Assignment 3A (50 marks) – Lab Week Nine

Due: End of your Week Ten's Lab Period – Week of 25 – 31 Mar 2018

This Lab has a Pre-Lab Component

Note: Your mark on Blackboard will be normalized to a mark /5

Late submissions will not be accepted and will receive a mark of zero (0).

I encourage you to start (or complete) this lab by Lab Week Nine and come to the lab prepared to demo no later than the start of Lab Week Ten. In that manner, you will not be "rushed" trying to get things done and competing for a Hardware Board "at the last minute" during Lab Week Ten!

More Assembly Programming – Using the Dragon 12 PLUS Trainer, Completing Code and Tracing a Program

PURPOSE OF LAB:

*The purpose of this lab is to gain experience in Assembly Language using **AsmIDE** using the **Dragon12 & Student Mode Simulator** and the **Dragon 12 PLUS Trainer** hardware board by creating software that will display values on Light Emitting Diodes (LEDs).*

Additionally, we will exercise our knowledge of Flowcharts and Pointers in Assembly Language.

PRELAB PROCEDURE – Preparing Your Computer for use with the Dragon 12 PLUS Trainer Hardware Board

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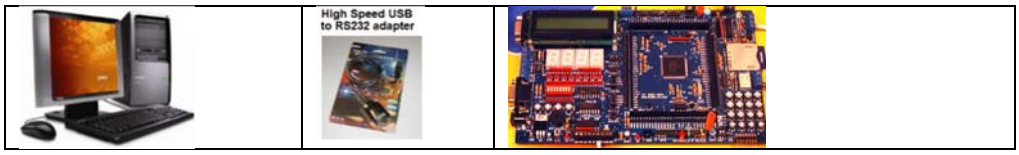


*In order to communicate with the Dragon12-Plus board, a USB to RS232 driver must be installed and configured **PRIOR TO YOUR LAB PERIOD**. The following instructions are provided to accomplish this.*

Resources

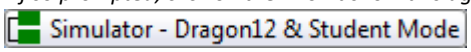
Prolific USB to Serial Bridge Chip Family Windows Driver and User Manual

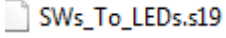
a. *Download the Prolific Driver Package from Blackboard and decompress the file.*
b. *Double click the driver install program, and then follow the prompts to continue with the installation.*
c. *Click Finish once the driver has been installed.*
d. ***Reboot your computer***

Important Step!

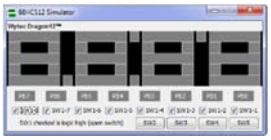
Now you are ready to connect the hardware board in the lab and complete the remainder of the installation.

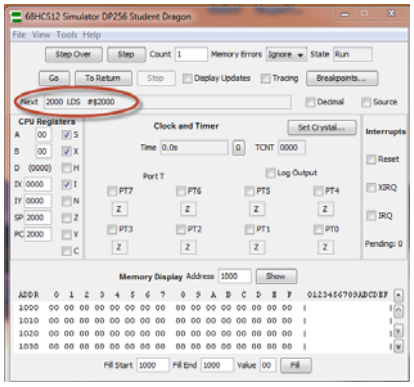
Assembly Language Implementation of Displaying Switch Values on LEDs

1. *Assemble SWs_To_LEDs.asm, which was provided to you with this assignment, then start the simulator.*
2. *If so prompted, click on the "Don't show this again unless necessary check box" then click on the*
   

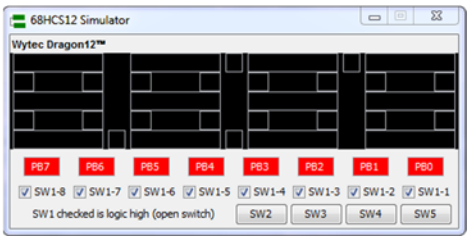
   "Dismiss" button.
3. *Use File → Load to locate*  *and load the file into the simulator.*

4. *To view the LEDs and Switches in the simulator, click on View → Parallel Ports, which will bring up the display on the right.*
5. *If you have correctly loaded the file, then **2000 LDS #$2000,** which is the first line of code within the program, will be displayed in the simulator as illustrated on the next page.*



