Experiment 5: ARM Assembly - Computations in ARM

Santhosh S P ee21b119

Problem 1

Problem statement

Compute the factorial of a given number using an ARM processor through assembly programming.

Flowchart for the program

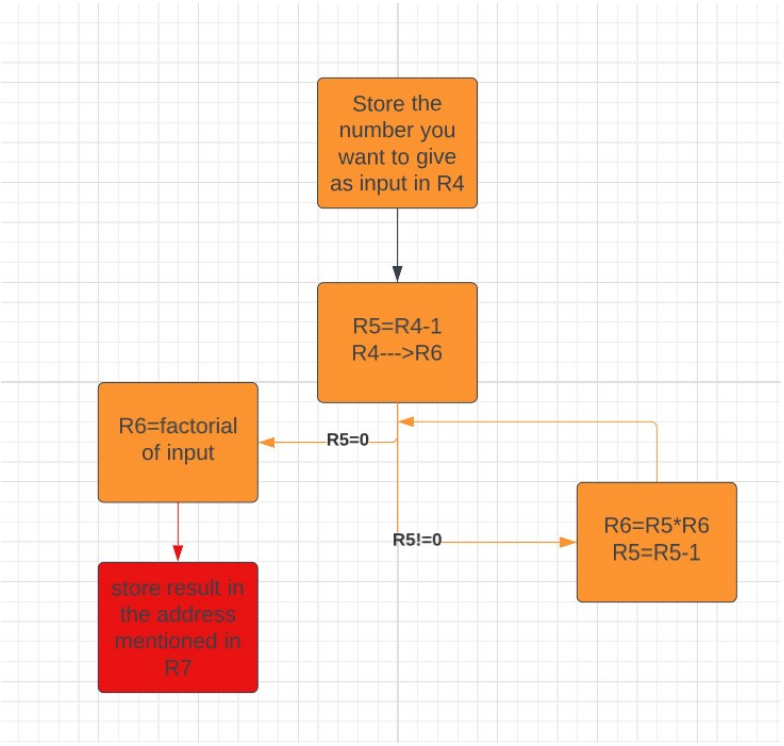

Figure 1: Flowchart for the problem

Code for the problem:

```
AREA Program,CODE,READONLY
ENTRY
Main
LDR R4 , NUM1
SUB R5 , R4 , #1
MOV R6 , R4

BACK
CMP R5 , #0
    BEQ FINISH
    MUL R6 , R5 , R6
SUB R5 , R5 , #1
    B BACK

FINISH
LDR R7, =Result
STR R6,[R7]
SWI &11             ;&-hex, #-decimal

NUM1 DCW &06
ALIGN
AREA DataRAM,DATA,READWRITE

Result DCD 0
END
```

Output:

