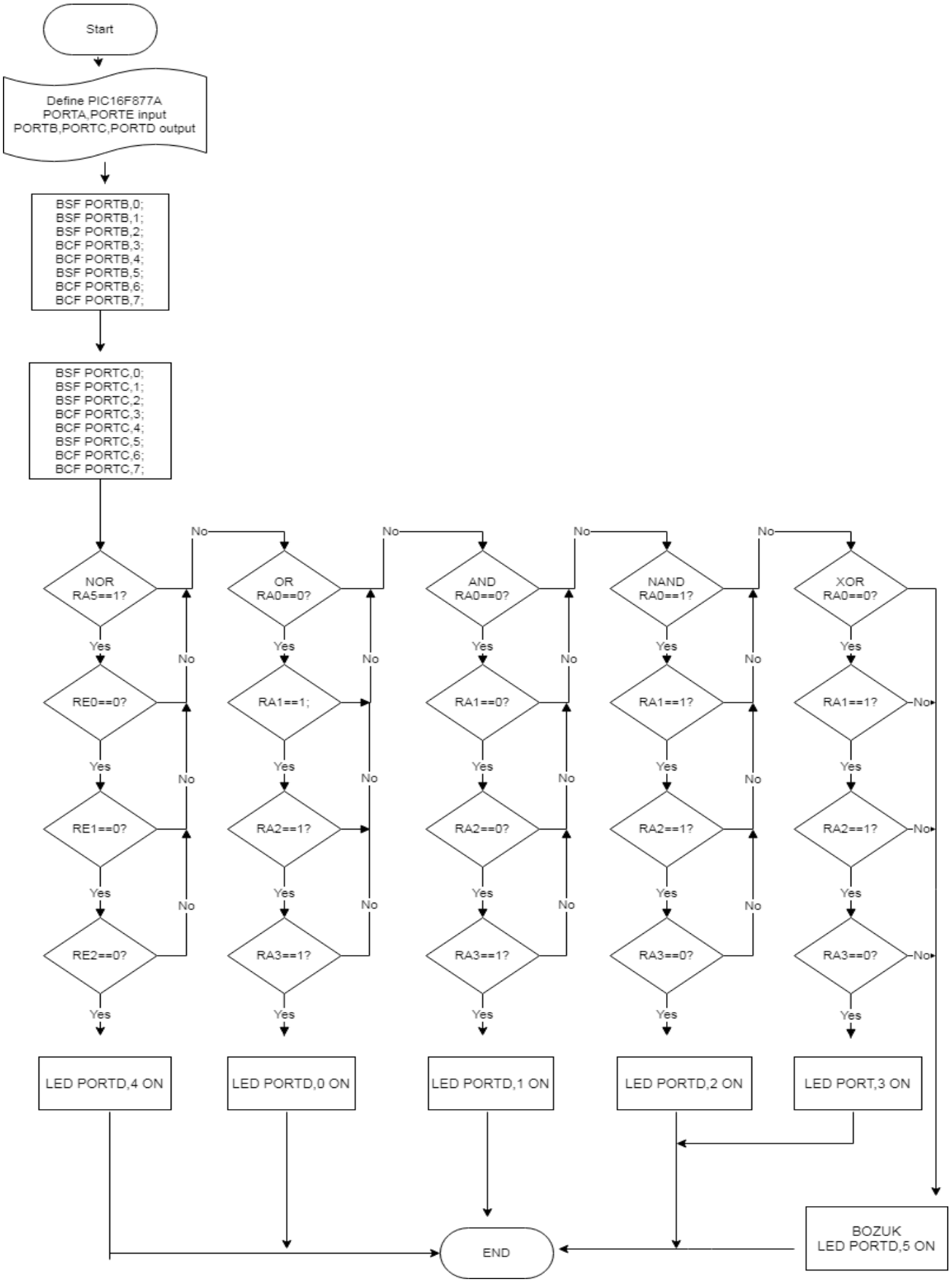
For Proteus Simulation



Schematic of the design



Flow Chart


Start
Define PIC16F877A
PORTA,PORTE input
PORTB,PORTC,PORTD output
BSF PORTB,0;
BSF PORTB,1;
BSF PORTB,2;
BCF PORTB,3;
BCF PORTB,4;
BSF PORTB,5;
BCF PORTB,6;
BCF PORTB,7;
BSF PORTC,0;
BSF PORTC,1;
BSF PORTC,2;
BCF PORTC,3;
BCF PORTC,4;
BSF PORTC,5;
BCF PORTC,6;
BCF PORTC,7;
NOR RA5==1?
RE0==0?
RE1==0?
RE2==0?
LED PORTD,4 ON
OR RA0==0?
RA1==1;
RA2==1?
RA3==1?
LED PORTD,0 ON
AND RA0==0?
RA1==0?
RA2==0?
RA3==1?
LED PORTD,1 ON
NAND RA0==1?
RA1==1?
RA2==1?
RA3==0?
LED PORTD,2 ON
XOR RA0==0?
RA1==1?
RA2==1?
RA3==0?
LED PORT,3 ON
BOZUK
LED PORTD,5 ON
END
Yes
No

METHODS

The project we planned to do before the distance education process was as follows. It was a project that we could test manually or automatically after plugging Logic gate onto the socket (we had thought about using keypads for this), showing the name logic gate and whether it was working on the LED or running the