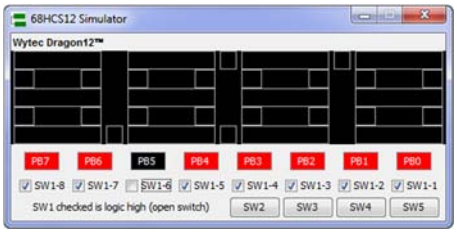


6. *Clicking on "Go" in the simululator should realize the following being displayed.*



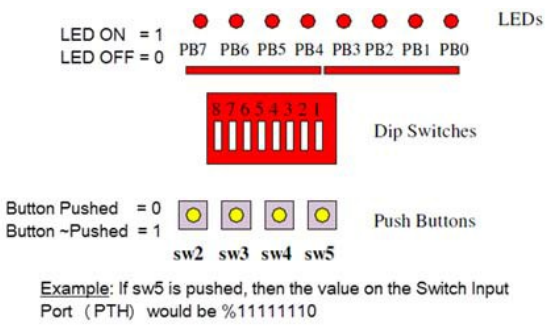
7. *The display shown in the previous paragraph indicates that all of the Switches are in the "ON" position. Technically, this means that each of the Port H (PTH) switch values are a logic level "1" or "+5V", turning on the common Cathode LEDs.*

8. *Now, click on any of the SW1-1 to SW1-8 check boxes, which simulate the physical DIP switches on Port H of the hardware board. Observe the resulting changes to the LEDs on Port B. You should observe a direct correlation with the Switches. That is, if SW1-6 is "unchecked", then PB5 is turned off as per the following display (binary code %11011111), noting that the Switches are numbered 1 – 8 and the PortB LEDs are numbered PB0 – PB7. Then, if SW1-6 is "checked", PB5 will turn on again. Try this with several of the switches and look at the source code so that you can gain an understanding of what is occurring.*



9. *Clicking on* 

and holding the switch down will also cause the associated LED on PB3, PB2, PB1 and PB0 to momentarily turn off until you release the switch – test this as well to ensure that you obtain the expected results. Ensure you read the comments in SWs_To_LEDs.asm and copy down the displayed values for SW2, SW3, SW4 and SW5 as you require these values for another program in this assignment.

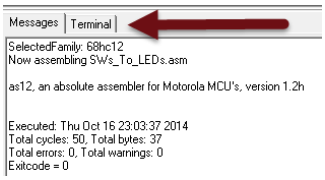


IN LAB CONFIGURATION PROCEDURE – SHOULD BE COMPLETED AT THE BEGINNING OF THE LAB

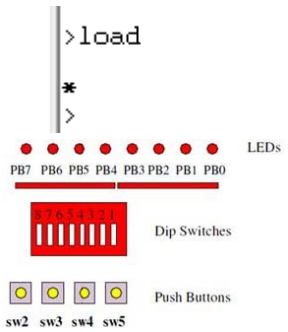
Checking Your Software on the Wytec HCS12 Dragon12-Plus board

In order to communicate with the Dragon12-Plus board, you previously installed a USB to RS232 driver. Now you must complete the installation process by connecting the hardware board using the following instructions:

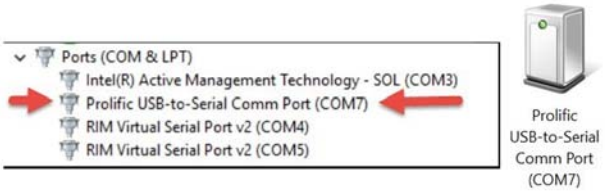
a. *Plug the powered-on Dragon12 Plus Board into a USB port on your computer. You should then notice a Driver Installation dialogue, noting that you may not see it if under Windows 10.*
b. *Once the installation is complete, the hardware will be ready to use as indicated by the following "example."*
c. *Run AsmIDE and Configure it as follows:*
   a. *Load and assemble your program that you have previously tested in the simulator*
   b. *Select View → Options*
   c. *Select COM Port → COM 3 (**use Window's Device Manager → Ports to determine the correct Comm Port # if you don't know which one it is**) (see next page)*
   d. *Click on "Set COM Options" A new dialogue box opens.*
   e. *Click on "OK" in that dialogue box.*
   f. *Click on "Enable the Terminal Window"*
   g. *Click on "OK"*
   h. *You should now see the Terminal Tab in the lower IDE window*
   i. *Click on the "Terminal" Tab*



