Lab1 Environment setup and Debugger Operation

實驗一 實驗環境建立與Debugger操作

1. Lab objectives 實驗目的

Test the kit.

Familiar with the development environment.

測試實驗器材

熟悉開發環境

2. Steps 實驗步驟

2.1. Project creation and Program compilation 專案建立與程式編譯(20%)

Create a STM32 eclipse project according to lab0. Add a "main.s" code as follows and observe program execution result through debugger.

請依照助教給的lab0教學，建立一個 STM32 eclipse project，新增一個程式碼如下的 main.s 並透過 debugger 觀察程式執行結果。

```
   .syntax unified
   .cpu cortex-m4
   .thumb

.text
   .global main
   .equ AA, 0x55

main:
   movs r0, #AA
   movs r1, #20
   adds r2, r0, r1

L: B L
```

Q: What is the R2 value after the program is executed ? How to observe ?

程式執行結束後 R2 值為多少？如何觀察？

2.2. Variable declaration and Memory observation 變數宣告與記憶體觀察 (40%)

Modify "main.s" into the following code and compile and execute and observe program execution result, and observe the X content value change through the memory monitor. Then answer the question.

將main.s修改成以下程式碼並編譯執行觀察程式執行結果，並透過memory monitor觀察X內容值變化與回答問題。

```
   .syntax unified
   .cpu cortex-m4
   .thumb

.data
   X: .word 100
   str: .asciz "Hello World!"
.text
   .global main
   .equ AA, 0x55

main:
   ldr  r1, =X
   ldr  r0, [r1]
   movs r2, #AA
   adds r2, r2, r0
   str   r2, [r1]

   ldr   r1, =str
   ldr   r2, [r1]
L: B L
```

Q1: Where is the initial value of the variables X and str initialized by whom?

變數X與str的初始值是由誰在何處初始化的？

Q2: What happens the program execution result if I change the X declaration to the text section?

若將X宣告改在text section對其程式執行結果會有何改變？

Q3: What is the difference between the r2 content and the str string in the first 4 bytes of memory after the program is executed?

程式執行完畢後r2內容與str字串在memory前4個byte呈現內容有何差異？

Q4: The variable str "Hello World!" Is there any other way to declare? If there is one, please explain one of them.

變數str “Hello World!” 有無其他種宣告方式？若有請說明其中一種。

2.3. Simple arithmetic and basic memory instruction operations 簡易算數與基本記憶體指令操作(40%)

This part of the lab requires students to declare three X, Y, and Z variables of length 4 bytes in the data section and calculate the following formula using the ARM assembly language. Find the memory address of these variables and observe the program execution results.

這部分實驗需要同學在 data section 中宣告三個 X, Y, Z 長度為 4 byte 的變數並利用 ARM 組合語言計算以下式子。找出這些變數的memory address並觀察程式執行結果。

```
X = 5
Y = 10
X = X * 10 + Y
Z = Y - X
```

Note: This program requires the use of arithmetic instructions MULS, ADDS, SUBS and memory read / write operation instructions LDR, STR

該程式需使用到算數指令MULS, ADDS, SUBS及記憶體讀寫操作指令LDR, STR