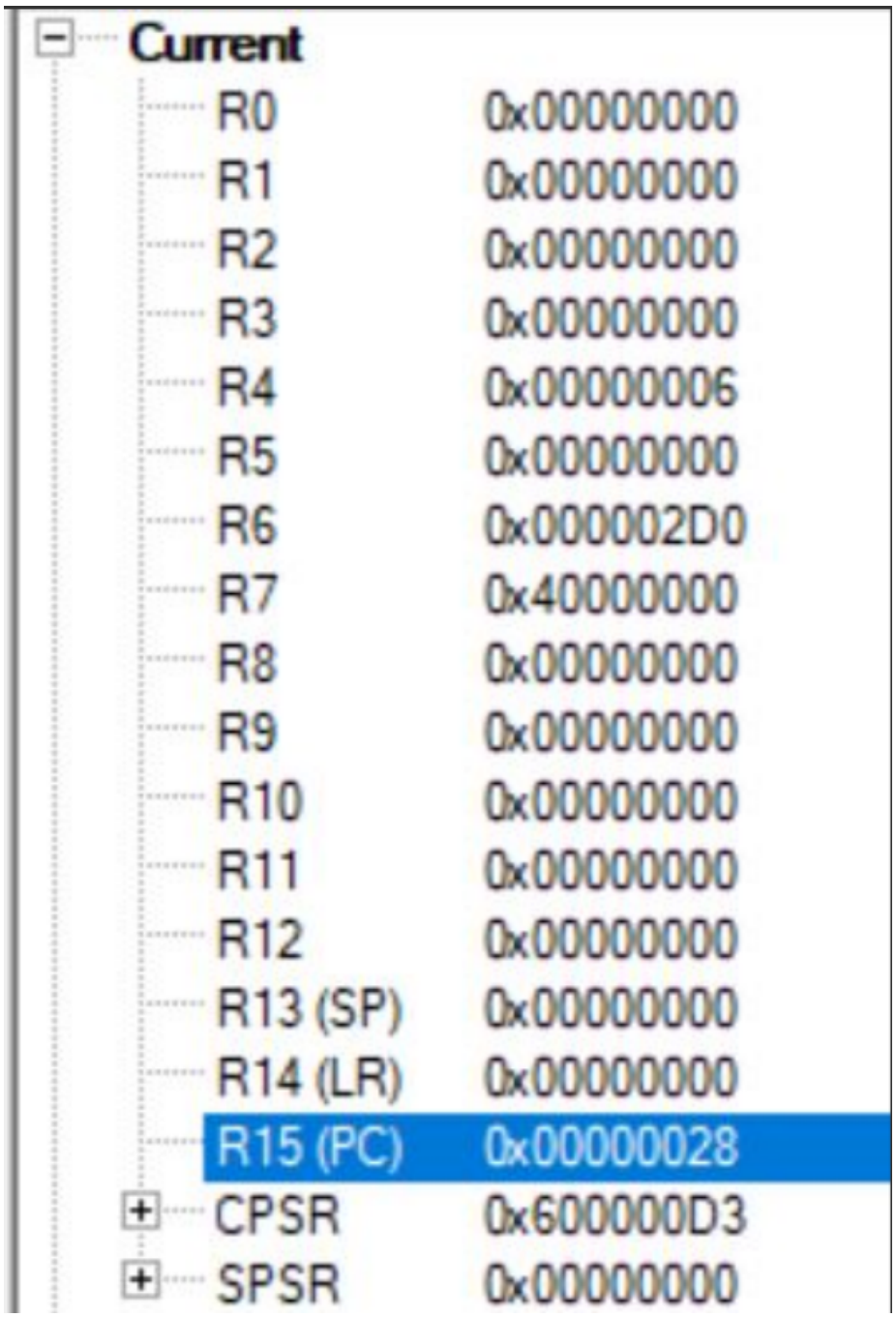

Figure 2: The given input NUM1 (0x04 here) is stored in the register R4, while the result of the factorial is stored in the register R7 (result is 0x02D0=720_{10}).

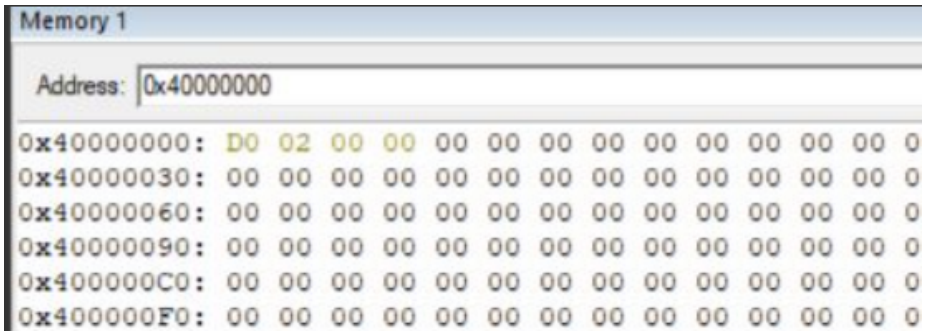

Figure 3: The result 0x02D0 is stored in the memory location 0x40000000 in the reverse order of bytes.

Problem 2

Problem statement

Combine the low four bits of each of the four consecutive bytes beginning at LIST into one 16-bit half-word. The value at LIST goes into the most significant nibble of the result. Store the result in the 32-bit variable RESULT.

