Microprocessor and Computer Architecture

UE20CS252

4th Semester, Academic Year 2021-22

Date: 27/03/2022

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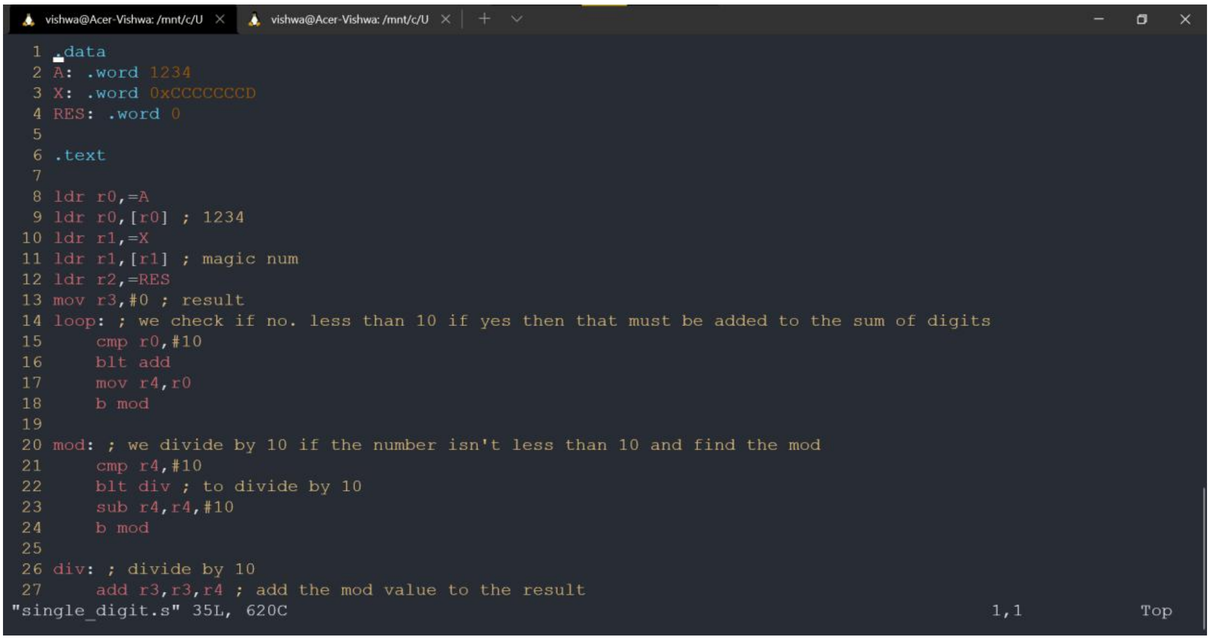
Week#____7_______ Program Number: ____1___

