Microprocessor and Computer Architecture Laboratory

UE19CS256

4th Semester, Academic Year 2020-21

Date: 1/2/2021

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Week#____2_____ Program Number: _ 1_____

Based on the value of the number in R0, Write an ALP to store 1 in R1 if R0 is zero, Store 2 in R1 if R0 is positive, Store 3 in R1 if R0 is negative.

ARM Assembly Code:

Case 1 (zero):

```
.text
        MOV R0,#0
        CMP R0,#0
        BEQ c1
        BMI c2
        MOV R1,#2
        SWI 0x11
        c1:
                MOV R1,#1
                SWI 0x11
```

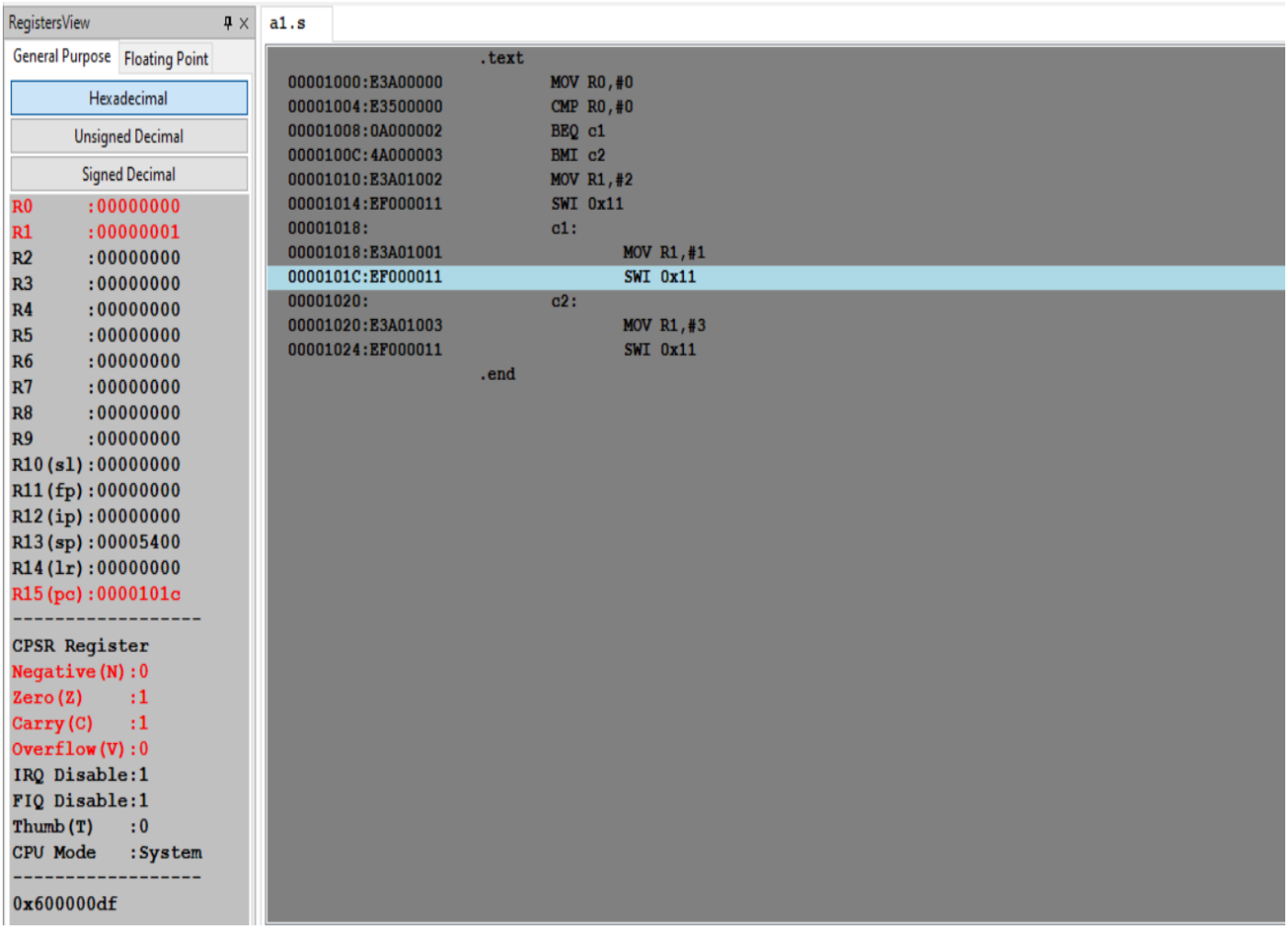
c2:

MOV R1,#3

SWI 0x11

.end

Output:



Case 2 (positive number):

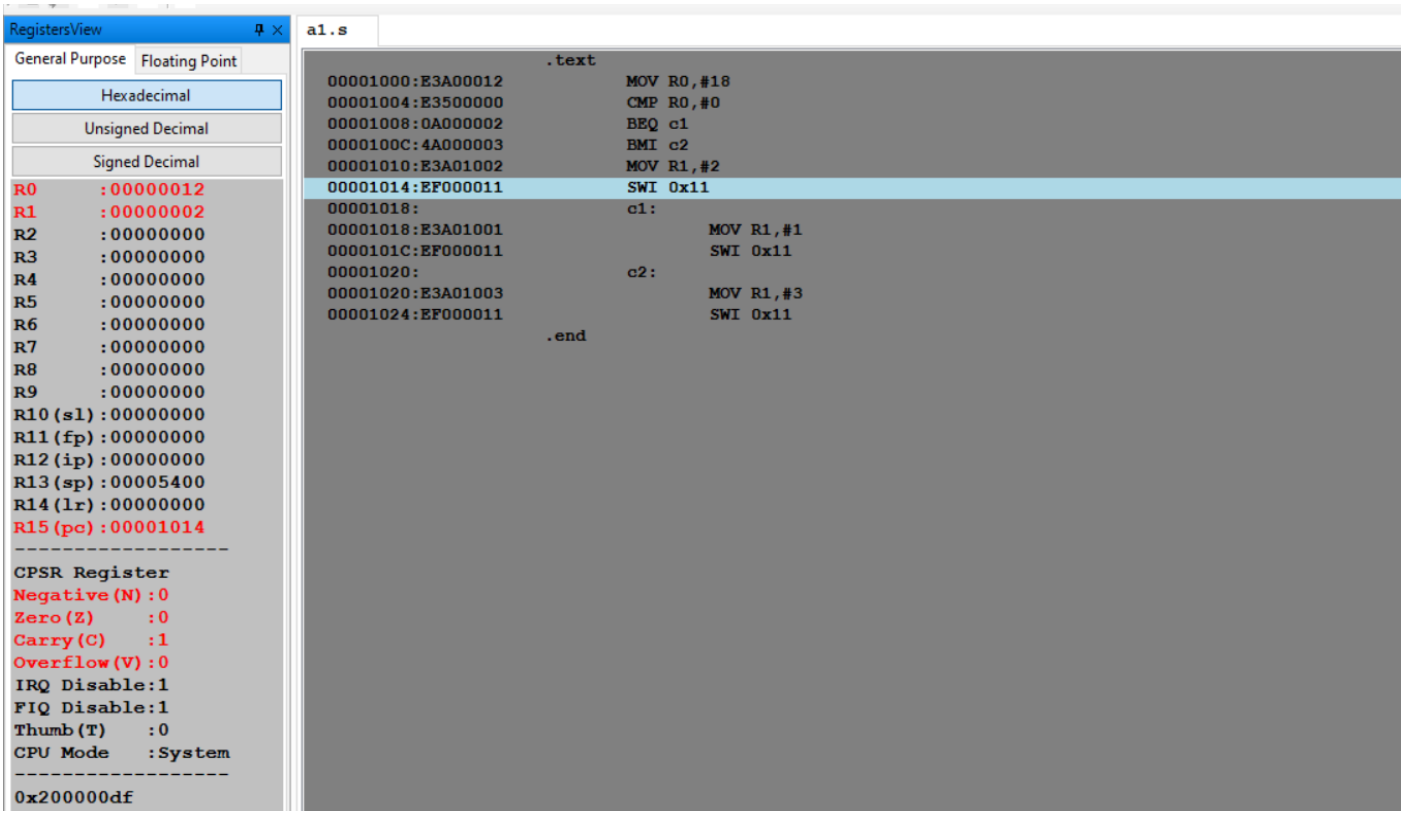
.text

MOV R0,#18

CMP R0,#0

```
        BEQ c1
        BMI c2
        MOV R1,#2
        SWI 0x11
        c1:
                MOV R1,#1
                SWI 0x11
        c2:
                MOV R1,#3
                SWI 0x11
.end
```