Flowchart for the program

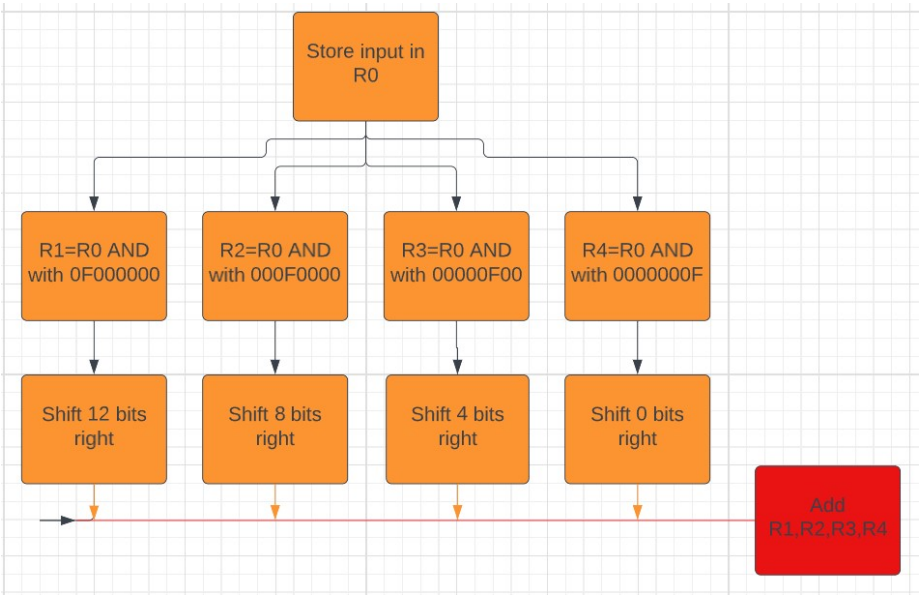

Figure 4: Flowchart for the problem

Code for the problem:

```
        AREA program, CODE, READONLY
ENTRY

Main
LDR R0,LIST
AND R1,R0, #0x0F000000
AND R2,R0, #0x000F0000
AND R3,R0, #0x00000F00
AND R4,R0, #0x0000000F
MOV R1,R1,LSR#12
MOV R2,R2,LSR#8
MOV R3,R3,LSR#4
ADD R5,R1,R2
ADD R6,R3,R4
ADD R7,R5,R6

LDR R8,=Result
STR R7,[R8]
SWI &11

LIST DCD &ABCD1234
ALIGN
AREA DataRAM,DATA,READWRITE

Result DCD 0
END
```

Output:

