**REQUIREMENTS NOT MET**

<insert any requirements not met, if applicable (if not applicable, write “N/A”)>

**PROBLEMS ENCOUNTERED**

<insert a brief summary of *all* problems encountered>

**FUTURE WORK/APPLICATIONS**

<insert a brief paragraph describing how the topics covered in this lab could potentially be used for other applications>

THE ABOVE SHOULD BE LIMITED TO THE FIRST PAGE, AND NOTHING ELSE SHOULD BE INCLUDED, WHICH ALSO IMPLIES THAT THIS SENTENCE OF TEXT SHOULD BE REMOVED.

**PRE-LAB EXERCISES**

**i. Which configuration register allows the utilization of an I/O port pin configured as an input? Which configuration registers allow the utilization of an I/O port pin configured as an output?**

**The “in” register of a port allows you to read the port as input.  
 The “out” register of a port allows you to output vales at certain pins.  
 The “outset” register writes a “high” signal to whichever bits are set to “1”  
 The “outclr” register writes a “low” signal to whichever bits are set to "1”  
 The “outtgl” register toggles a signal to whichever bits are set to "1”**

**ii. What is the purpose of the SET/CLR/TGL variants of the DIR and OUT registers?**

**The purpose is to allow you to adjust the signal levels of individual pins without   
Affecting other pins**

**iii. Are the LEDs on the OOTB Switch & LED Backpack active-high, or active-low? Draw a schematic diagram for a single LED circuit with the same activation level used on the backpack, as well as one with the opposite activation level. Also, draw a schematic diagram for a single-pole, single-throw (SPST) switch circuit, using the same pull-up or pull-down resistor condition utilized on the backpack, as well as another switch circuit using the opposite configuration.**

**iv. Which I/O ports are utilized for the DIP switches and LEDs on the OOTB Switch & LED Backpack?**

**The led circuits utilize port C  
 The switch circuit utilizes port A**

**v. Would it be possible to interface the OOTB µPAD with an external input device consisting of 24 inputs? If so, describe how many I/O ports would be necessary. If not, explain why.**

**The OOTB has 3 ports with 8 pins each. All ports are configurable as inputs. Therefore, it should  
be possible to connect a 24-pin input device.**

**PSEUDOCODE/FLOWCHARTS**

**SECTION 1**

A diagram of a flowchart

Description automatically generated with low confidence **Figure 1:Flowchart for “lab2\_1.asm”. This copies  
the switch circuit register values to the   
output registers for the LED’s**

**SECTION 2.1**

**A diagram of a flowchart

Description automatically generated with low confidence  
Figure 2: Flowchart for “lab2\_2.asm” with “delay\_10ms” being the only subroutine.  
This toggles pin 0 of port C every 10ms, giving us a 10ms PWM signal.**

**A diagram of a flowchart

Description automatically generated with low confidence  
Figure 3: Flowchart for “delay\_10ms” subroutine.  
“FAUS” creates a delay of 250us by executing 500 single cycle instructions.  
 “ONEKUS” creates a 1000us delay by running “FAUS” 4 times.  
“TENMS” creates a 10000us delay by running “ONEKUS” 10 times.  
Giving us a delay of 10ms.**

**PROGRAM CODE**

**SECTION 1**

;Lab 2, Section 1

;Name: Steven Miller

;Class #: 11318

;PI Name: Anthony Stross

;Description: Allows control of LED's through switch circuit

;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*INCLUDES\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

.include "ATxmega128a1udef.inc"

;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*END OF INCLUDES\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*EQUATES\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

.EQU INPUT = 0B00000000

.EQU OUTPUT = 0B11111111

;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*END OF EQUATES\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*DEFS\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

;\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*END OF DEFS\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

;\*\*\*\*\*\*\*\*\*\*\*MEMORY CONFIGURATION\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

;\*\*\*\*\*\*\*\*\*\*\*END OF MEMORY CONFIGURATION\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

;\*\*\*\*\*\*\*\*\*\*\*MAIN PROGRAM\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

.CSEG

.org 0x0100

MAIN:

;set port directions

LDI R16, INPUT

STS PORTA\_DIR , R16

LDI R16, OUTPUT

STS PORTC\_DIR , R16

;loop for actual led and switch circuits

LOOP:

;copy load value from switch registers into led registers

LDS R16, PORTA\_IN

STS PORTC\_OUT,R16

RJMP LOOP

;\*\*\*\*\*\*\*\*\*\*\*END MAIN PROGRAM\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

**APPENDIX**

<insert copy of all *supporting* ASM or C program code, e.g., header files referenced within your programs, as well as any other relevant information, e.g., screenshots (with meaningful captions), when applicable (if not applicable, write “N/A”)>