Assignment 2B (30 marks) – Lab Week Seven

Due: End of your week Eight's lab period: Week of 26 – 30 Oct 2015

Second Assembly Program – Assemble and Trace

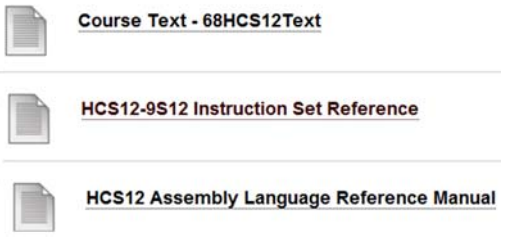
This portion of the lab exercise has you create and trace a simple program using 68HCS12 Assembly Language as the target language using ***AsmIDE*** *and* ***Simulator – Dragon12 & Student Mode*****.**

PURPOSE OF LAB:

The purpose of this lab is to gain more experience with both the assembler and simulator that will be extensively used in this course. Additionally, you will have the opportunity to confirm your understanding of Mathematical Principles taught during in-class lectures.

Resources:

The following material is available on Blackboard in the Resources folder to assist you in answering questions contained in this lab exercise. The Help feature in ***AsmIDE*** may also be of assistance to you.



Task One – Assemble; Trace; Answer (26 Marks)

a. Load the source code for Math_Operations.asm into ***AsmIDE*****.** You may find that you will have to align Labels, Opcodes, Operands and Comments into their correct columns in order to correctly assemble the program. This alignment was explained in a previous lab exercise and discussed in a lecture period.

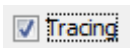
```
1  ; Math_Operations.asm
2  ;
3  ; Author:          D. Haley
4  ; Student Number:  nnn-nnn-nnn
5  ; Date:            4 Oct 2015
6  ;
7  ; Purpose:         To Gain Experience with Assembly Language instructions
8
9  ; Program Constants
10 STACK   equ     $2000
11
12         org     $1000           ; Data starts at $1000
13 MyArray db      $0C,$81
14 Result  ds      2
15
16         org     $2000           ; Program Code starts at $2000
17 Start   lds     #STACK          ; Setup the stack
18
19         ldaa    #$25            ; Note: This code is purposely NOT documented
20         ldab    #25
21         adda    MyArray
22         staa    Result
23         stab    Result+1
24         ldaa    Result+1
25         ldab    Result
26         incb
27         ldaa    #%10101010
28         std     Result
29         swi
30         end
```

b. Assemble the code, ensure that there are no errors or warnings present.

c. Start ***Simulator – Dragon12 & Student Mode*** and load Math_Operations.s19

d. As you 

through the program, **trace the Task One – Part One Questions on the A2B Lab Week Seven Hand-In sheet.**

e. Once you have completed the above steps, prepare the simulator to rerun the program by using **File → Reset**. Now, click on 

then select **View → Console Log** and Step through the program again. What you will observe is a complete trace of your program, which is very handing in debugging Assembly Language programs!

f. Now, **answer the Task One – Part Two Questions on the A2B Lab Week Seven Hand-In sheet.**

Assignment 2B (30 marks) – Lab Week Seven Hand-In Sheet (Due: End of your week Eight's lab period).

Name: _____

Student Number: _____

Circle Your Lab Period/Time

Tue: 10 – 12 Wed: 1 – 3 Wed 3 – 5 Fri 2 – 4

Task One – Part One Questions (18 marks)–Place your answers in the allocated space.

Record the values of the registers and memory locations **after** executing each listed instruction for ***Math_Operations.asm***. Watch how each instruction changes the memory locations and registers that are recorded in the table.

Ensure all hexadecimal values are proceeded with a dollar ($) sign and are in CAPITAL LETTERS – e.g. $4F (otherwise, marks may be deducted).

To assist you, I have included the entries for the first line of interest in the supplied source code listing, which is line 19 **ldaa #$25**. Note that memory locations $1000 and $1001 were filled with their values before line 19 executes.

Line, Instruction		PC	A	B	D	$1000	$1001	$1002	$1003
19	**ldaa #$25**	$2005	$25	$00	$2500	$0C	$81	$00	$00
20	**ldab #25**								
21	**adda MyArray**								
22	**staa Result**								
23	**stab Result+1**								
24	**ldaa Result+1**								
25	**ldab Result**								
26	**incb**								
27	**ldaa #%10101010**								
28	**std Result**								

Task One – Part Two Questions (12 marks) – Place your answers in the allocated space.

Now, based upon the values in the above table, answer the following questions.
Ensure all hexadecimal values are proceeded with a dollar ($) sign and are in CAPITAL LETTERS – e.g. $4F (otherwise, marks may be deducted).

Question	Answer
a. How did $1000 and $1001 initially have their memory addresses filled with the indicated values at line 19? To answer this question, replicate the line of code that accomplished that.	
b. After the execution of line 20, what value is loaded into Accumulator B?	
c. After the execution of line 21, the address associated with the label “MyArray” has its value changed. What is that address?	
d. After the execution of line 21, the value in Accumulator A changed. What arithmetic operation took place?	
e. After the execution of line 22, the address associated with the label “Result+1” has its value changed. What is that address?	
f. What high-level programming function do lines 23 to 25 perform? (5 marks – think about this one)	
g. What address mode is used in line 27? To answer this question, look up Load Accumulator A (LDAA) in the HCS12 Assembly Language Reference Manual. This instruction uses a Source Form of *opr8a*	
h. What address mode is used in line 28? To answer this question, look up Store Double Accumulator (STD). This instruction uses a Source Form of *opr16a*	