Introduction:

Learning how to multiply two 3-bit numbers using assembly.

Equipment:

* Simon Board
* Atmel Studio 7

Procedure:

* Open Atmel Studio 7 and create a new assembly project.
* In order to do multiplication, addition is repeated multiple times.
* First PortA, and PortD are set to be inputs and outputs.
* By adding three to the register five times, the result will be equal to 3\*5.
* Map the sum to PortD, the LEDs light up to represent 15.
* For part 2, use the first three buttons, and the last three buttons to then multiply and map the result to the LEDs.
* Use the input pins to determine what is being added and how many times.
* Since the LEDs for each pin in PortD are flipped, reverse the bits.
* Check if each bit was active then map it to the corresponding LED.
* Output the bits to the PortD to the LEDs.

Results:

The two 3 bit numbers were multiplied as expected by the written code.

Questions:

1. Use a register to store the carried bit.
2. The code could use less machine states and does not consider edge cases.

Conclusion:

I learned how to create a project in Atmel Studio 7 to multiply two 3 bit numbers. I also learned how to reverse bits to correctly output the bits to the LEDs.

Appendices:

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; lab2.asm

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; port made configs

LDI R16, 0xFF

LDI R17, 0x00

OUT DDRD, R16

OUT PORTD, R16

OUT DDRA, R17

OUT PORTA, R16

MAIN:

IN R20, PINA

COM R20 ; switches are active low

LDI R16, 0x00

LDI R17, 0x00

CLC

ROR R20

ROL R16

CLC

ROR R20

ROL R16

CLC

ROR R20

ROL R16

LSR R20

LSR R20

; serialization 3 times on R17

IN R28, PINA

CLC

ROR R28

ROL R17

CLC

ROR R28

ROL R17

CLC

ROR R28

ROL R17

LDI R21, 0x00

MULT:

ADD R21, R16

DEC R17

BRNE MULT

; Reverse bits of R20 into R22

LDI R22, 0x00

CLC

ROR R21

ROL R22

CLC

ROR R21

ROL R22

CLC

ROR R21

ROL R22

LSR R21

LSR R21

; Complement and output the Result to PORTD since active low

COM R22

OUT PORTD, R22

CALL DELAY

RJMP MAIN

DELAY:

LDI R24, 255

D1:

LDI R25, 255

D2:

LDI R26, 25

D3:

NOP

NOP

DEC R26

BRNE D3

DEC R25

BRNE D2

DEC R24

BRNE D1

RET