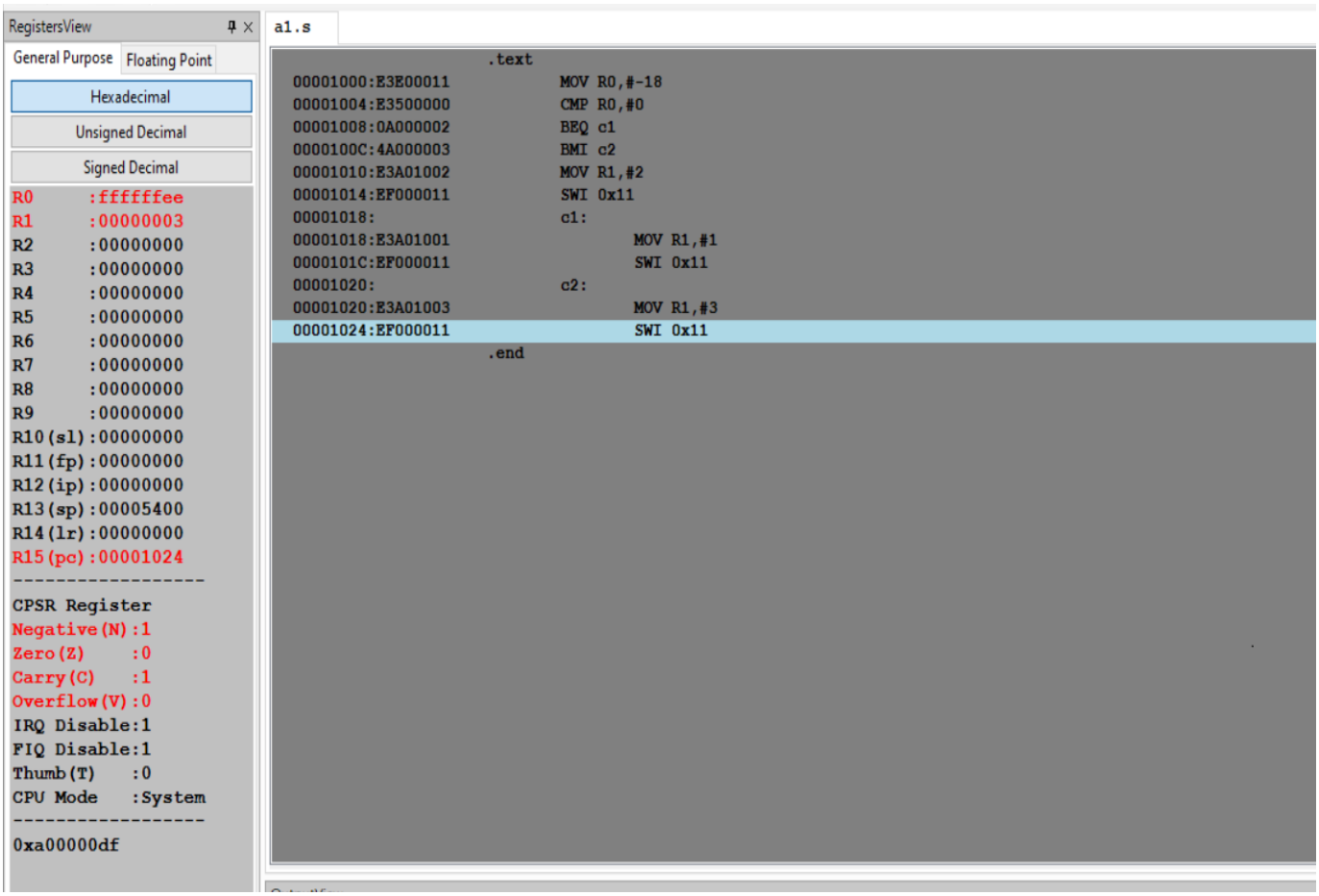
Output:



Case 3 (negative number):

```
.text
        MOV R0,#-18
        CMP R0,#0
        BEQ c1
        BMI c2
        MOV R1,#2
        SWI 0x11
        c1:
                MOV R1,#1
                SWI 0x11
        c2:
                MOV R1,#3
                SWI 0x11
.end
```

Output:



Week#____2_____ Program Number: _ 2_____

Write an ALP to compare the value of R0 and R1, add if R0 = R1, else subtract.

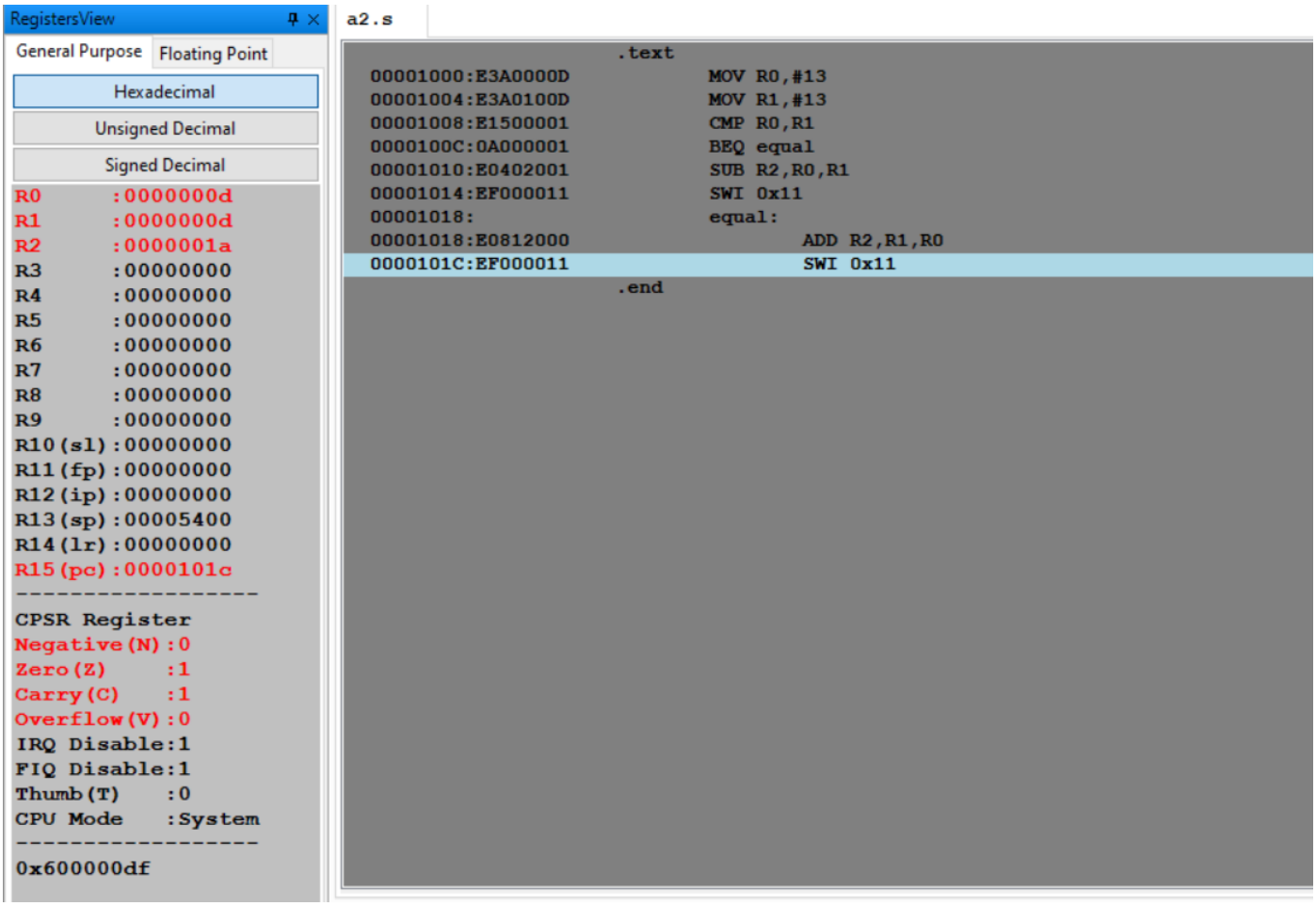
ARM Assembly Code:

Case 1:

```
.text
        MOV R0,#13
        MOV R1,#13
        CMP R0,R1
```

```
        BEQ equal
        SUB R2,R0,R1
        SWI 0x11
        equal:
                ADD R2,R1,R0
                SWI 0x11
.end
```

