Instructions _03

CS2400

Spring 2020

Modify the factorial code so that we can reduce the number of instructions ?

Modified Factorial Program

```
;Factorial with conditional branch
        MOV r3,#5   ; load n into r3
        MOV r2,#1   ;
loop
        CMP r3, #0 ;compare r3 with 0
        MULGT r2, r3, R2
        SUBGT r3, r3, #1   ; decrement n
        BGT loop   ;  do another mul if counter!= 0
stop B stop
        END
```

Swapping two numbers

To swap the contents of two registers without using an intermediate storage location is to use the exclusive OR operator.

$A = A \oplus B$

$B = A \oplus B$

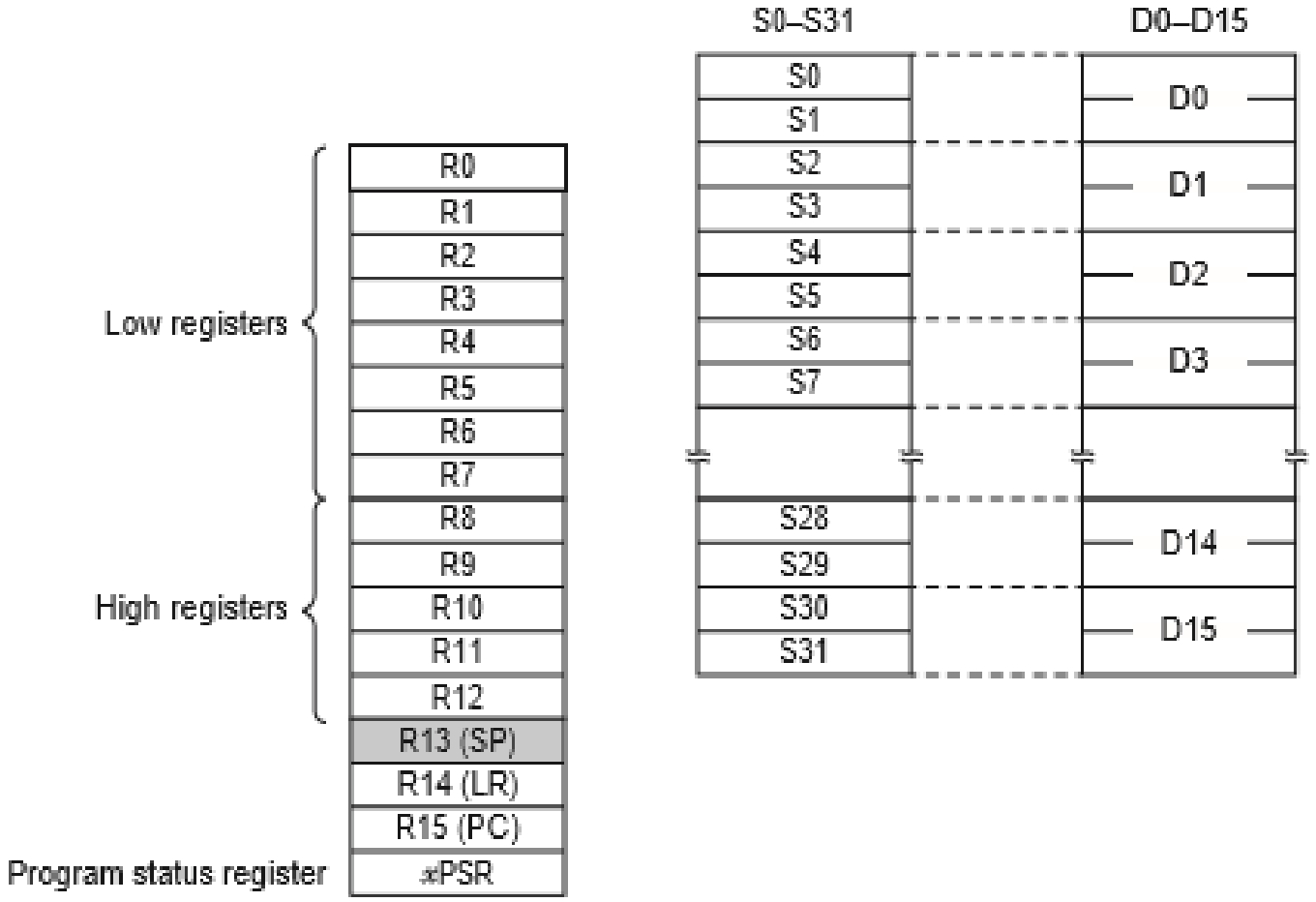
$A = A \oplus B$

Program Example

- Swapping two numbers in Register r0 and r1

```
LDR r0,=2 ; load some data
LDR r1, =4 ; load some data
EOR r0, r0, r1 ; r0 XOR r1
EOR r1, r0, r1 ; r1 XOR r0
EOR r0, r0, r1 ; r0 XOR r1
```

FLOATING-POINT NUMBERS



Example

```
LDR r3, =0x3F800000 ; single precision 1.0
VMOV.F32 s3, r3 ; transfer contents from ARM to FPU
VLDR.F32 s4, =6.02
VMOV.F32 r4, s4 ; transfer contents from FPU to ARM
```

Example

```
;Area of circle
    VLDR.F32 s4, =3.14
   VLDR.F32 s2, =2
   VMUL.F32 S3,S2,S2
   VMUL.F32 S3,S4,S2
```

Program Exercise

1. Replace the last LSL instructions in code with ADD r2, r1, r1, LSL #2

   - What value is in register r2 when the code Ends? What is the ADD instruction actually doing?

```
        MOV r0, #1 ; load initial value
        LSL r1, r0, #1 ; shift 1 bit left
        LSL r2, r1, #1 ; shift 1 bit left
stop    B stop  ; stop program
        END
```

Q

Write a program to implement

```
if (char = = ‘!’ || char = =’?’ )
    found ++;
```

Q solutions

```
LDR r0, ='!’
TEQ r0,#'!’
TEQNE r0,#'?’
ADDEQ r1,r1,#1
```

Array

```
                LDR r0,=a
LOOP
                LDR R1,[R0,#0]
                ADD R2,R2, R1
                ADD R0,R0,#4
                ADD R3,R3,#1
                CMP R3,#4
                BLT  LOOP
a  DCD   4,2,3,1
```

Q

What will be the output of this program?

```
                    LDR r0,=a
LOOP
                    LDR R1,[R0,#0]
                    ADD R2,R2, R1
                    ADD R0,R0,#8
                    ADD R3,R3,#1
                    CMP R3,#3
                    BLT  LOOP
a  DCD   6,4,2,3,1
```

Program Exercise

- Write an ARM instruction program to read array of 3 elements 1,3, and 5 and find the product of array elements and store the product in memory.

- Write an ARM instruction program to read array and check if the given number is present in array.Modify the program to count number of occurrences of the given number.