buzzer. Before the distance education process, we planned to do the project with different circuit elements. These were various materials such as 20 pin ZIF socket, LCD, keyboard, buzzer. But we decided to make some changes to the project because we were just going to do a simulation. For example, we would see the result of our project on the LCD screen, and with the new arrangement we get our results with led. Second change was to the 20 pin ZIF socket. We used buttons instead of 20 pin ZIF sockets. We have removed the key pad that we will use for automatic or manual testing from the project. We planned to use PIC16F4A microprocessor, but the pin numbers were not enough to use. We used PIC16F877A instead of PIC16F84A which has more pins decided to use.

Properties of circuit elements we use

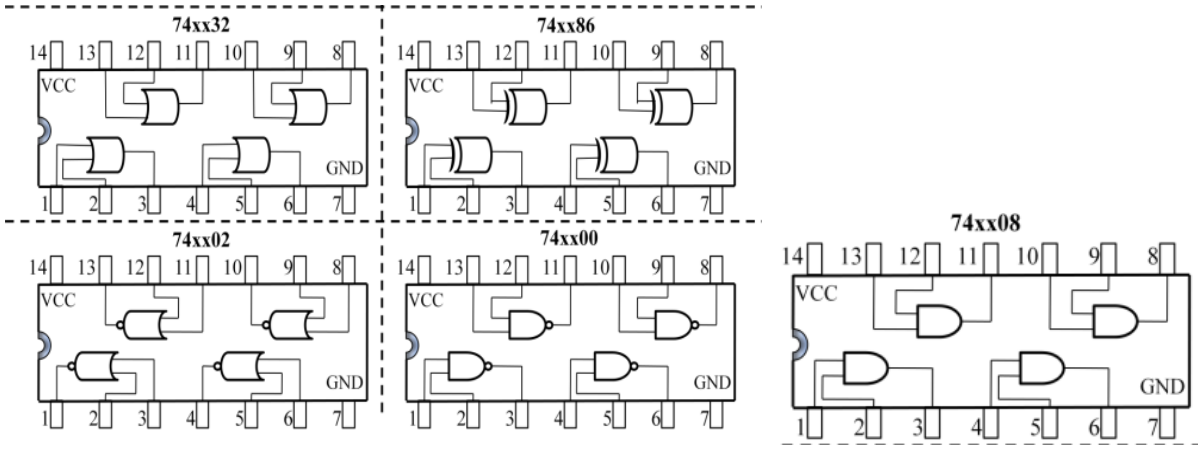
PIC16F877A

PIC16F877a is a 40-pin PIC Microcontroller and is used mostly in Embedded Projects and Applications. Few of its features are as follows:

