

Microprocessor and Computer Architecture Laboratory

UE19CS256

4th Semester, Academic Year 2020-21

Date:03/02/2021

| | | |
|------------------------|-------------------|--------------|
| Name: SUHAN B REVANKAR | SRN:PES2UG19CS412 | Section G |
|------------------------|-------------------|--------------|

Week# 2

Program Number: 1

Title of the Program :

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. (Program shown in class)

1. ARM Assembly Code for each program

```
File Edit Format View Help
.TEXT
|
@BASED ON THE VALUE IN R0 STORE 1,2,3 IN R1 IF R0 HAS ZERO,POSITIVE,NEGATIVE NUMBER
RESPECTIVELY

MOV R0,#0
CMP R0,#0
MOVEQ R1,#1
BEQ L1
MOVMI R1,#3
BMI L1
MOV R1,#2

L1:
    SWI 0x1011
```

```
File Edit Format View Help
.TEXT

@BASED ON THE VALUE IN R0 STORE 1,2,3 IN R1 IF R0 HAS ZERO,POSITIVE,NEGATIVE NUMBER
RESPECTIVELY

MOV R0,#102
CMP R0,#0
MOVEQ R1,#1
BEQ L1
MOVMI R1,#3
BMI L1
MOV R1,#2

L1:
    SWI 0x1011
```