   j. *Click any place in the Terminal window to get focus for that window.*
   k. *Press "Enter" on your keyboard – you should observe the display to the right. (If not, then press the Blue Reset Button located on the lower-middle portion of the board to end the program on the board).*
   l. *Type "load" (without the quotes) and press "Enter", then press the lightning bolt (or use Build →Download) and observe the display to the right:*
   m. *In the Terminal window, type "g 2000" (without the quotes) and press "Enter." Observe the LEDs on the Dragon12 Plus board. Note that "g 2000" executes the program code starting at address $2000 and that there is a <space> between 'g' and '2000'*
   n. *Experiment with the Switches on the board to confirm that the LEDs turn on/off as per what you observed in the simulator.*
   o. *Press the Blue Reset Button located on the lower-middle portion of the board to end the program on the board.*



Note: If you missed the Comm Port display or you are using Windows 10, then you can always determine what Comm Port via the Window's Device Manager as per the "example" to the right.



Assessment Portion of Assignment 3A (50 Marks) – Lab Exercise Week Nine
Note: Your mark on Blackboard will be normalized to a mark /5

Task One – Switch it Up! (30 marks)

Using the software Assembly Language Implementation of Displaying Switch Values on LEDs (Switches_to_LEDs.asm) on page 1 of this assignment, you should have discovered that pressing one of the four Push Buttons SW2, SW3, SW4 or SW5 resulted in the associated LED being momentarily turned off until the switch was released – e.g. pressing SW2 momentarily turned off PB3.

In Task One, you create an Assembly Language program *Switch_It_Up.asm, which has its* requirements detailed in the video in the compressed file on Blackboard.

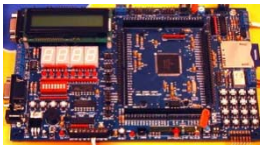
18W Switches 2-5.zip

To assist you with this task, the problem solution flowchart and a partial code listing (skeleton code) has been provided on Blackboard.

Switch_It_Up.asm
Visio-18W_Flowchart for Switch_It_Up.pdf

A notepad version of the code (Switch_It_up.txt) has also been supplied in case the .asm code becomes misaligned when loaded into ASMIde.

As part of your solution, you are to complete to the program listing; complete the missing Switch values; use all of the CONSTANT values provided; ensure that your header information is complete and accurate; code properly aligned and commented; code conforms to the flow of the provided flowchart; code is totally functional as per the requirements in the supplied video



You will demonstrate your solution using the Wytec Dragon 12+ Hardware board,

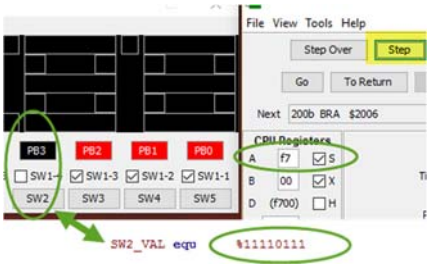
ensuring first that your solution works using the Simulator

Simulator - Dragon12 & Student Mode

Hint:

*You will have to determine the **binary** values input from Port H for each of SW2, SW3, SW4 and SW5. Given that Dip Switches SW1-4 to SW1-1 use the same physical connections as SW2-SW5, you can determine the missing values by single stepping through SWs_To_LEDs.asm (see page 1) to complete the supplied source code, a snippet of which is repeated below.*

```
25 ; When one of switch S2 - S4 is pressed, these values are input on Port H (PTH)
26 ; Note that only ONE bit can be a zero (0) at any one time
27 SW2_VAL equ     %111110111
28 SW3_VAL equ
29 SW4_VAL equ
30 SW5_VAL equ
```



You can accomplish this by following the instructions in paragraph 10 of the pre-lab instructions.

Task Two – Write Some Code Snippets on page 1 of the Hand-In Sheet (9 Marks)

Task Three – Complete the Program Tracing material on page 2 of the Hand-In Sheet (11 Marks)

Assignment 3A (50 marks) – Lab Week Nine – Hand-In Sheet (Page 1 of 2)

Due: End of your Week Ten's Lab Period – Week of 25 – 31 Mar 2018

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Please staple the pages together.