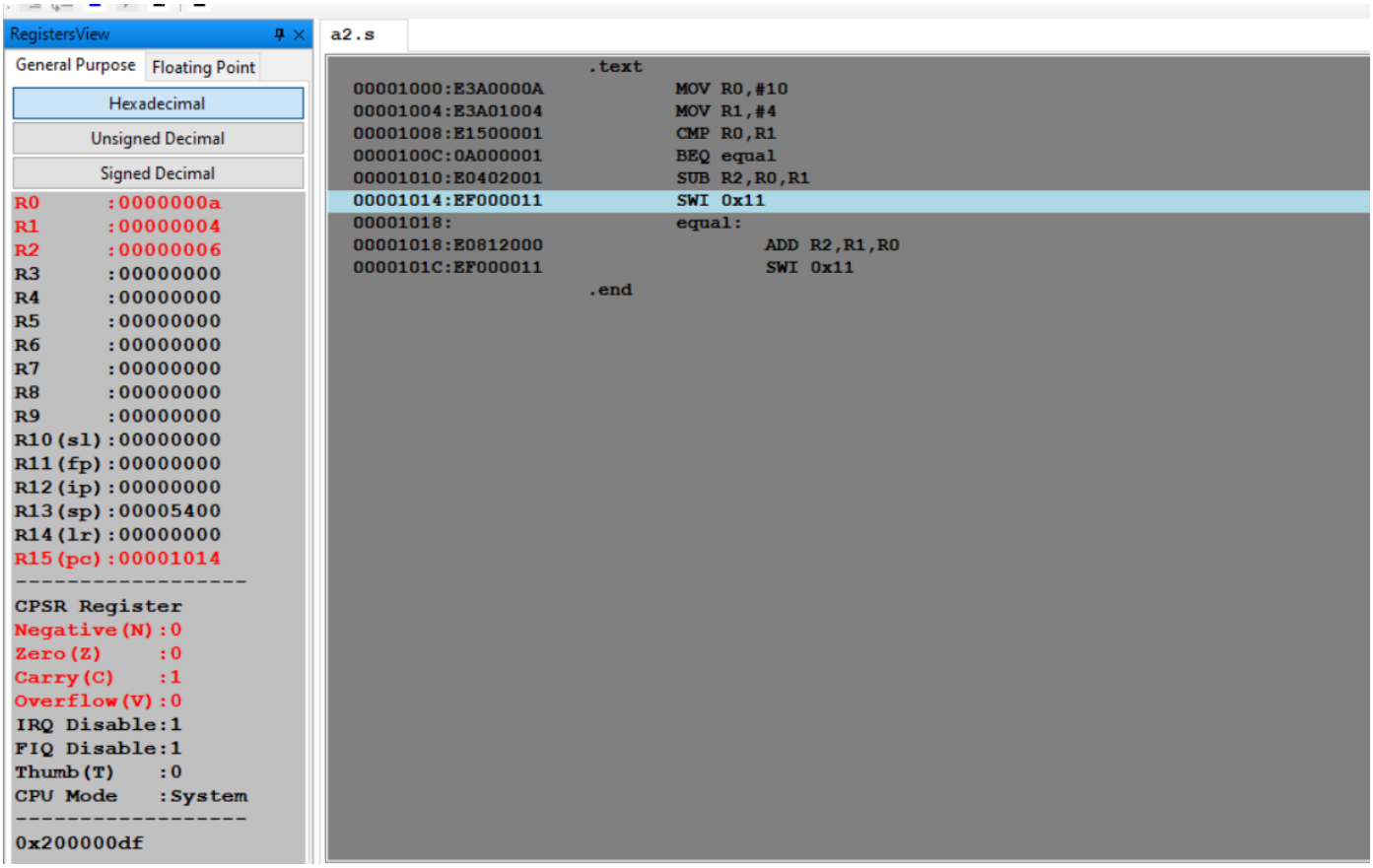
Output:



Case 2:

```
.text
        MOV R0,#10
        MOV R1,#4
        CMP R0,R1
        BEQ equal
        SUB R2,R0,R1
        SWI 0x11
        equal:
                ADD R2,R1,R0
                SWI 0x11
.end
```

Output:



Week#____2_____ Program Number: _ 3_____

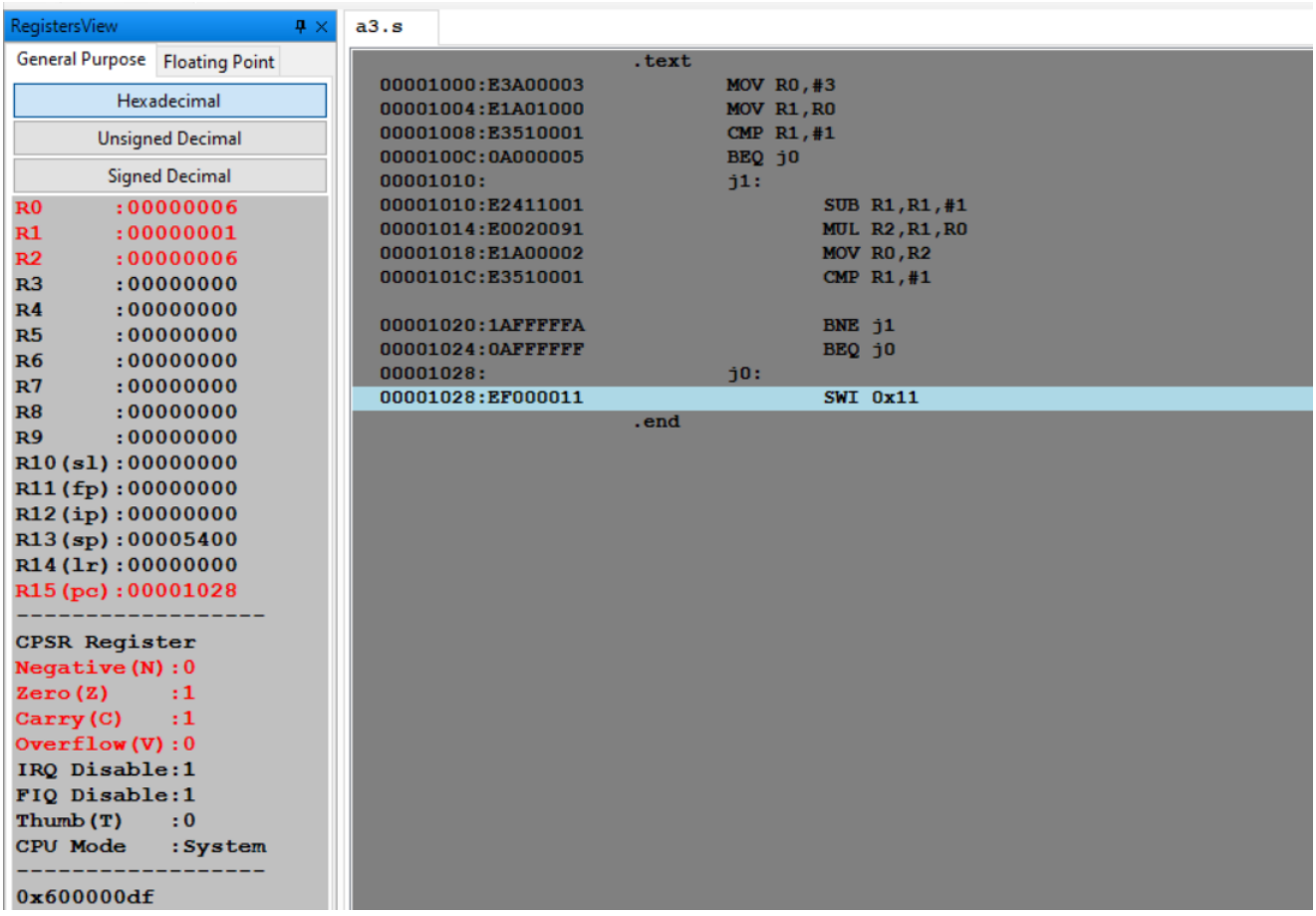
Write an ALP to find the factorial of a number stored in R0. Store the value in R1 (without using LDR and STR instructions). Use only registers.