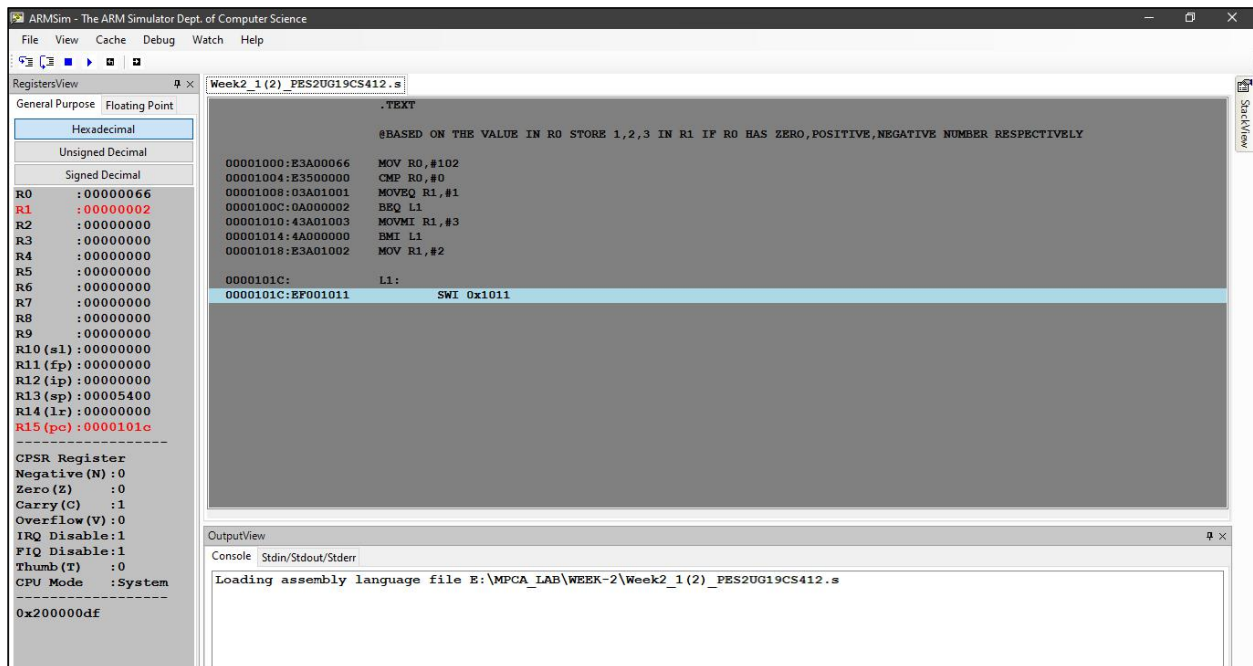
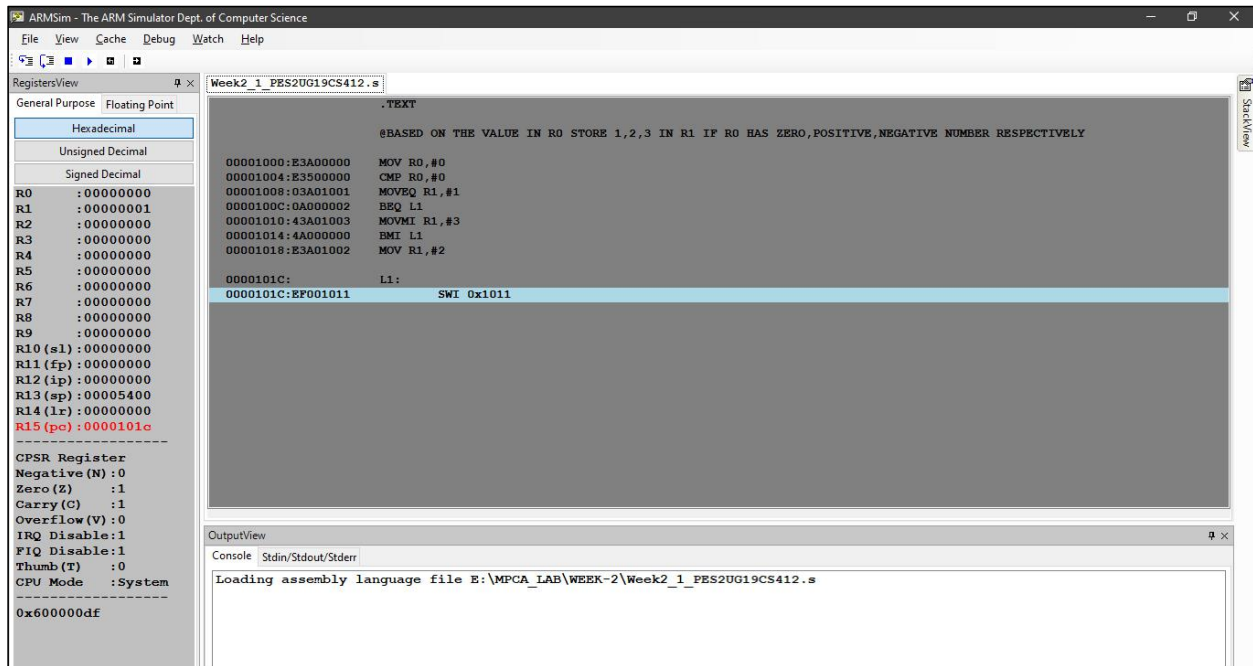
```
File Edit Format View Help
.TEXT

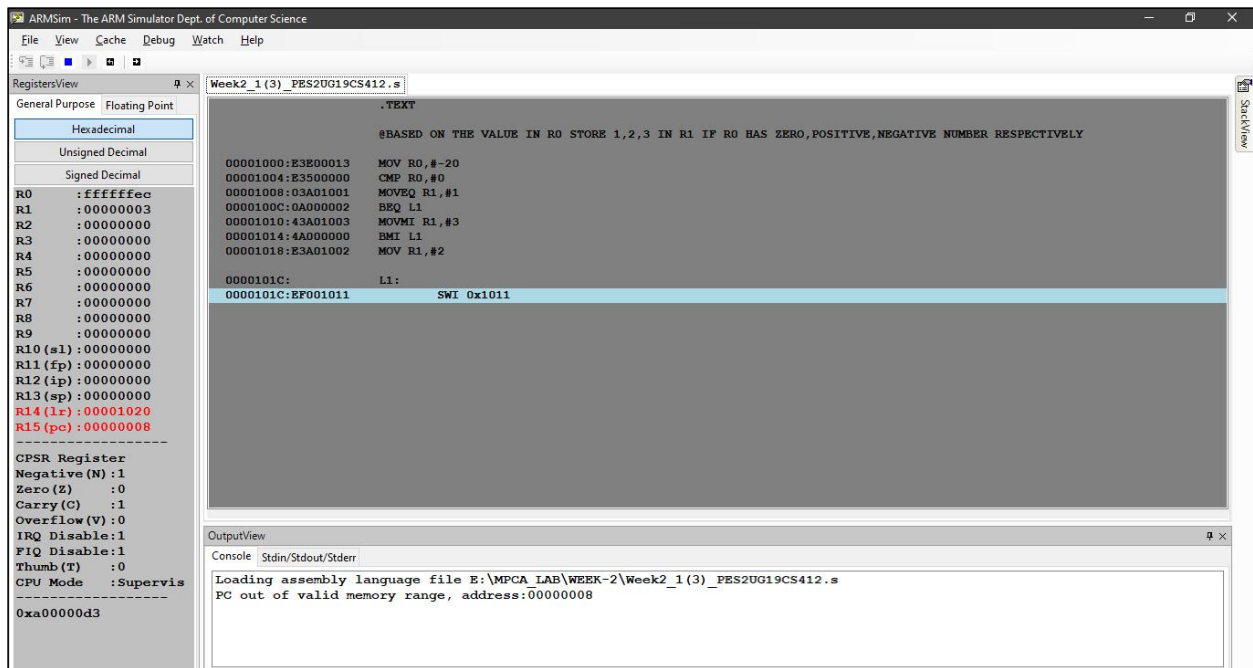
@BASED ON THE VALUE IN R0 STORE 1,2,3 IN R1 IF R0 HAS ZERO,POSITIVE,NEGATIVE NUMBER
RESPECTIVELY

MOV R0,#-20
CMP R0,#0
MOVEQ R1,#1
BEQ L1
MOVMI R1,#3
BMI L1
MOV R1,#2

L1:
    SWI 0x1011
```