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Name: _____ Indicate Your Lab Period

Student Number: _____ _____

For all Tasks with demos, there is only ONE Demo permitted on the hardware boards. If you have problems with your solutions in the simulator, discuss them with me BEFORE you demo on the hardware board. This means being prepared to demo your solutions during the early stage of the lab period; not "at the last minute!"

Task One – Switch it Up! (20 marks)

A. *Demo of your solution on the Hardware Board (Must work 100% correct for full credit)* *Professors Initials: _____* */10*

B. *Post-Lab Code Inspection Check-Off List (Hand in a Hard Copy of your Switch_It_Up.asm code listing printed from ASMIde)*

As part of your solution, you are to complete to the program listing; complete the missing Switch values; use all of the CONSTANT values provided; ensure that your header information is complete and accurate; code properly aligned and commented; code conforms to the flow of the provided flowchart; code is totally functional as per the requirements in the supplied video

✓ *Switch Values correctly coded as Binary values*	*/3*
✓ *Used all of the CONSTANT values provided*	*/3*
✓ *Header information complete and correct*	*/2*
✓ *Code properly aligned and commented*	*/3*
✓ *Code conforms to the flow of the provided flowchart*	*/9*

Post-Lab Code Inspection – Total of Available Post-Lab Code Inspection Marks */20*

***Note**: If the Post-Lab Code Inspection reveals that the code is not functional, a mark reduction of 10 marks will be applied.*

Task Two – Write Some Code Snippets (*9* Marks)

Write a single line of code, using the HCS12 Instruction Set, that performs the listed Required Operation.
*Hint: You **should** use the two-page Instruction Set handout on Blackboard, which will be included with the Term Test).*

Note: All lines of code are independent from each other.

Required Operation	*Line of Code*
a. Points Y to the address designated by the label My_Array	
b. Loads B with the value where X points	
c. Loads A with the value stored two memory locations past where X points	
d. Stores A at the location where Y points and then increments Y by one	
e. Stores D at the memory location four positions past where X points	
f. Stores D at the memory location where X points and then increments X by two	
g. Loads A with the value one position past where X points	
h. Increments X	
i. Loads X with the value where X points	

Post-Lab Code Snippets */9*

Assignment 3A (50 marks) – Lab Week Nine – Hand-In Sheet (Page 2 of 2)

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Name: _____ Indicate Your Lab Period

Student Number: _____ _____

Task Three – Program Tracing (11 Marks)

*(Given the following program listing, trace the results (hexadecimal value of registers being asked) of each program step **after** the line of code has been executed, as per the example answer for the Stack Pointer (SP).*

*Ensure all Hexadecimal values are **CAPITALIZED** and preceded by a **$** sign.*

*Hint: You **should** use the two-page Instruction Set handout on Blackboard, which will be included with the Term Test).*

```
1  ; 18W_Trace1.asm
2
3          org     $1000
4  Data1   db       $55, $19, $35, $08
5  Data2   db       $00, $FF, $10, $01, $E7, $9E, $8F, $31
6
7          org     $2000
8          lds     #$2000          ; SP =?  ____$2000_____ <= example answer
9
10         ldy     #Data1          ; Y = ?  _____________  (1 mark)
11
12         ldab    4,y             ; B = ?  _____________  (1 mark)
13
14                                 ; Y = ?  _____________  (1 mark)
15
16         ldaa    1,y+            ; A = ?  _____________  (1 mark)
17
18                                 ; Y = ?  _____________  (1 mark)
19
20         ldab    0,y             ; B = ?  _____________  (1 mark)
21
22                                 ; Y = ?  _____________  (1 mark)
23
24         ldx     #Data2          ; X = ?  _____________  (1 mark)
25
26         ldd     6,x+            ; D = ?  _____________  (1 mark)
27
28                                 ; X = ?  _____________  (1 mark)
29
30         std     2,x+            ; X = ?  _____________  (1 mark)
31
32         swi
33         end
34
```

Post-Lab Code Evaluation */11*

The solution to Task Two and Three of this assignment will be posted on Blackboard after 8 p.m. on Thursday, March 29, 2018