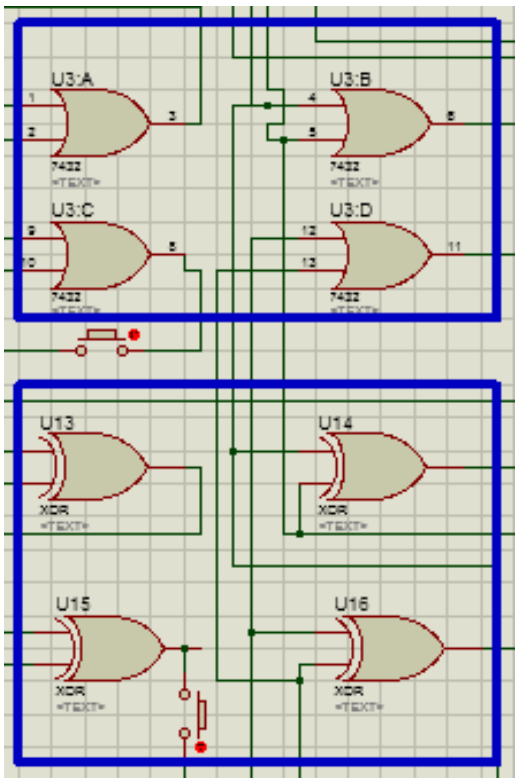
It has five Ports on it starting from Port A to Port E.
It has three Timers in it, two of which are 8 bit Timers while 1 is 16 Bit.
It supports many communication protocols like:
Serial Protocol.
Parallel Protocol.
I2C Protocol.
It supports both hardware pin interrupts and timer interrupts.

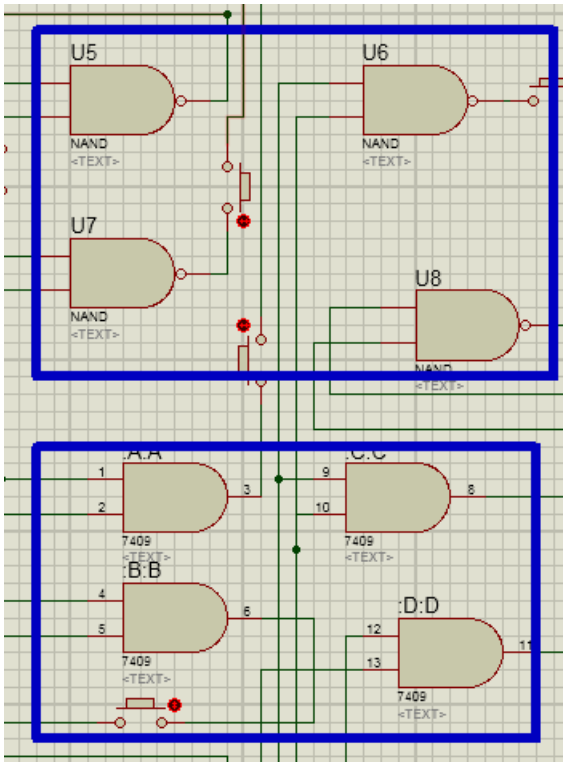
LOGIC GATES

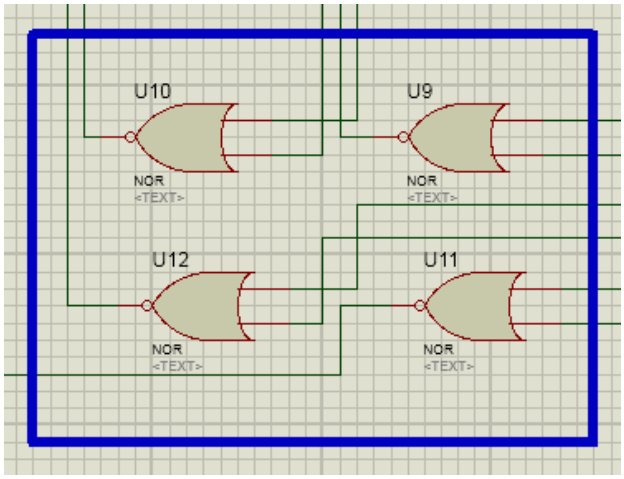
These are the logic gates we're going to test. OR Gate(74xx32),AND Gate(74xx08), NOR Gate(74xx02), NAND Gate(74xx00) and XOR Gate(74xx86). Data sheeds;



There are 12 input and output pins on logic gates. Of these, 8 for input to 4 for output. In the Proteus simulation, we created a logic gate ourselves, where we could not find an element with 8 inputs and 4 outputs.