2. Output Screenshot





3 . Input -Output Table for each program

| CASE 1 | R0 | | 0x00 |
|--------|----|---------------|------|
| | R1 | After compare | 1 |
| CASE 2 | R0 | | 0x66 |
| | R1 | After compare | 2 |
| CASE 3 | R0 | | 0xec |
| | R1 | After compare | 3 |

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Week# 2

Program Number: 2

Title of the Program :

Write an ALP to compare the value of R0 and R1, add if
R0 = R1, else subtract (Program shown in class)

1. ARM Assembly Code for each program

```
File Edit Format View Help
@Comparing the value in R0 and R1, add if R0=R1 else subtract

.TEXT
MOV R0,#41
MOV R1,#41
CMP R0,R1
BEQ L1
SUB R2,R1,R0
B L2

L1:
    ADD R2,R0,R1

L2:
    SWI 0x011

.END
```

```
File Edit Format View Help
@Comparing the value in R0 and R1, add if R0=R1 else subtract

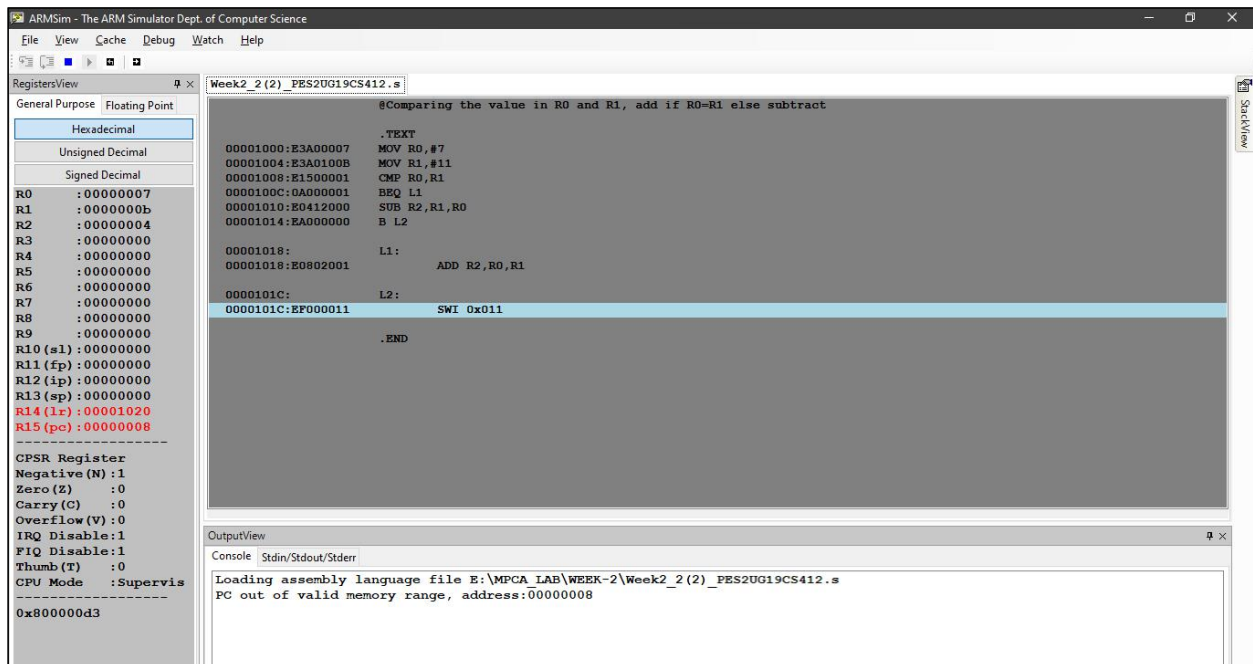
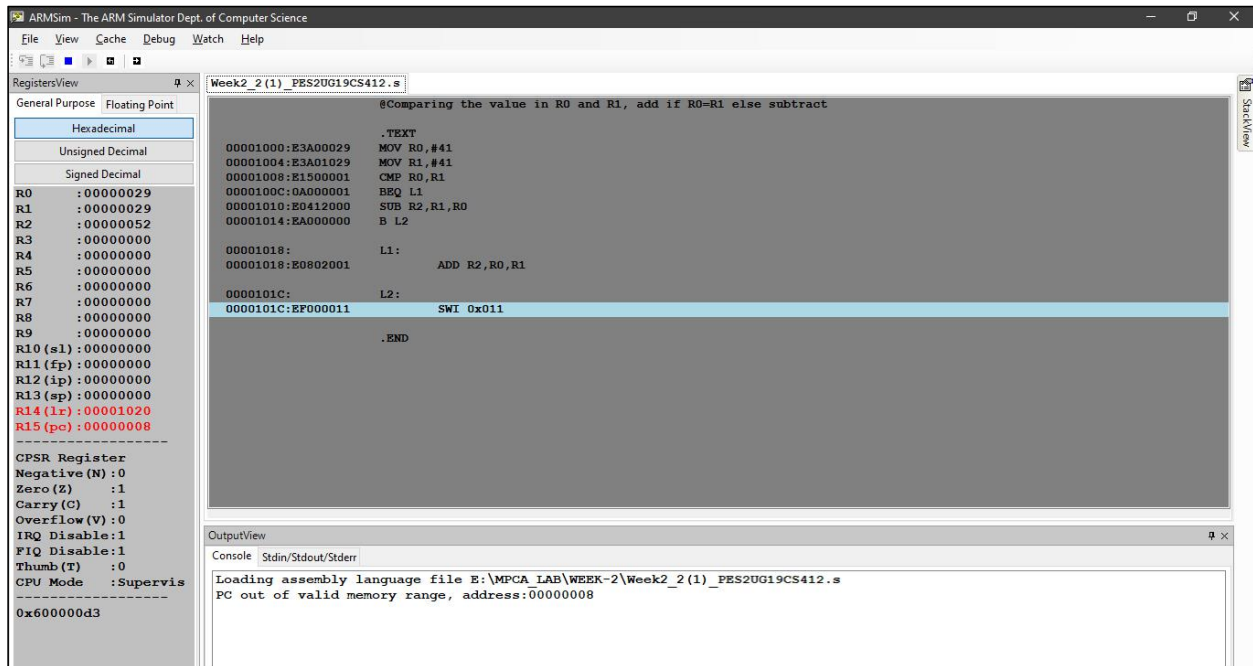
.TEXT
MOV R0,#7
MOV R1,#11
CMP R0,R1
BEQ L1
SUB R2,R1,R0
B L2

L1:
    ADD R2,R0,R1

L2:
    SWI 0x011

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| CASE 1 | R1=0x29, R0=0x29 | | |
|--------|------------------|--|--|
| | R2=R1+R0=0x52 | | |
| CASE 2 | R1=0x07,R0=0x0b | | |
| | R2=R1-R0=0x04 | | |

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Week#____2_____

Program Number: ____3____

Title of the Program :

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. (Program shown in class)

1. ARM Assembly Code for each program

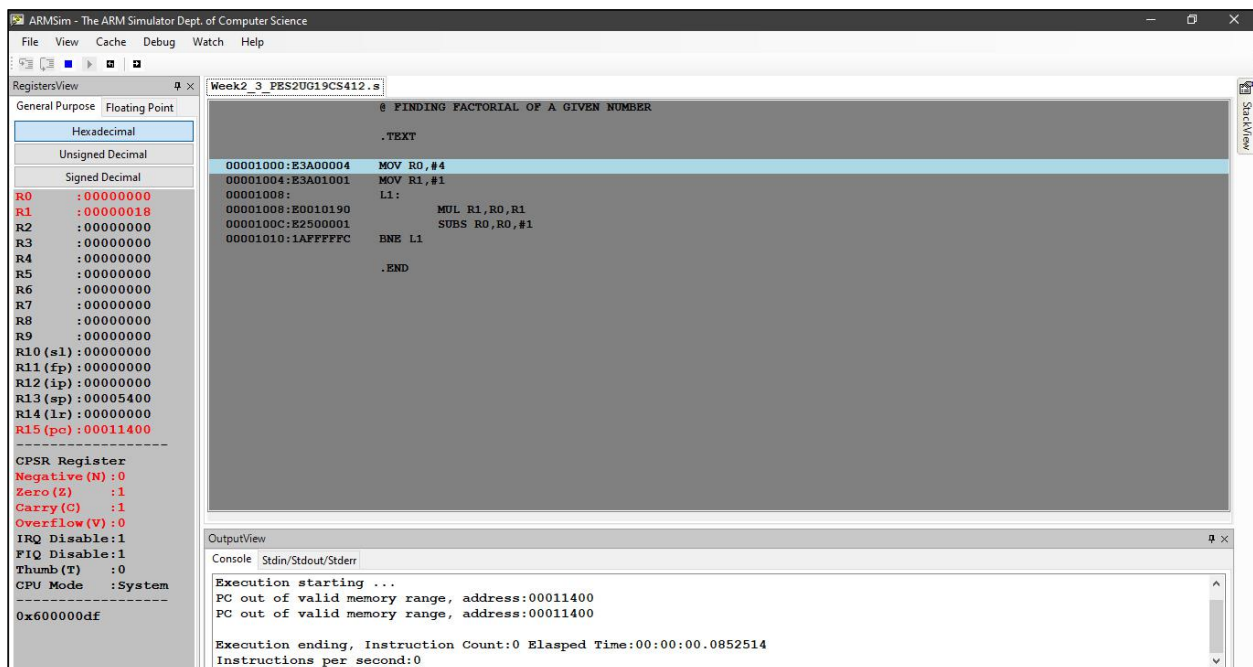
```
File Edit Format View Help
@ FINDING FACTORIAL OF A GIVEN NUMBER

