


Lab Assignment-1

[Weightage - 15%]

Assignment Instructions:

1. Assignment should be solved individually.
2. **No marks will be awarded if plagiarism is detected.**
3. Questions can be performed in simulation mode.
4. It is mandatory to create a uVision Project folder in D:/ or E:/ or any other drive of your computer and give name to that folder as your BITS_ID e.g. 2022MT13xxx.

 2022MT13xxx

Under this folder, you will do assignment wise folders and save Keil project in that folder.

5. Please take complete (without cropping) screen shots of the KEIL IDE-in debug mode to demonstrate the desired output. Ensure that the screenshot captures **system date and time**.
6. Screenshots must be clearly visible (good resolution). For blur, adjusted, cropped and without system date and time screenshots, marks will be reduced.

Submission instructions:

Upload a single PDF document (named based on your BITS-ID number and name (**ID-No_Full-Name**)) which consist of answers of questions and relevant screenshots on Course Website (<http://taxila-aws.bits-pilani.ac.in>).

Submission Date: on or before **September 11, 2024**.

Q.1. Assembly Language Programs (ALP) for an ARM7TDMI processor to implement following IF-ELSE statement are given below:

```
if ( a<b)
{
    x=5
    y=c+d
}
else
    y=c-d
```

Code-1:

```
AREA RESET, CODE, READONLY
ENTRY
START
    ADR R4,SRC
    LDR R5,=DST
    BL SUB1
STOP B STOP
SUB1 LDR R0,[R4],#4
    LDR R1,[R4],#4
    CMP R0,R1
```

```

        BGE  FB1
        LDR R0,[R4],#4
        LDR R1,[R4],#4
        ADD R0,R0,R1
        MOV R2,#5
        STR R2,[R5],#4
        STR R0,[R5]
        B AFT
FB1     LDR R0,[R4],#4
        LDR R1,[R4]
        SUB R0,R0,R1
        STR R0,[R5,#4]
AFT     MOV PC,LR
SRC     DCD 0x20, 0x40, 0x30, 0x10
        AREA RESULT, DATA, READWRITE
DST     DCD 0, 0
        END

```

Code-2:

```

        AREA RESET, CODE, READONLY
        ENTRY
START
        ADR R4,SRC
        LDR R5,=DST
        BL SUB1
STOP    B STOP
SUB1    LDR R0,[R4],#4
        LDR R1,[R4],#4
        CMP R0,R1
        LDR R0,[R4],#4
        LDR R1,[R4]
        MOVL R2,#5
        STRLT R2,[R5]
        ADDLT R0, R0, R1
        SUBGE R0, R0, R1
        STR R0,[R5,#4]

AFT     MOV PC,LR
SRC     DCD 0x20, 0x40, 0x30, 0x10
        AREA RESULT, DATA, READWRITE
DST     DCD 0, 0
        END

```

Simulate the above given Code-1 and Code-2 using Keil uVision5 software for ARM7TDMI processor or LPC2378 microcontroller and answer the following questions.

- a) On reset what is the ARM7TDMI processor's state and mode of operation? [2 Mark]

- b) How many states are taken for the execution of an Arithmetic instruction, Load and Store instruction respectively (For Code-1)? [2 Mark]
- c) Are the number of states taken for completion same for BGE instruction if the branch – (1) is taken (2) not taken? Please give the states are taken for each. (For Code-1) [2 Mark]
- d) Measure the performance of code-1 and code-2 for the following conditions [2 Mark]

Condition	Code-1- States	Code-2- States
a<b		
a>b		
a=b		

- Q.2. Write an assembly language program for ARM7TDMI to count the number of 0's and 1's in the last 5 digits of your BITS ID (number must be given in decimal number format). Store the number of 0's in register R0 and the number of 1's in register R1. Verify your result by performing manual calculation.

Give suitable screen shots of the KEIL IDE-in debug mode to demonstrate the desired outputs. Ensure that the screenshot captures system date and time.

[10 Marks]

- Q.3. Write an assembly language program for ARM Cortex M3/4 to handle Supervisor Call (SVC) exception. The program should meet the following requirements:

1. The SVC should be called from an application task running at Thread unprivileged mode. [SVC number must be your BITS ID either last 3 digits or last 2 digits, depending on whether it's less than (or equal) or greater than to 255 (number must be given in decimal number format)]
2. Two parameters [each parameter is last 5 digits of your BITS ID (number must be given in decimal number format)] should be passed to the SVC handler.
3. The SVC number should be determined dynamically by examining the actual SVC instruction in memory.
4. The SVC exception handler should set up a stack pointer in SVC mode before handling the exception.
5. If the SVC number matches your BITS ID (either last 3 digits or last 2 digits, depending on whether it's less than or equal to 255), the handler should perform addition of the two passed parameters.
6. If the SVC number does not match your BITS ID, the handler should perform subtraction of the two passed parameters. Ensure that the program properly handles stack usage and resumes the application task after performing the required operation.

Give suitable screen shots of the KEIL IDE-in debug mode to demonstrate the desired outputs. Ensure that the screenshot captures system date and time.

[12 Marks]