German-Russian Institute of Advanced Technologies

TU-Ilmenau (Germany) and KNTRU-KAI (Kazan, Russia)

Guidelines for laboratory work №5 of the subject

«**Computer systems**»

« Proteus Virtual System Modeling (VSM)

Part I. Some Logic Function Design

Part II. Delay Loops Applications Flasher & Counter »

Kazan 2014

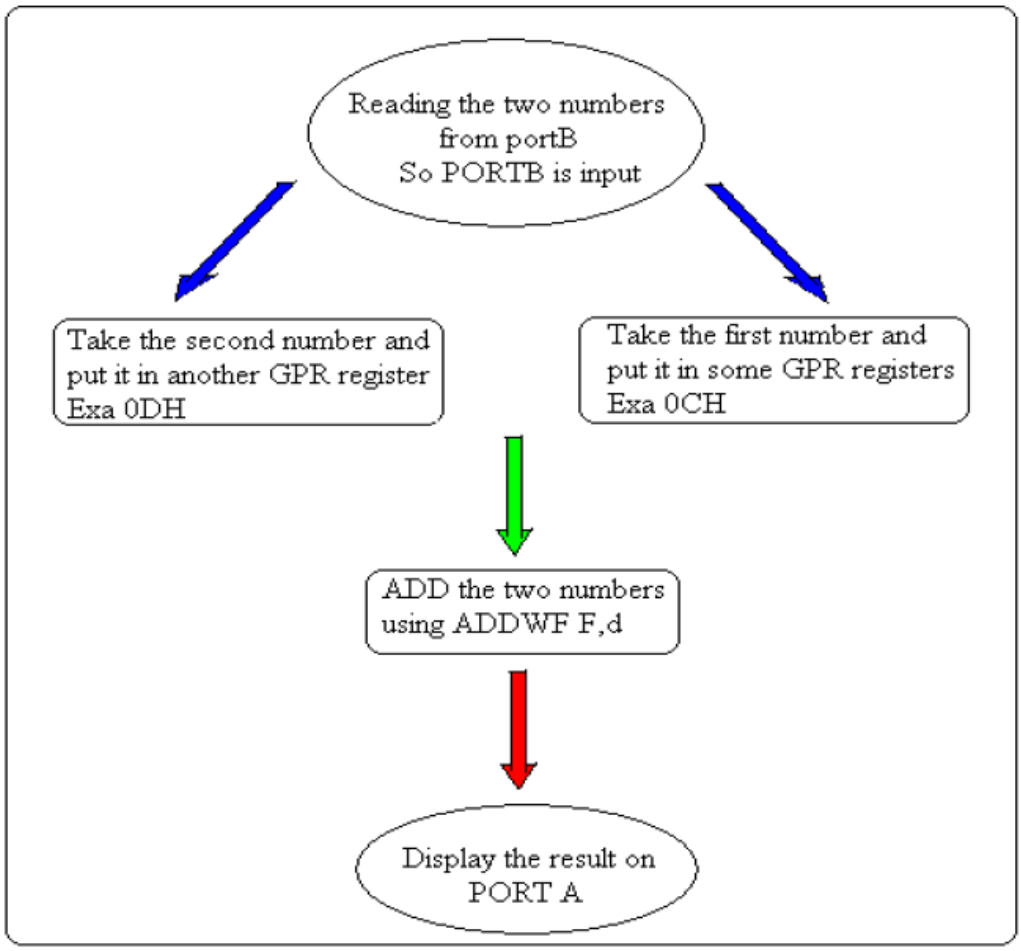
Proteus Virtual System Modeling (VSM)

Part I. Some Logic Function Design

In this laboratory work we will implement the Addition and Subtraction Functions using PIC16F84A microcontroller.

Addition and subtraction functions

The addition function is summarized as follow:



1. We use the method of **masking** to separate the two numbers, since the first number is in the LSB of PORTB and the second number is in the MSB, we separate the first number using the instruction ANDLW 0X0F, and the second number using the instruction ANDLW 0XF0.

2. After that before we add the two numbers, the first number is ready for addition but the second number needs to be swapped, so we use the instruction SWAPF F,d to swap it (swapping means F(0:3) = F(4:7), F(4:7) = F(0:3)).