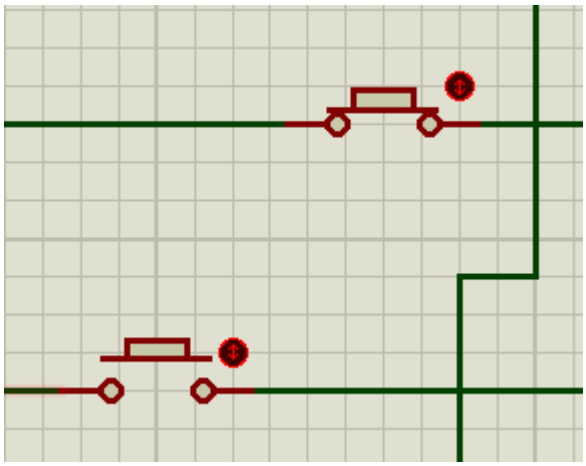






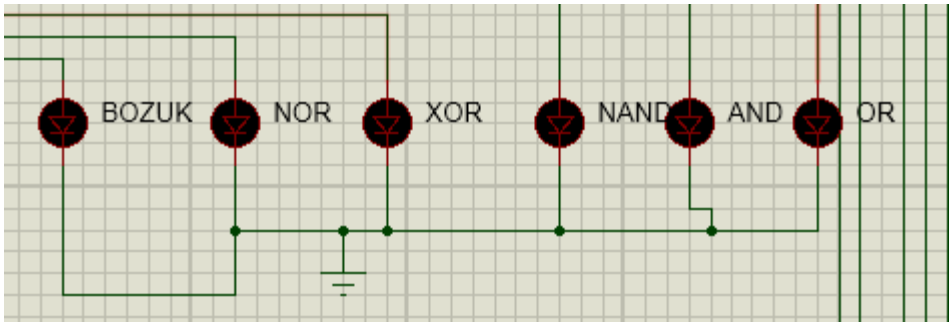
Buttons

We used the buttons instead of the 20 PIN ZIF socket in the project. So whatever logic gate we want to test, we open its buttons, we close the others.



LEDs

In the previous case of our project, we planned to receive our results via LCD. Because the number of pins is not enough, and to make the simulation clearer, we have replaced the LCD with a led for each logic gate and for its corrupted state.



Structure of the project

First of all, we introduced the truth tables of our logic gates to our microprocessor.

A	B
0	0
0	1
1	0
1	1

```
BSF PORTB,0;
BSF PORTB,1;
BSF PORTB,2;
BCF PORTB,3;
BCF PORTB,4;
BSF PORTB,5;
BCF PORTB,6;
BCF PORTB,7;
```

These values that we define as output according to PIC16F877A, we connected these values to the input pins of our logic gates by cables and gave the output values of the logic gates(OR, AND, NAND, XOR) as input to our microprocessor.

We have set a separate port(PORTC) for Nor logic gate because the input and output pins of NOR logic gate are different from the other logic gates we have tested

A	B
0	0
0	1
1	0
1	1

```
BSF PORTC,0;
BSF PORTC,1;
BSF PORTC,2;
BCF PORTC,3;
BCF PORTC,4;
BSF PORTC,5;
BCF PORTC,6;
BCF PORTC,7;
```