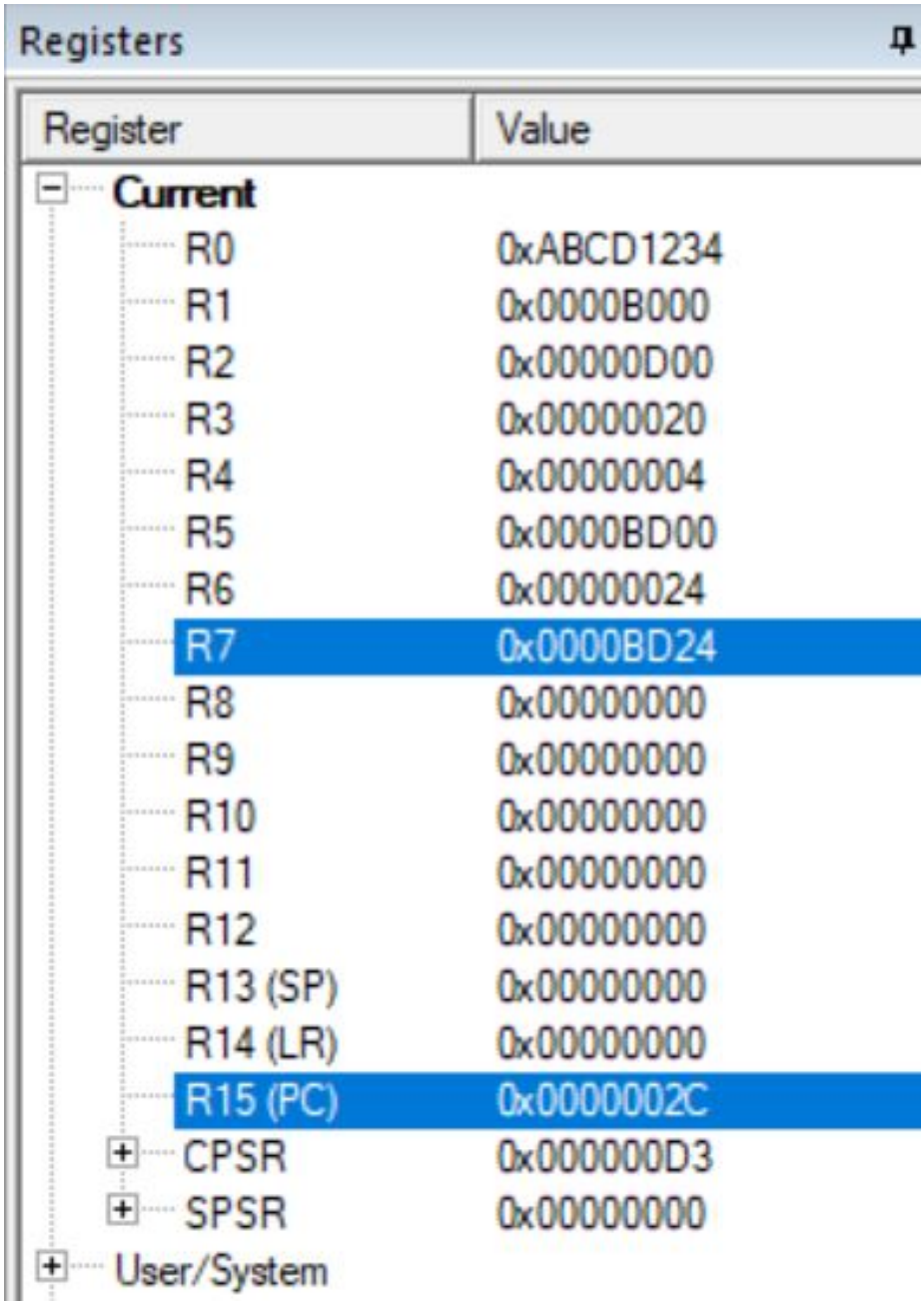

Figure 5: The value of LIST is stored in the register R0. The result is stored in the register R7.

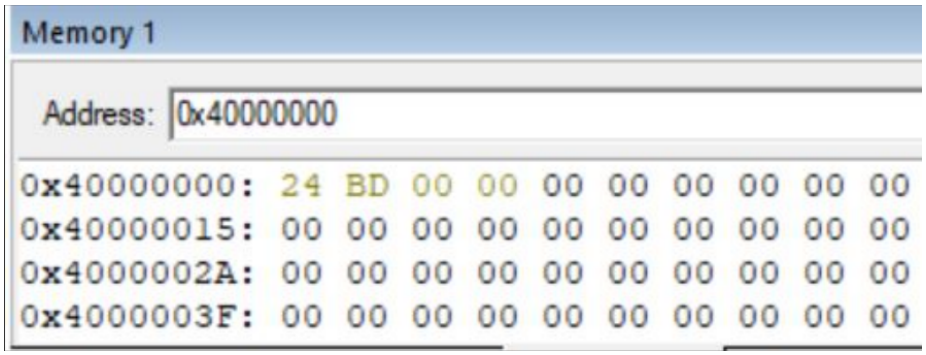

Figure 6: The result is stored in the memory location 0x40000000.

Problem 3

Problem statement

Given a 32-bit number, identify whether it is even or odd.