3. After that we add the two numbers using the instruction ADDWF F,d and then we display the result on PORTA.

The subtraction function is the same as the addition function except you will subtract the two numbers instead of adding them. To avoid negative answer the first number must be greater than the second.

TASKS

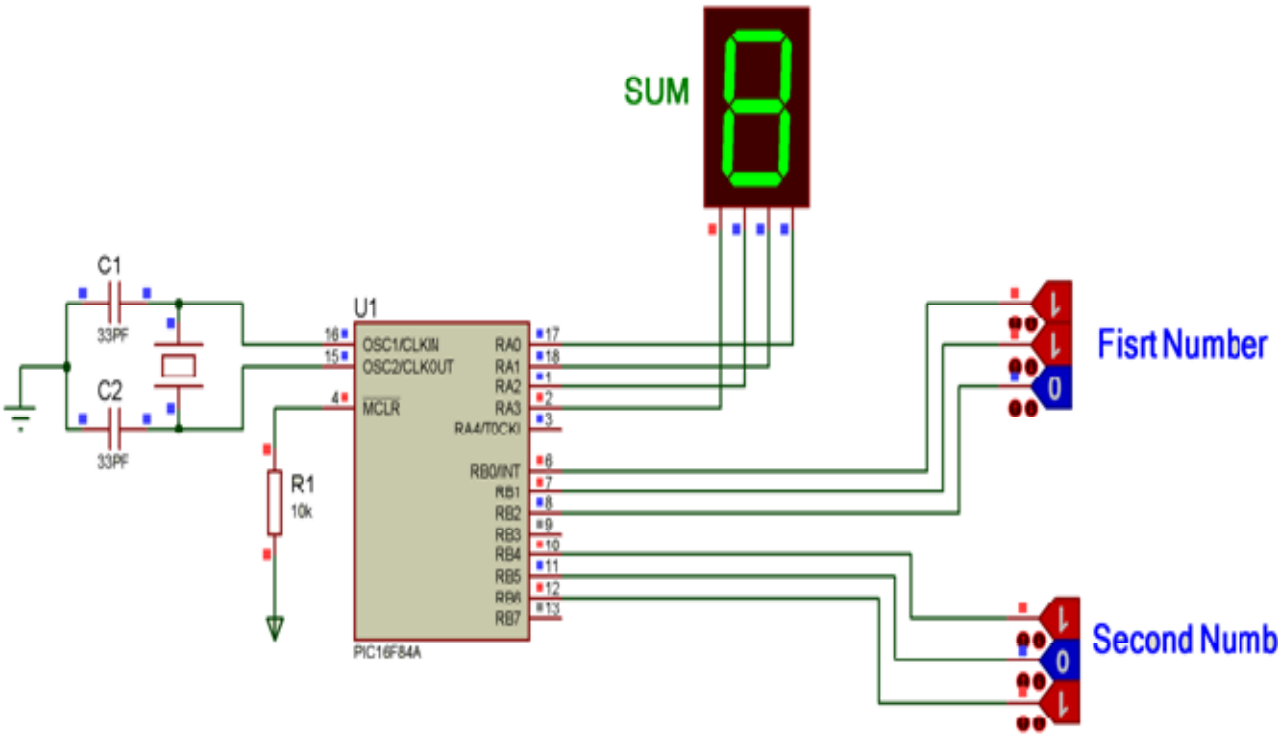
Addition Function

• Write an assembly program to achieve the addition of two numbers entered to port B and display the result on port A.

• Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated.

• Program a PIC 16F84A using the QL2006 programmer.

• Build the circuit using the programmed PIC 16F84A and then observe its operation. Demonstrate the circuits operation to the instructor.