Logic Gate's Truth Tables

AND

INPUT		OUTPUT
A	B	
0	0	0
1	0	0
0	1	0
1	1	1

OR

INPUT		OUTPUT
A	B	
0	0	0
1	0	1
0	1	1
1	1	1

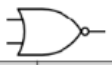
XOR

INPUT		OUTPUT
A	B	
0	0	0
1	0	1
0	1	1
1	1	0

NAND

INPUT		OUTPUT
A	B	
0	0	1
1	0	1
0	1	1
1	1	0

NOR



INPUT		OUTPUT
A	B	
0	0	1
1	0	0
0	1	0
1	1	0

According to the values entered into the microprocessor, we tested the name of the integrated and whether it worked.

```
OR
BTFSC PORTA,0;
GOTO NAND
BTFSS PORTA,1;
GOTO AND
BTFSS PORTA,2;
GOTO AND
BTFSS PORTA,3
GOTO AND
BSF PORTD,0; OR İÇİN
```

```
AND
BTFSC PORTA,0;
GOTO NAND
BTFSC PORTA,1;
GOTO NAND
BTFSC PORTA,2;
GOTO NAND
BTFSS PORTA,3
GOTO NAND
BSF PORTD,1; AND İÇİN
```

```
NAND
BTFSS PORTA,0;
GOTO XOR
BTFSS PORTA,1;
GOTO XOR
BTFSS PORTA,2;
GOTO XOR
BTFSC PORTA,3
GOTO XOR
BSF PORTD,2; NAND İÇİN
```

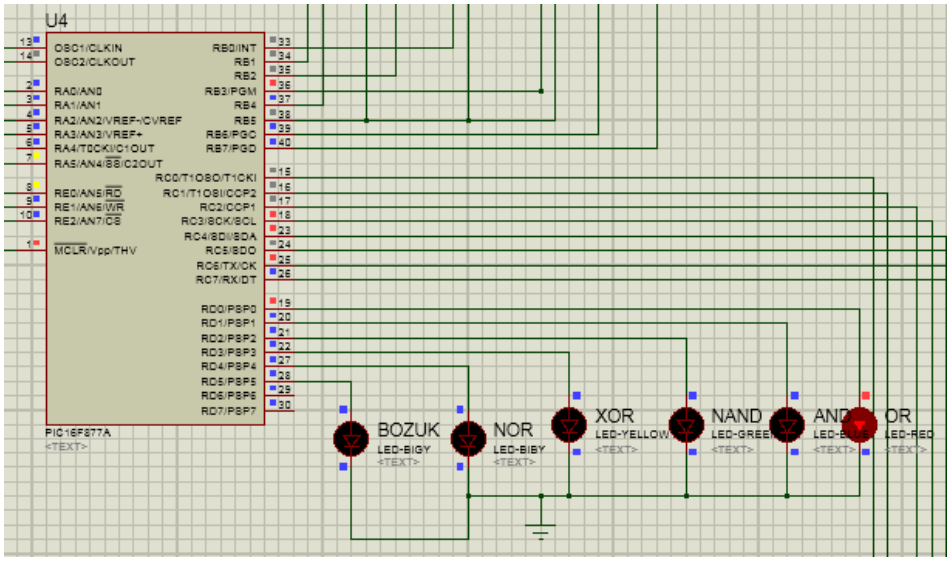
```
XOR
BTFSC PORTA,0;
GOTO BOZUK
BTFSS PORTA,1;
GOTO BOZUK
BTFSS PORTA,2;
GOTO BOZUK
BTFSC PORTA,3
GOTO BOZUK
BSF PORTD,3; XOR İÇİN
```

```
NOR
BTFSS PORTA,5;
GOTO BOZUK
BTFSC PORTE,0;
GOTO BOZUK
BTFSC PORTE,1;
GOTO BOZUK
BTFSC PORTE,2;
GOTO BOZUK
BSF PORTD,4; NOR İÇİN
```