ARM Assembly Code:

```
.text
        MOV R0,#3
        MOV R1,R0
        CMP R1,#1
        BEQ j0
        j1:
                SUB R1,R1,#1
                MUL R2,R1,R0
                MOV R0,R2
                CMP R1,#1

                BNE j1
                BEQ j0
        j0:
                SWI 0x11
.end
```

Output:



Week#____2_____ Program Number: _ 4a_____

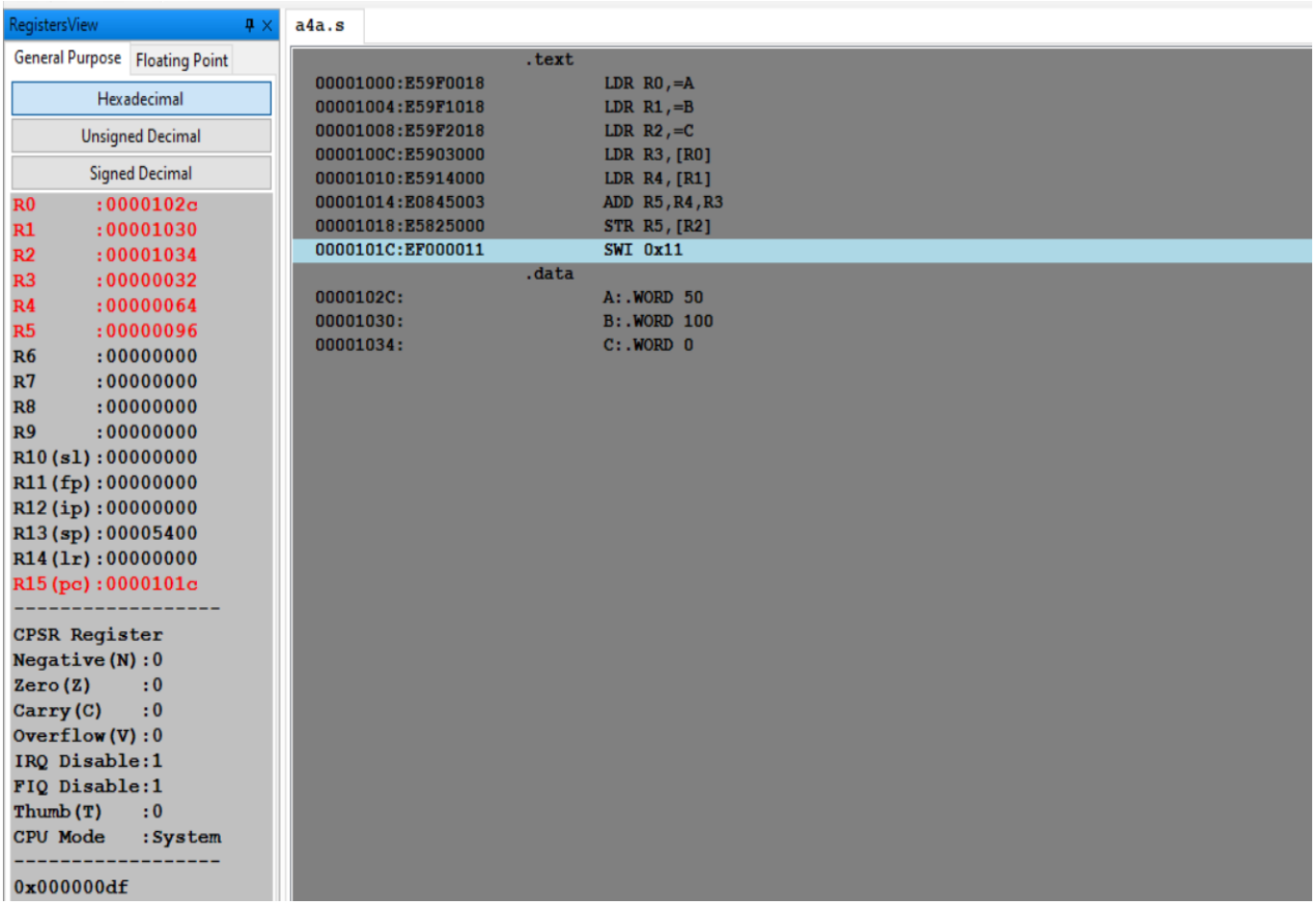
Write an ALP to add two 32 bit numbers loaded from memory and store the result in memory.

ARM Assembly Code:

```
.text
        LDR R0,=A
        LDR R1,=B
        LDR R2,=C
        LDR R3,[R0]
        LDR R4,[R1]
        ADD R5,R4,R3
```

```
        STR R5,[R2]
        SWI 0x11
.data
        A:.WORD 50
        B:.WORD 100
        C:.WORD 0
```

Output:



Week#____2_____ Program Number: _ 4b_____

Write an ALP to add two 16 bit numbers loaded from memory and store the result in memory.

ARM Assembly Code:

.text

LDR R0,=A

LDR R1,=B

LDR R2,=C

LDRH R3,[R0]

LDRH R4,[R1]

ADD R5,R4,R3

STRH R5,[R2]

SWI 0x11

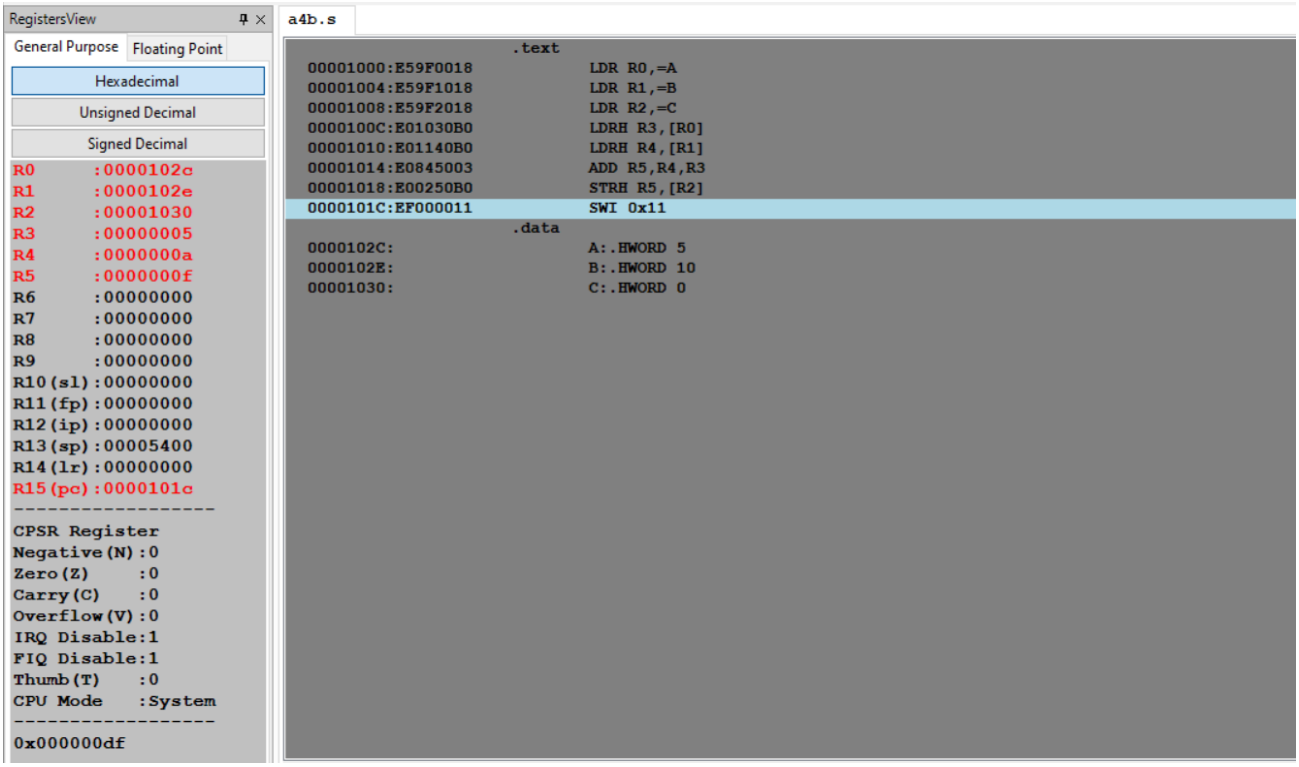
.data

A:.HWORD 5

B:.HWORD 10

C:.HWORD 0

Output:



Week#____2_____ Program Number: _ 5a_____

Write an ALP to find GCD of two numbers (without using LDR and STR instructions). Both numbers are in registers. Use only registers.