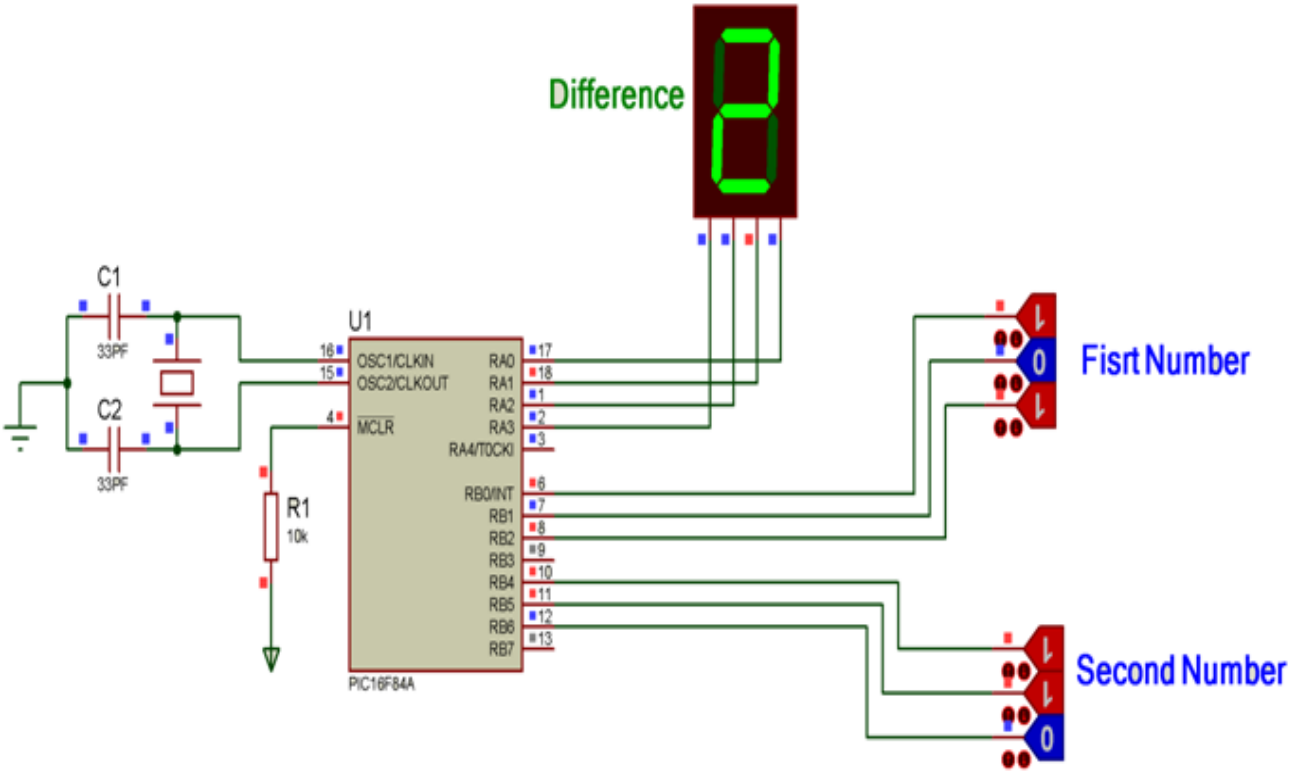
Subtraction Function

• Write an assembly program to achieve the subtraction of two numbers entered to port B and display the result on port A.

• Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated.

• Program a PIC 16F84A using the QL2006 programmer.

• Build the circuit using the programmed PIC 16F84A and then observe its operation. Demonstrate the circuits operation to the instructor. Present your results in a lab report including a copy of the source codes.



Part II. Delay Loops Applications Flasher & Counter

There are two methods to generate Delay in PIC16F84A Microcontroller:

• The first method is using TMR0, which is a built in timer in PIC16F84A microcontroller.

• The second method is using Delay Loops Technique. In this experiment we will know how to generate a Delay with a certain value using the Delay Loops Technique; after that we will use this delay to make some applications like Flasher and Counter.

The Ordinary Instructions need 1 cycle to be executed, but the cycles which cause the program counter (PC) to be changed need 2 cycles.

Examples

Movlw .100 → needs 1 cycle.
Movwf portb → needs 1 cycle.
Call delay → needs 2 cycles.
Goto loop → needs 2 cycles. And so on.

Delay Subroutine

Consider the following delay subroutine:

```
DELAY
MOVLW .255
MOVWF 0CH
LOOP1
MOVLW .255
MOVWF 0DH
LOOP0
(1)NOP
.
.
(n)NOP
DECFSZ 0DH,F
GOTO LOOP0
DECFSZ 0CH,F
GOTO LOOP1
RETURN
END
```

How to calculate the value of the Delay for this subroutine?
1) Look for the inner Loop
13(# of NOPS) + 1(DECFSZ 0DH,F) + 2(GOTO LOOP0) = 16
2) Intermediate Loop
1(MOVLW .255) + 1(MOVWF 0DH) + 1(DECFSZ 0CH,F) + 2(GOTO

LOOP1) = 5
3) Outer Loop
1(MOVLW .255) + 1(MOVWF 0CH) + 2(RETURN) = 4
So the value of the delay is
(16*255*255 + 5*255 + 4)*(4/Osc Freq) = 1.04sec (if Osc Freq = 4MHz).