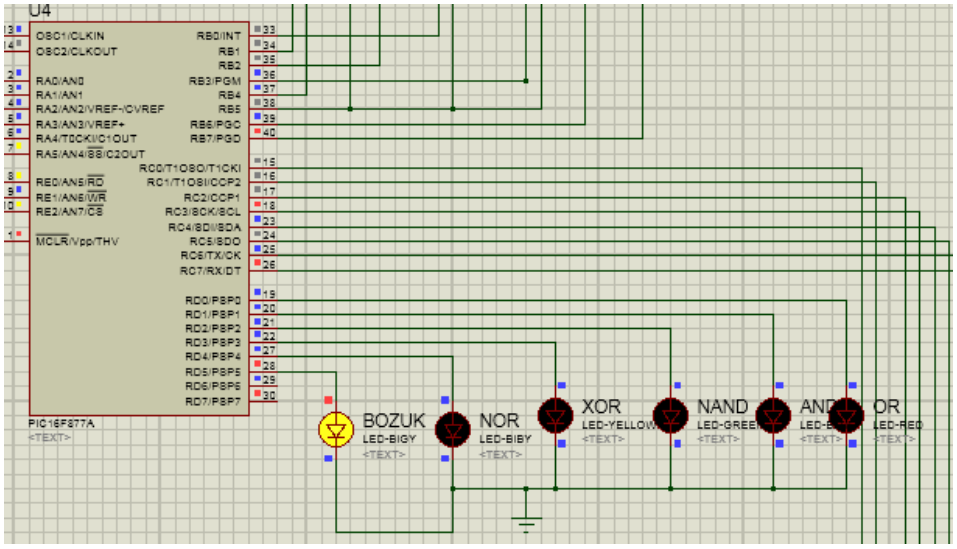
```
BOZUK
BSF PORTD,5; BOZUK
```

If it provides the right conditions, the led we set for that logic gate is on. If no conditions are met, according to the code, the logic gate is broken and the led we set for the corrupted is lit. We used all the gates in the simulation. We used a button instead of a 20pin ZIF socket. If we want to test which integrated button we connect to its outputs are activated, we leave the buttons of other logic gates open. So we check the logic gate according to the codes and Data Sheet we want.

For example, I want to test OR logic gate, turn off the button connected to OR and open the buttons of other logic gates. The LED we set for OR is lit and we understand that Logic gate is 'OR'.



If no conditions are provided, the led we have determined to be defective is lit.



Assembly codes

```
LIST P=16F877A
#INCLUDE <P16F877A.INC>
__config _CP_OFF&_WDT_OFF&_XT_OSC

   BANKSEL TRISB
        CLRF TRISB
BANKSEL TRISC
        CLRF TRISC
BANKSEL TRISA
        MOVLW 0XFF
        MOVWF TRISA
BANKSEL TRISD
        MOVLW 0X00
        MOVWF TRISD
BANKSEL TRISE
        MOVLW 0XFF
        MOVWF TRISE

        CLRF PORTB
        CLRF PORTC
        CLRF PORTA
        CLRF PORTD
        CLRF PORTE

BSF PORTB,0;
BSF PORTB,1;
BSF PORTB,2;
BCF PORTB,3;
BCF PORTB,4;
BSF PORTB,5;
BCF PORTB,6;
BCF PORTB,7;

BSF PORTC,0;
BSF PORTC,1;
BSF PORTC,2;
BCF PORTC,3;
BCF PORTC,4;
BSF PORTC,5;
BCF PORTC,6;
BCF PORTC,7;
```

NOR

```
BTFSS PORTA,5;
GOTO OR
BTFSC PORTE,0;
GOTO OR
BTFSC PORTE,1;
GOTO OR
BTFSC PORTE,2;
GOTO OR
BSF PORTD,4; NOR İÇİN
```

OR

```
BTFSC PORTA,0;
GOTO NAND
BTFSS PORTA,1;
GOTO AND
BTFSS PORTA,2;
GOTO AND
BTFSS PORTA,3
GOTO AND
BSF PORTD,0; OR İÇİN
```

AND

```
BTFSC PORTA,0;
GOTO NAND
BTFSC PORTA,1;
GOTO NAND
BTFSC PORTA,2;
GOTO NAND
BTFSS PORTA,3
GOTO NAND
BSF PORTD,1; AND İÇİN
```

NAND

```
BTFSS PORTA,0;
GOTO XOR
BTFSS PORTA,1;
GOTO XOR
BTFSS PORTA,2;
GOTO XOR
BTFSC PORTA,3
GOTO XOR
BSF PORTD,2; NAND İÇİN
```

XOR

```
BTFSC PORTA,0;
GOTO BOZUK
BTFSS PORTA,1;
GOTO BOZUK
BTFSS PORTA,2;
GOTO BOZUK
BTFSC PORTA,3
GOTO BOZUK
BSF PORTD,3; XOR İÇİN

BOZUK
BSF PORTD,5; BOZUK

END
```

Aleyna KARAPINAR
201614032