Flowchart for the program

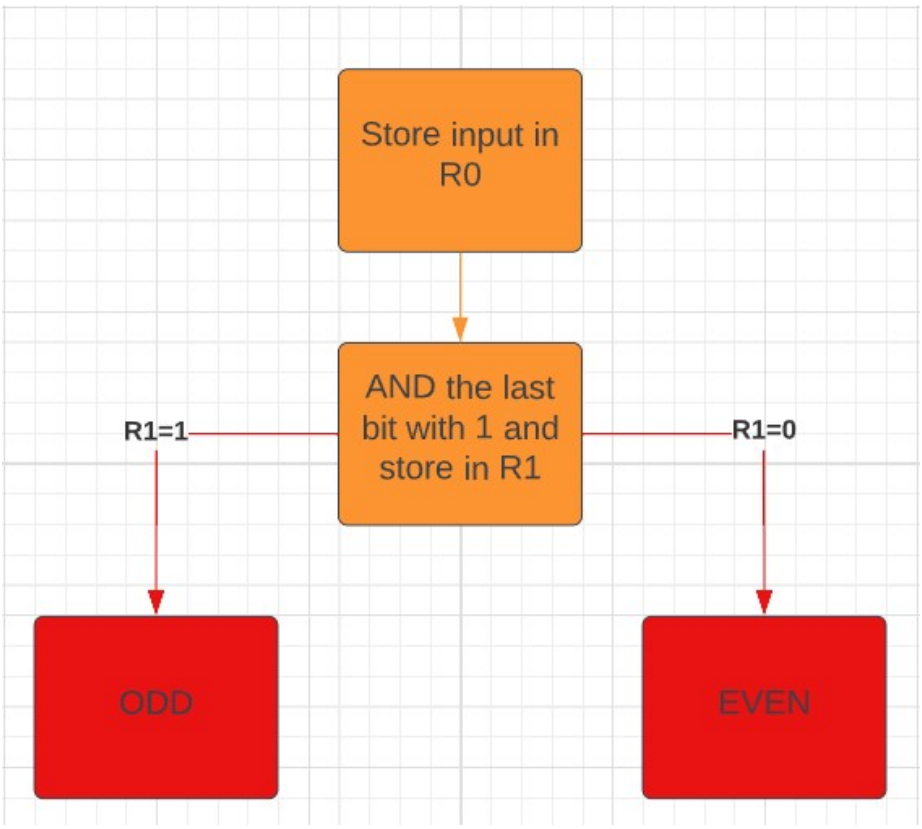

Figure 7: Flowchart for the problem

Code for the problem:

```
        AREA Program,CODE,READONLY
ENTRY
Main
    LDR R0,NUM1
AND R1,R0, #1
LDR R2, =Result
STR R1,[R2]
SWI &11

NUM1 DCW &ABCD
ALIGN
Result DCD 0
END
```

Output:

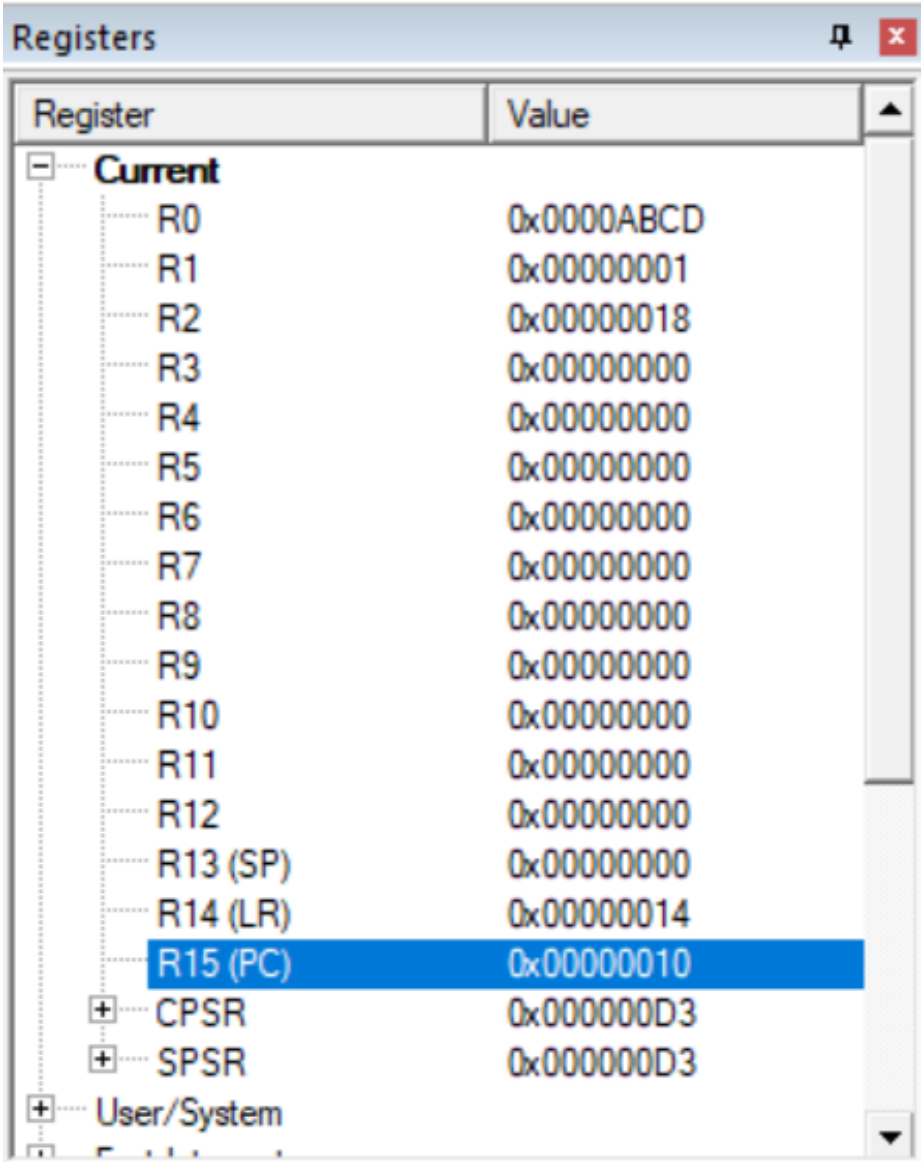

Figure 8: The register R1 stores the value 0x00000001, which shows that the number input is odd.