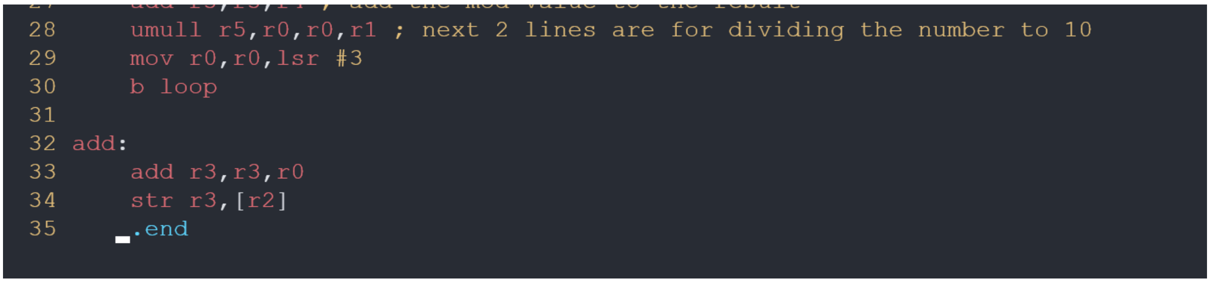
Title of the Program

1. Write a program in ARM7TDMI-ISA to find the sum of all the digits in an 32bit number.

1. ARM Assembly Code(1)

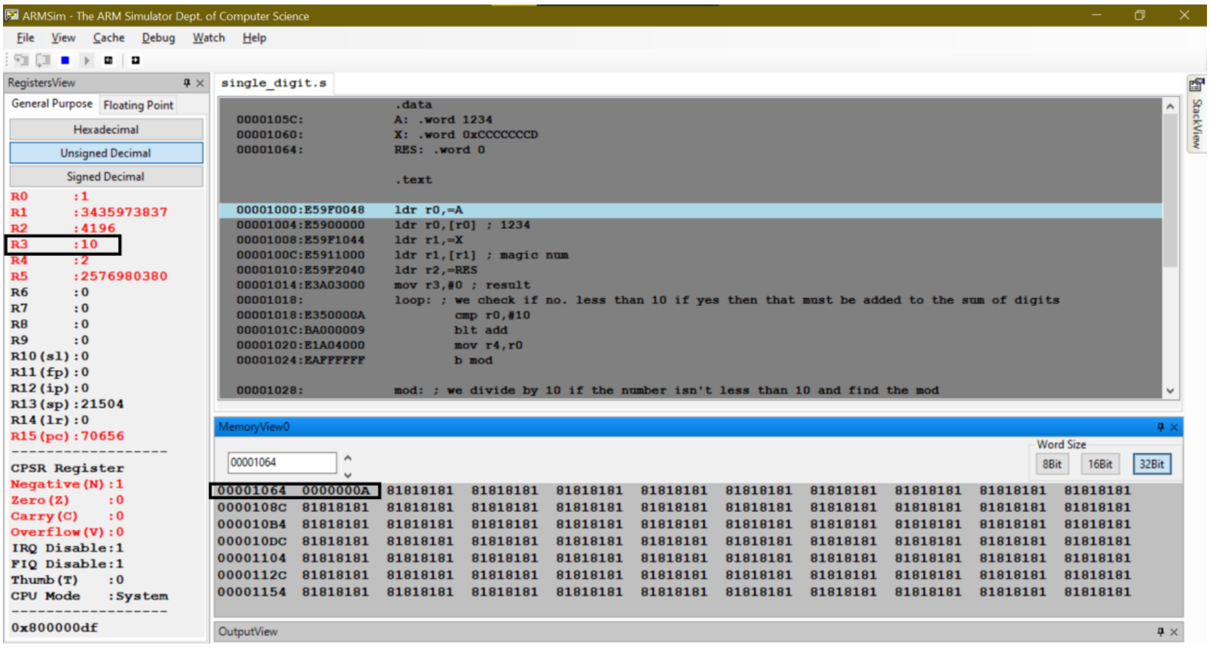


```
.data
A: .word 1234
X: .word 0xCCCCCCCD
RES: .word 0

.text

ldr r0,=A
ldr r0,[r0] ; 1234
ldr r1,=X
ldr r1,[r1] ; magic num
ldr r2,=RES
mov r3,#0 ; result
loop: ; we check if no. less than 10 if yes then that must be added to the sum of digits
    cmp r0,#10
    blt add
    mov r4,r0
    b mod

mod: ; we divide by 10 if the number isn't less than 10 and find the mod
    cmp r4,#10
    blt div ; to divide by 10
    sub r4,r4,#10
    b mod

div: ; divide by 10
    add r3,r3,r4 ; add the mod value to the result
"single_digit.s" 35L, 620C                                  1,1          Top
```



```
    umull r5,r0,r0,r1 ; next 2 lines are for dividing the number to 10
    mov r0,r0,lsr #3
    b loop

add:
    add r3,r3,r0
    str r3,[r2]
   .end
```