ARM Assembly Code:

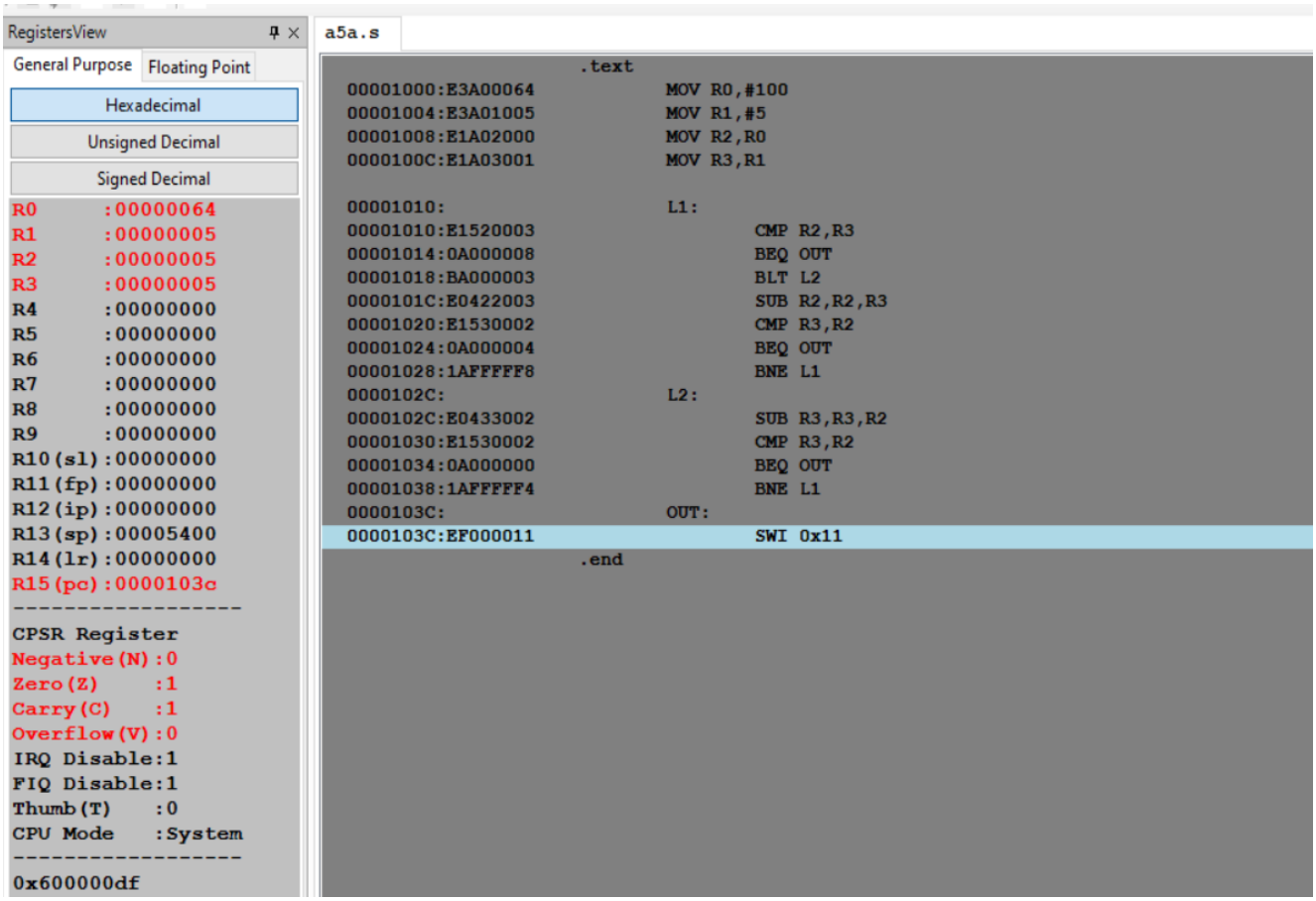
```
.text
        MOV R0,#100
        MOV R1,#5
        MOV R2,R0
        MOV R3,R1

        L1:
                CMP R2,R3
                BEQ OUT
                BLT L2
                SUB R2,R2,R3
                CMP R3,R2
                BEQ OUT
                BNE L1
        L2:
                SUB R3,R3,R2
                CMP R3,R2
                BEQ OUT
                BNE L1
        OUT:
```

SWI 0x11

.end

Output:



Week#____2_____ Program Number: _ 5b_____

Write an ALP to find the GCD of given numbers (both numbers in memory) Store result in memory.

ARM Assembly Code:

Ex 1 (A=B):

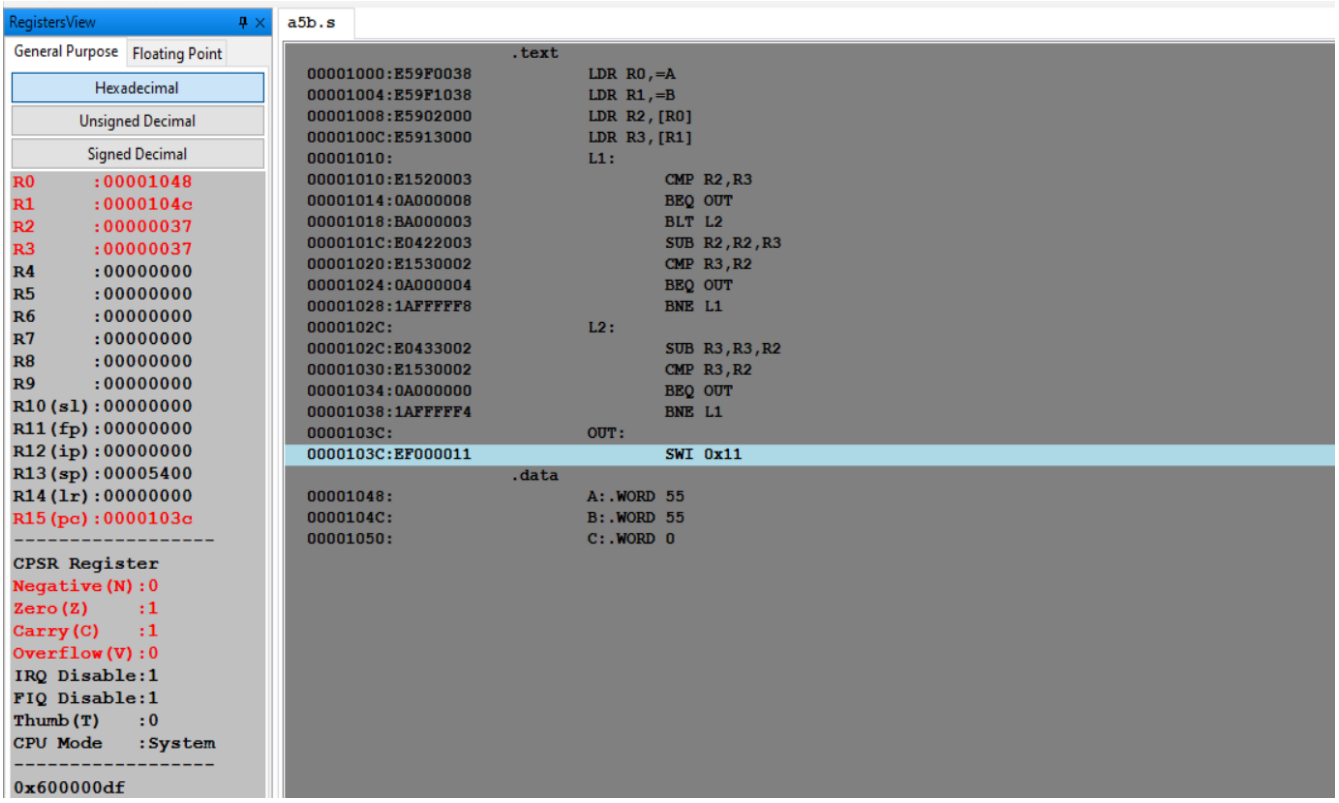
.text

LDR R0,=A

LDR R1,=B

```
        LDR R2,[R0]
        LDR R3,[R1]
        L1:
                CMP R2,R3
                BEQ OUT
                BLT L2
                SUB R2,R2,R3
                CMP R3,R2
                BEQ OUT
                BNE L1
        L2:
                SUB R3,R3,R2
                CMP R3,R2
                BEQ OUT
                BNE L1
        OUT:
                SWI 0x11
.data
        A:.WORD 55
        B:.WORD 55
        C:.WORD 0
```

Output:

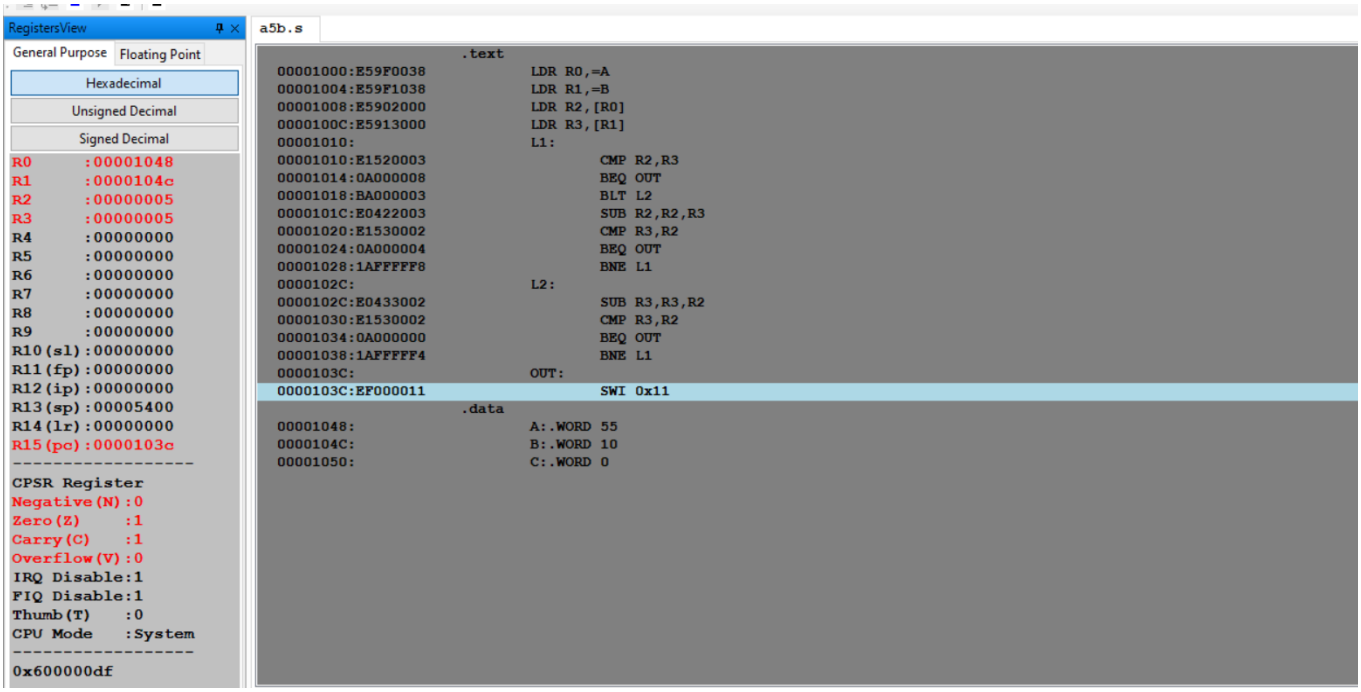


Ex 2 (A>B):

```
.text
        LDR R0,=A
        LDR R1,=B
        LDR R2,[R0]
        LDR R3,[R1]
        L1:
                CMP R2,R3
                BEQ OUT
                BLT L2
                SUB R2,R2,R3
                CMP R3,R2
```

```
        BEQ OUT
        BNE L1
    L2:
        SUB R3,R3,R2
        CMP R3,R2
        BEQ OUT
        BNE L1
    OUT:
        SWI 0x11
.data
    A:.WORD 55
    B:.WORD 10
    C:.WORD 0
```

Output:

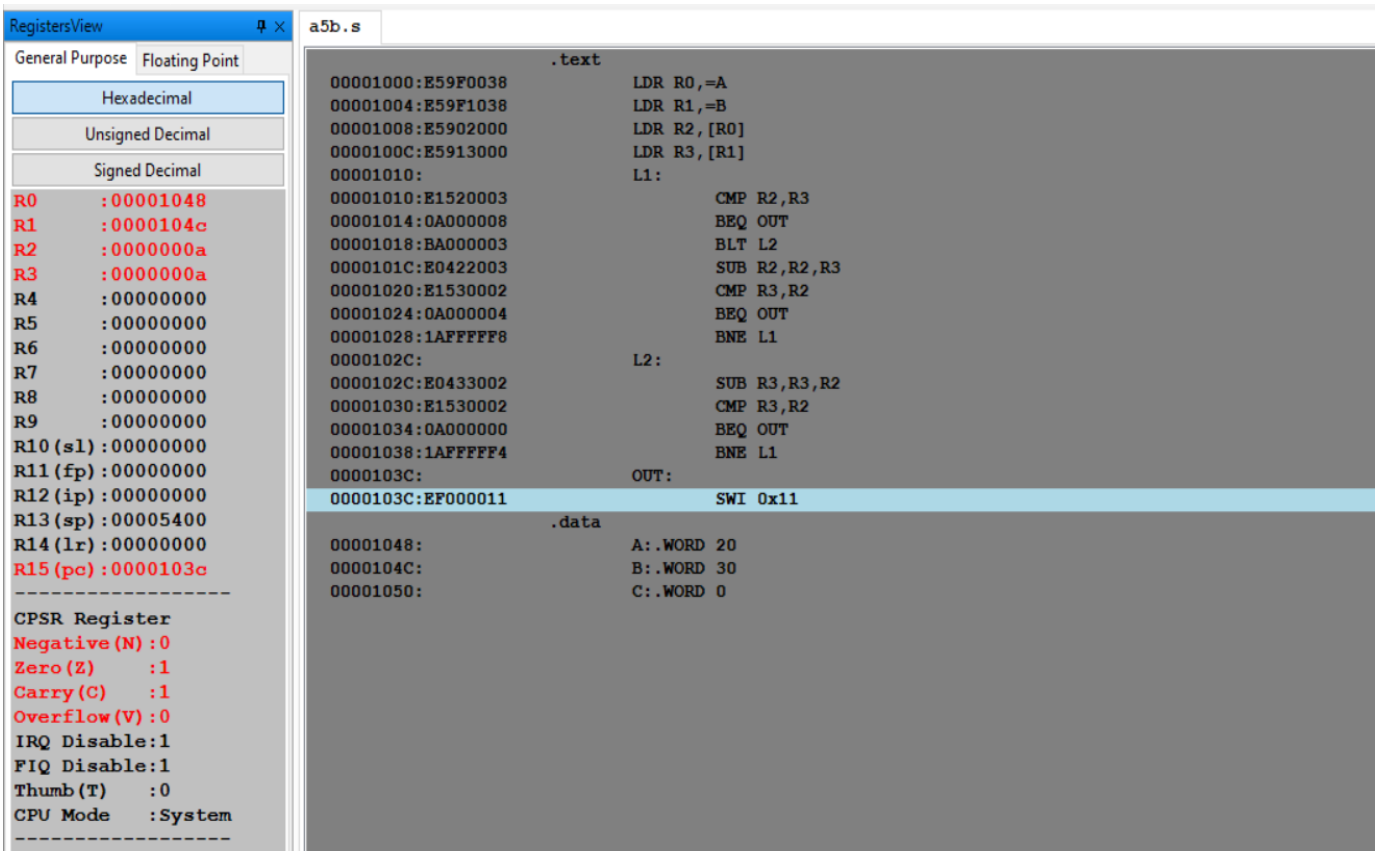


Ex 3 (A<B):

```
.text
        LDR R0,=A
        LDR R1,=B
        LDR R2,[R0]
        LDR R3,[R1]
        L1:
                CMP R2,R3
                BEQ OUT
                BLT L2
                SUB R2,R2,R3
                CMP R3,R2
                BEQ OUT
                BNE L1
        L2:
                SUB R3,R3,R2
                CMP R3,R2
                BEQ OUT
                BNE L1
        OUT:
                SWI 0x11
.data
        A:.WORD 20
        B:.WORD 30
```

C:.WORD 0

Output:



Week#____2_____ Program Number: _ 6a_____

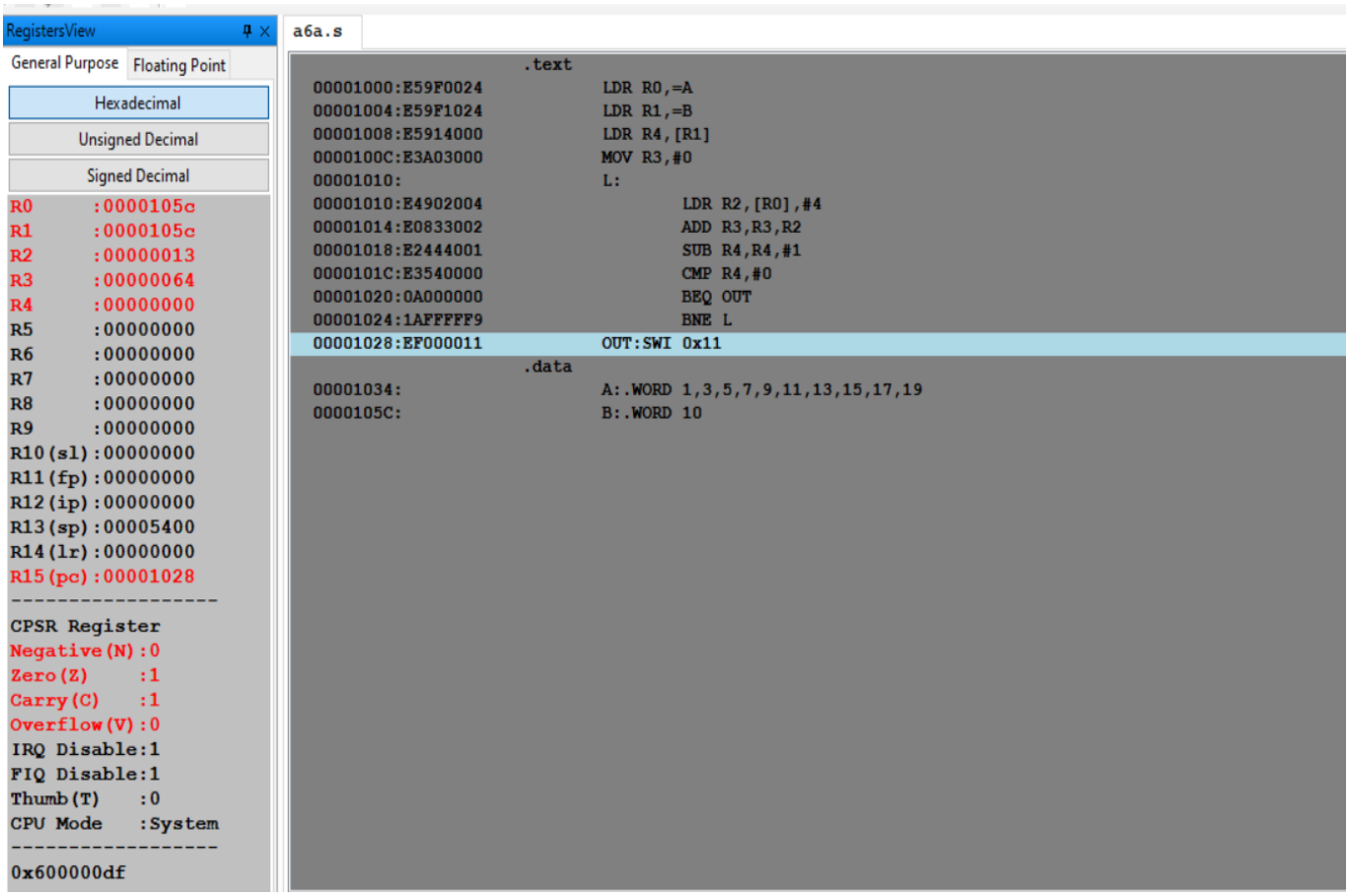
Write an ALP to add an array of ten 32 bit numbers from memory.

ARM Assembly Code:

```
.text
        LDR R0,=A
        LDR R1,=B
        LDR R4,[R1]
        MOV R3,#0
        L:
            LDR R2,[R0],#4
```

```
        ADD R3,R3,R2
        SUB R4,R4,#1
        CMP R4,#0
        BEQ OUT
        BNE L
    OUT:SWI 0x11
.data
    A:.WORD 1,3,5,7,9,11,13,15,17,19
    B:.WORD 10
```

Output:



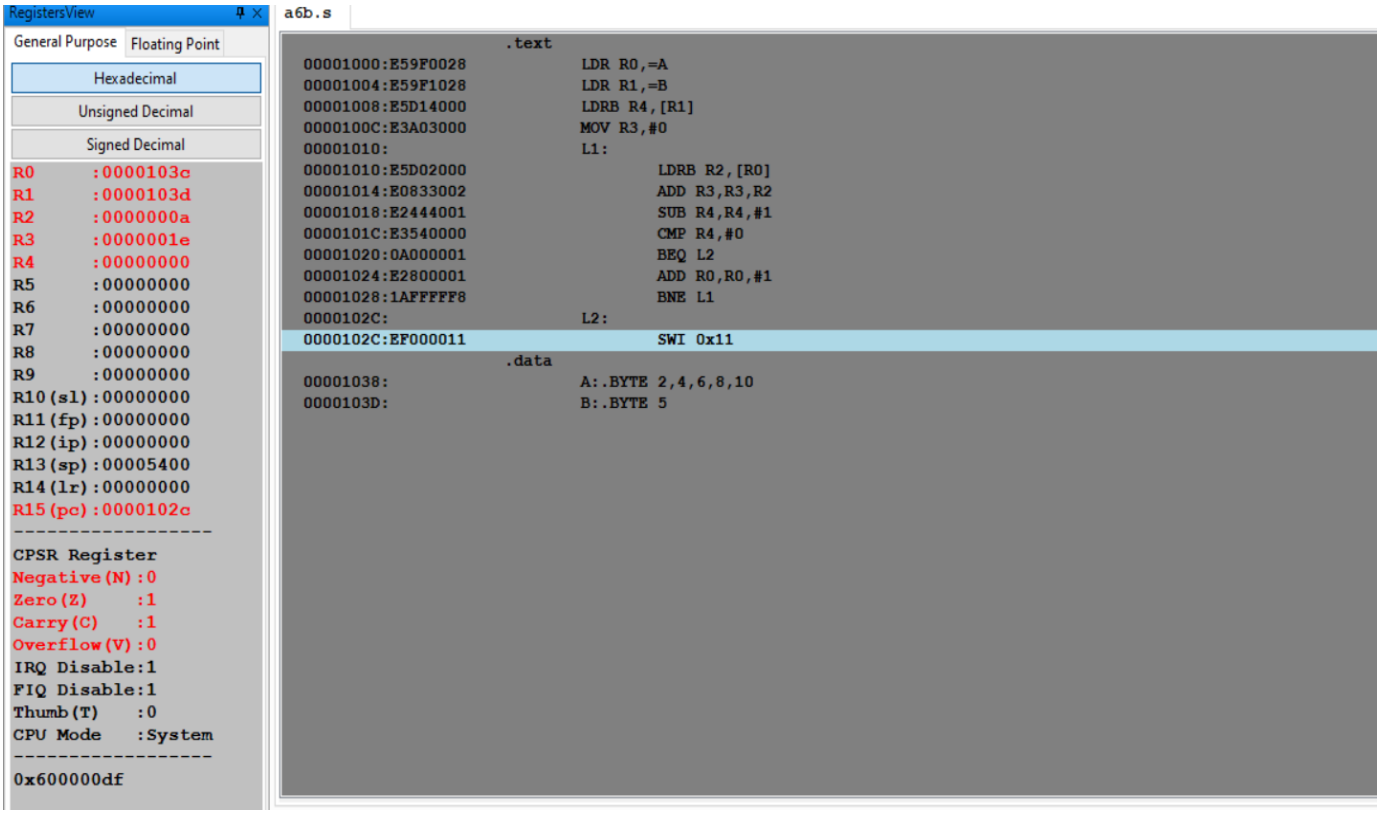
Week#____2_____ Program Number: _ 6b_____

Write an ALP to add array of ten 8 bit numbers taking data from memory location stored as byte data (use .byte to store the data instead of .word)

ARM Assembly Code:

```
.text
        LDR R0,=A
        LDR R1,=B
        LDRB R4,[R1]
        MOV R3,#0
        L1:
                LDRB R2,[R0]
                ADD R3,R3,R2
                SUB R4,R4,#1
                CMP R4,#0
                BEQ L2
                ADD R0,R0,#1
                BNE L1
        L2:
                SWI 0x11
.data
        A:.BYTE 2,4,6,8,10
        B:.BYTE 5
```

Output:



Week#____2_____ Program Number: _ 7_____

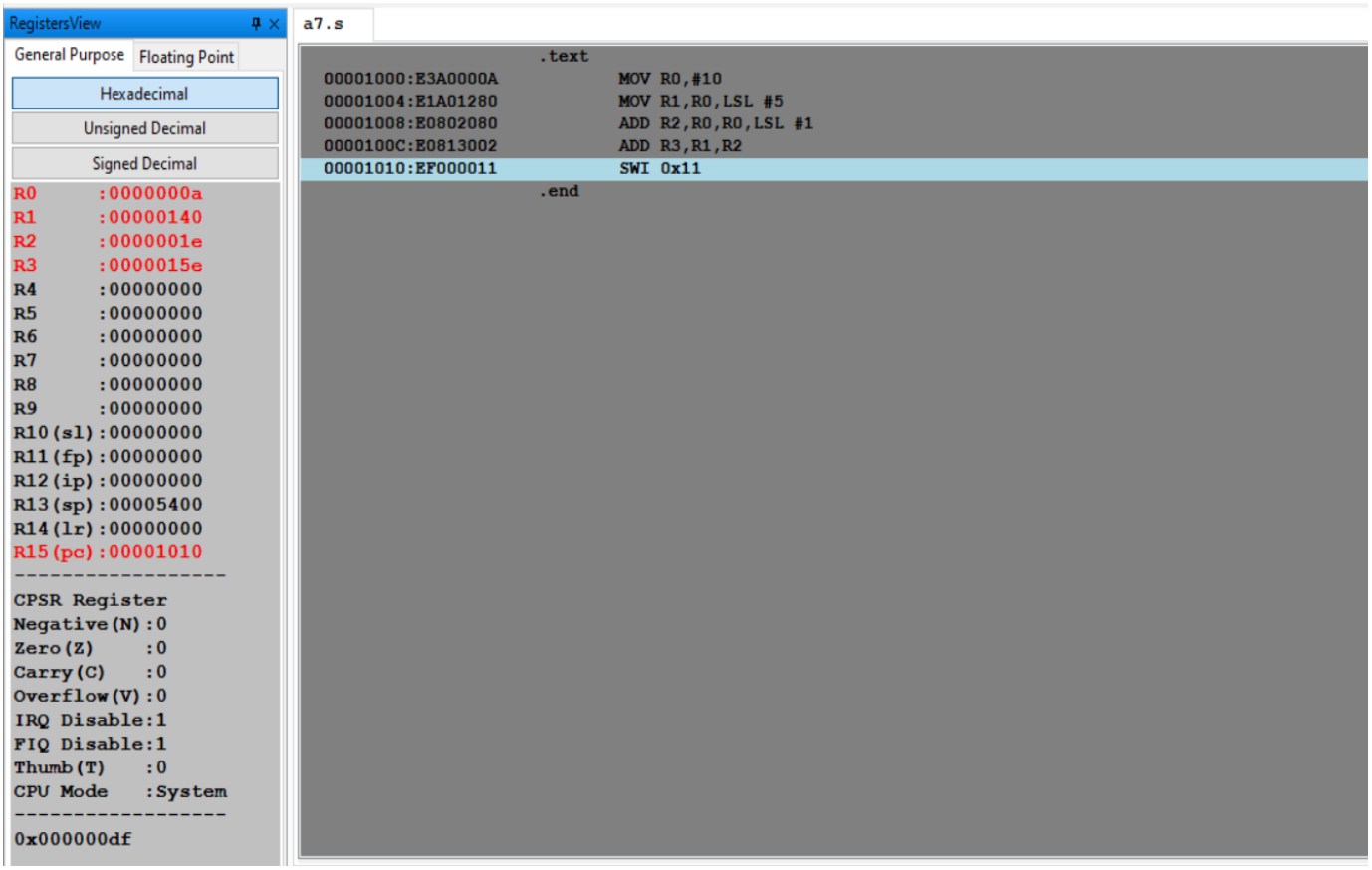
Write an ALP to multiply using barrel shifter.

35*R0

ARM Assembly Code:

```
.text
        MOV R0,#10
        MOV R1,R0,LSL #5
        ADD R2,R0,R0,LSL #1
        ADD R3,R1,R2
        SWI 0x11
.end
```

Output:



Week#____2_____ Program Number: _ 8_____

Write an ALP to evaluate the expression (A+B) + (3*B), where A and B are memory location.

* Use LSL instruction for multiplication

ARM Assembly Code:

```
.text
        LDR R0,=A
        LDR R1,=B
        LDR R2,[R0]
        LDR R3,[R1]
```

ADD R5,R2,R3,LSL #2

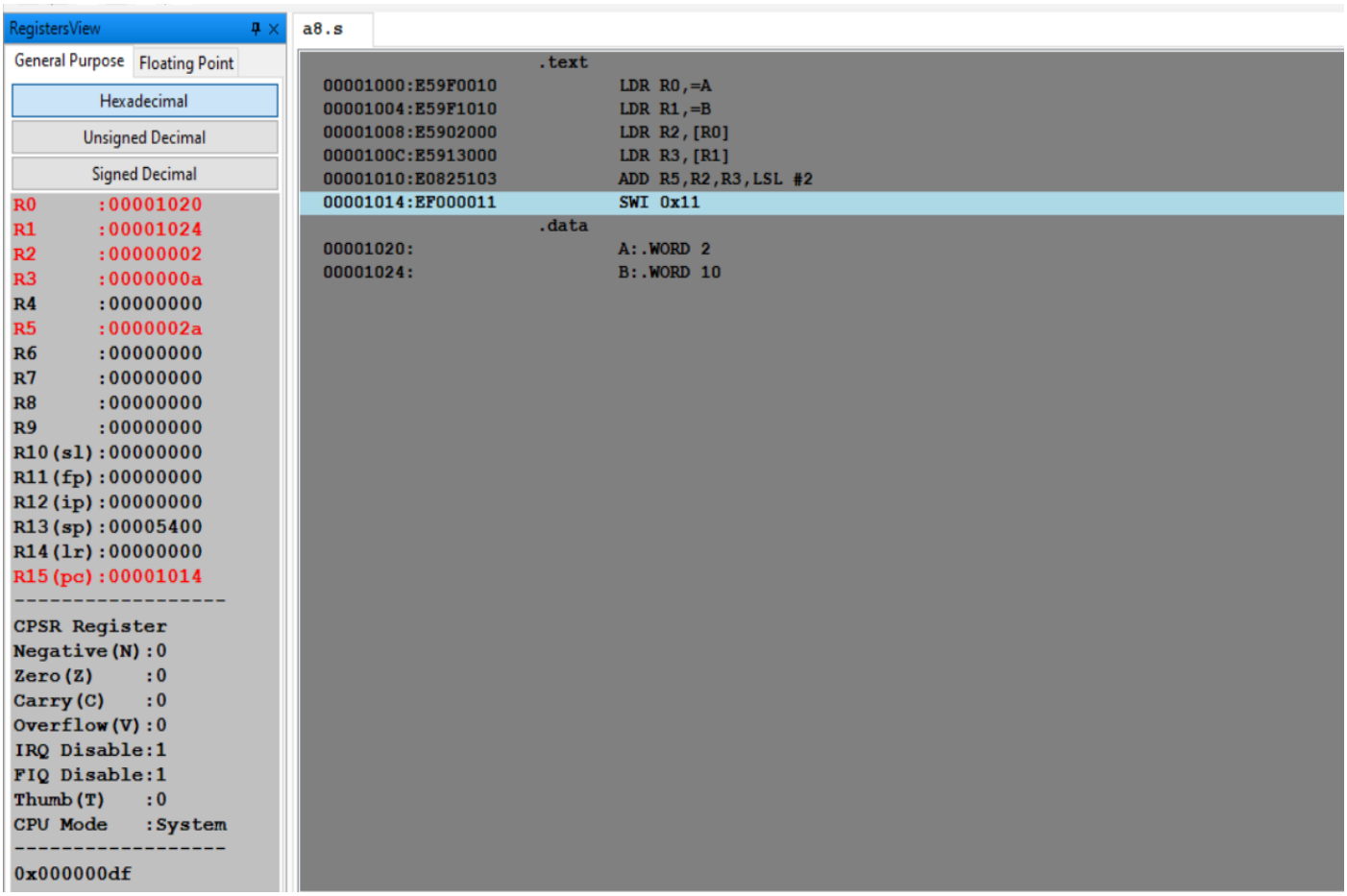
SWI 0x11

.data

A:.WORD 2

B:.WORD 10

Output:



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- The programs and output submitted is duly written, verified and executed by me.
- I have not copied from any of my peers nor from the external resource such as internet.
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