Note that this value of the delay is not precise 100%, since we ignore that the instruction DECFSZ needs 2 cycles in the last turn, and hence this method (Delay Loops Method) is not effective for precise and large values of Delay.

TASKS

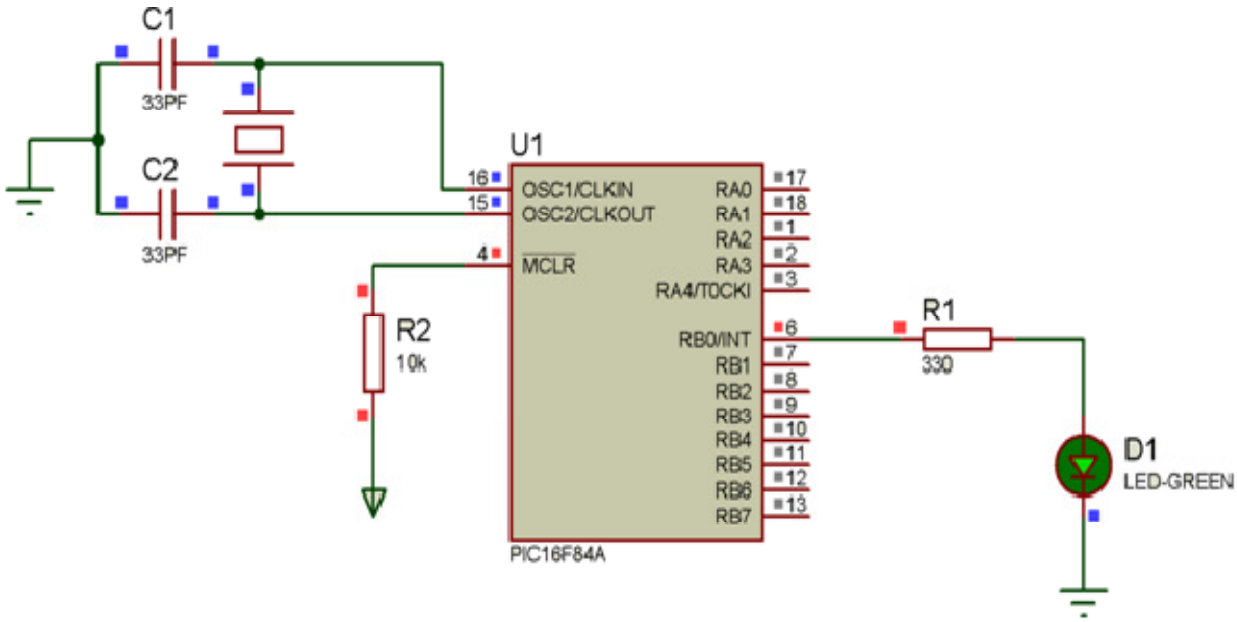
Flasher

• Write an assembly program to make a Flasher on RB0 (Hint: Use the Delay Subroutine).

• Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated

• Program a PIC 16F84A using the QL2006 programmer.

• Build the circuit using the programmed PIC 16F84A and then observe its operation. Demonstrate the circuits operation to the instructor.



Counter

• Write an assembly program to make a Counter (0 – 9) on Port A. RB0 (Hint: Use the Delay Subroutine).

• Simulate the program using the circuit shown in figure via Proteus software. Verify it operates properly when simulated

• Program a PIC 16F84A using the QL2006 programmer.

• Build the circuit using the programmed PIC 16F84A and then observe its operation. Demonstrate the circuits operation to the instructor. Present your results in a lab report including a copy of the source codes. How the

CONTROL QUESTIONS

1. How to write the addition function?
2. What is the method of masking?
3. How many methods do you know generating Delay in PIC16F84A?
4. What are these methods?

REPORT FORM

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Laboratory work 5

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Student: _____

Teacher: _____

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