2. Output Screen Shot (1)



```
R0       :1
R1       :3435973837
R2       :4196
R3       :10
R4       :2
R5       :2576980380
R6       :0
R7       :0
R8       :0
R9       :0
R10(sl):0
R11(fp):0
R12(ip):0
R13(sp):21504
R14(lr):0
R15(pc):70656
------------------
CPSR Register
Negative(N):1
Zero(Z)     :0
Carry(C)    :0
Overflow(V):0
IRQ Disable:1
FIQ Disable:1
Thumb(T)    :0
CPU Mode    :System
------------------
0x800000df
```

```
                         .data
 0000105C:               A: .word 1234
 00001060:               X: .word 0xCCCCCCCD
 00001064:               RES: .word 0

                         .text

 00001000:E59F0048       ldr r0,=A
 00001004:E5900000       ldr r0,[r0] ; 1234
 00001008:E59F1044       ldr r1,=X
 0000100C:E5911000       ldr r1,[r1] ; magic num
 00001010:E59F2040       ldr r2,=RES
 00001014:E3A03000       mov r3,#0 ; result
 00001018:               loop: ; we check if no. less than 10 if yes then that must be added to the sum of digits
 00001018:E350000A               cmp r0,#10
 0000101C:BA000009               blt add
 00001020:E1A04000               mov r4,r0
 00001024:EAFFFFFF               b mod

 00001028:               mod: ; we divide by 10 if the number isn't less than 10 and find the mod
```

```
00001064

00001064  0000000A  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
0000108C  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
000010B4  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
000010DC  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
00001104  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
0000112C  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
00001154  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181  81818181
```

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Week#____7_______ Program Number: ____2___

Title of the Program

2. Write a program in ARM7TDMI-ISA to find the number of occurrences of a given character in a string.

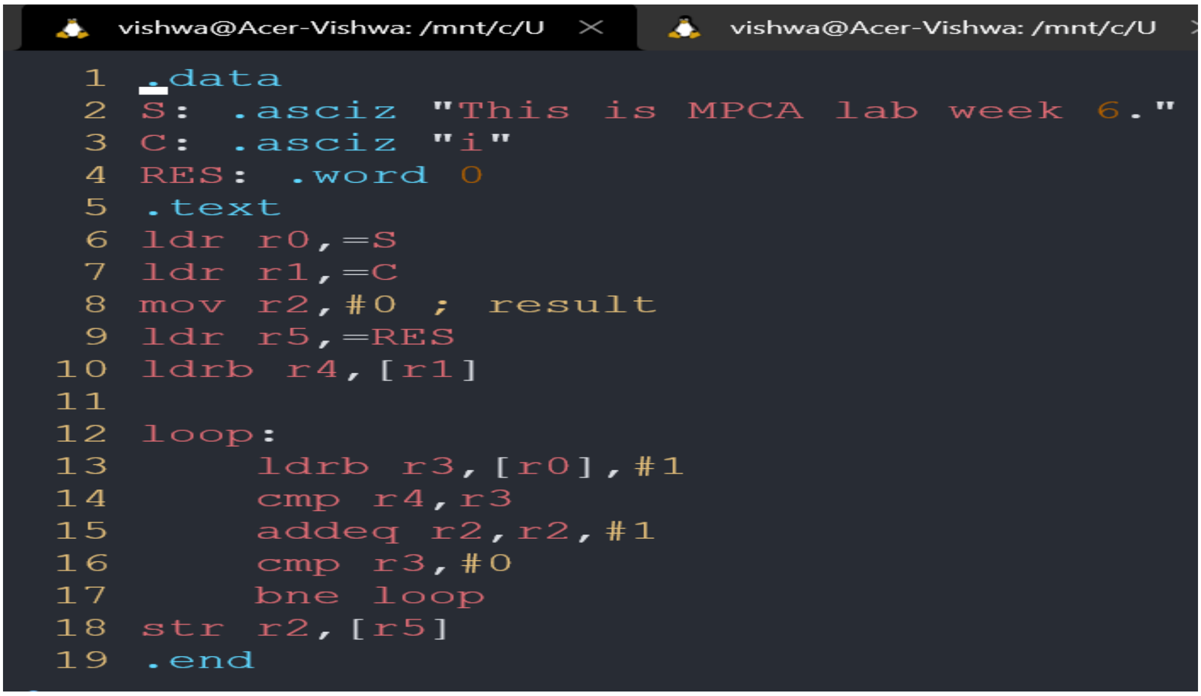
Example:

Given string: My name is Bond.

Character: ‘n’.

Expected output: Display 2 in a register.

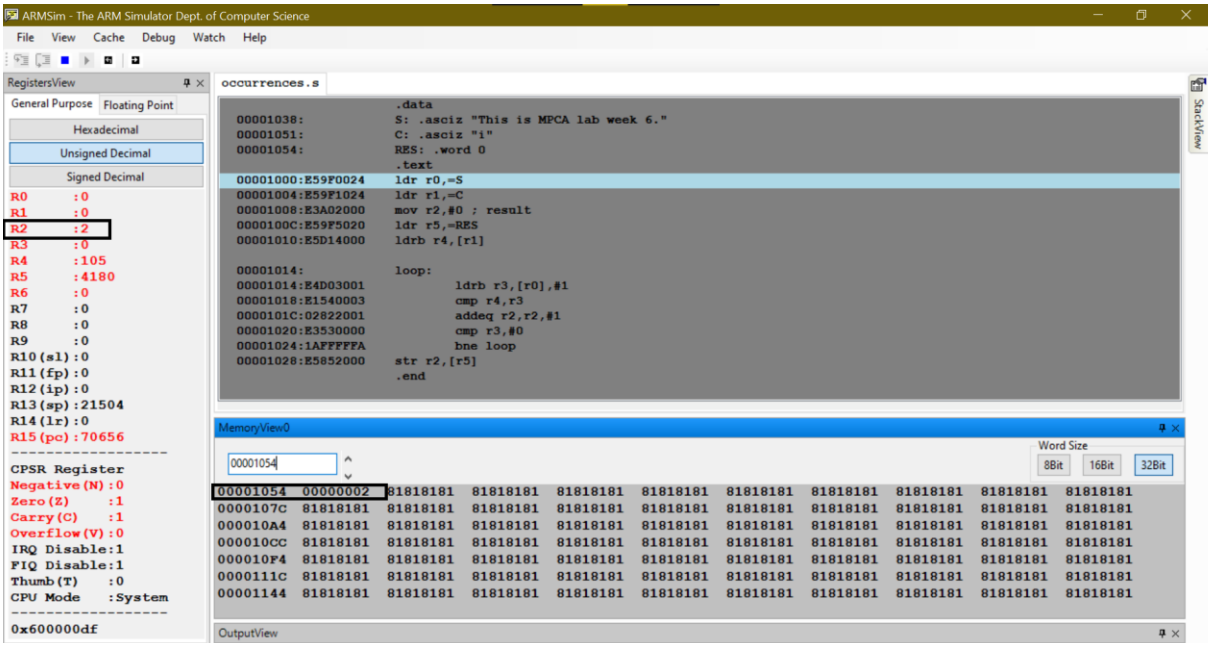
1. ARM Assembly Code(1)



```
.data
S: .asciz "This is MPCA lab week 6."
C: .asciz "i"
RES: .word 0
.text
ldr r0,=S
ldr r1,=C
mov r2,#0 ; result
ldr r5,=RES
ldrb r4,[r1]

loop:
    ldrb r3,[r0],#1
    cmp r4,r3
    addeq r2,r2,#1
    cmp r3,#0
    bne loop
str r2,[r5]
.end
```

2. Output Screen Shot (1)



```
R0        :0
R1        :0
R2        :2
R3        :0
R4        :105
R5        :4180
R6        :0
R7        :0
R8        :0
R9        :0
R10(sl):0
R11(fp):0
R12(ip):0
R13(sp):21504
R14(lr):0
R15(pc):70656
------------------
CPSR Register
Negative(N):0
Zero(Z)      :1
Carry(C)     :1
Overflow(V):0
IRQ Disable:1
FIQ Disable:1
Thumb(T)     :0
CPU Mode     :System
------------------
0x600000df
```

```
                    .data
00001038:           S: .asciz "This is MPCA lab week 6."
00001051:           C: .asciz "i"
00001054:           RES: .word 0
                    .text
00001000:E59F0024   ldr r0,=S
00001004:E59F1024   ldr r1,=C
00001008:E3A02000   mov r2,#0 ; result
0000100C:E59F5020   ldr r5,=RES
00001010:E5D14000   ldrb r4,[r1]

00001014:           loop:
00001014:E4D03001           ldrb r3,[r0],#1
00001018:E1540003           cmp r4,r3
0000101C:02822001           addeq r2,r2,#1
00001020:E3530000           cmp r3,#0
00001024:1AFFFFFA           bne loop
00001028:E5852000   str r2,[r5]
                    .end
```

```
00001054

00001054  00000002 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
0000107C  81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
000010A4  81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
000010CC  81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
000010F4  81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
0000111C  81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
00001144  81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
```

Disclaimer:

- The programs and output submitted is duly written, verified and executed by me.
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