.TEXT

MOV R0,#4
MOV R1,#1
L1:
    MUL R1,R0,R1
    SUBS R0,R0,#1
BNE L1

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| 1 st Iteration | R1=0x04 |
|---------------------------|---------------------------|
| | R0=0x03 |
| | R2=0X0C=Decimal 12 |
| 2 nd Iteration | R1=0x0C |
| | R0=0X02R2=0x18=Decimal 24 |
| 3rd Iteration | R1=0x18 |
| | R0=0X01 |
| | R2=0x18 |

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Week# 2

Program Number: 4a

Title of the Program :

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

1. ARM Assembly Code for each program

```
File Edit Format View Help
@ ADDING TWO 32-BIT NUMBERS LOADED FROM MEMORY AND STORING THE RESULT BACK IN MEMORY

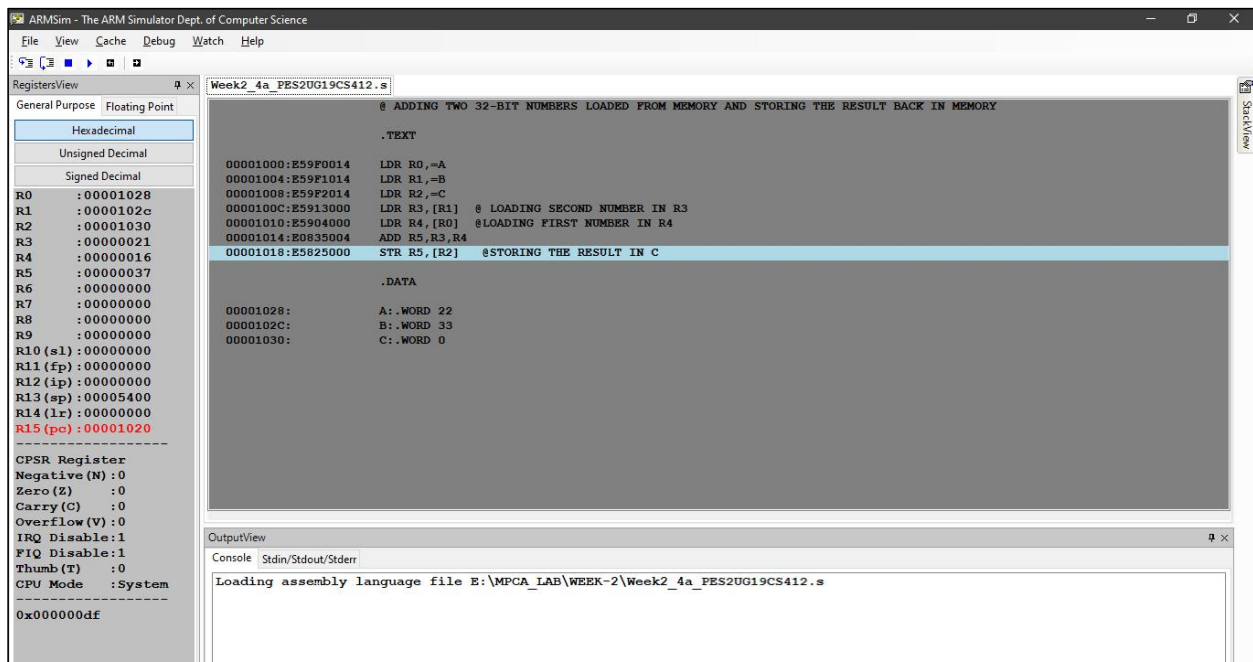
.TEXT

LDR R0,=A
LDR R1,=B
LDR R2,=C
LDR R3,[R1] @ LOADING SECOND NUMBER IN R3
LDR R4,[R0] @LOADING FIRST NUMBER IN R4
ADD R5,R3,R4
STR R5,[R2] @STORING THE RESULT IN C

.DATA

A:.WORD 22
B:.WORD 33
C:.WORD 0
```

2. Output Screenshot



3 . Input -Output Table for each program

| | A=0x16, B=0x21 |
|------------|--|
| R0 | Address of A=0x28 |
| R1 | Address of B=0x2c |
| R2 | Address of C=0x30 |
| R3 | 0x21=Decimal 33 =Content of Location B |
| R4 | 0x16=Decimal 22= Content of Location A |
| R5 | 0x37=Decimal 55 |
| Location C | 0x30=Decimal 55 |

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Week# 2

Program Number: 4b

Title of the Program :

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

1. ARM Assembly Code for each program

```
File Edit Format View Help
@ ADDING TWO 32-BIT NUMBERS LOADED FROM MEMORY AND STORING THE RESULT BACK IN MEMORY

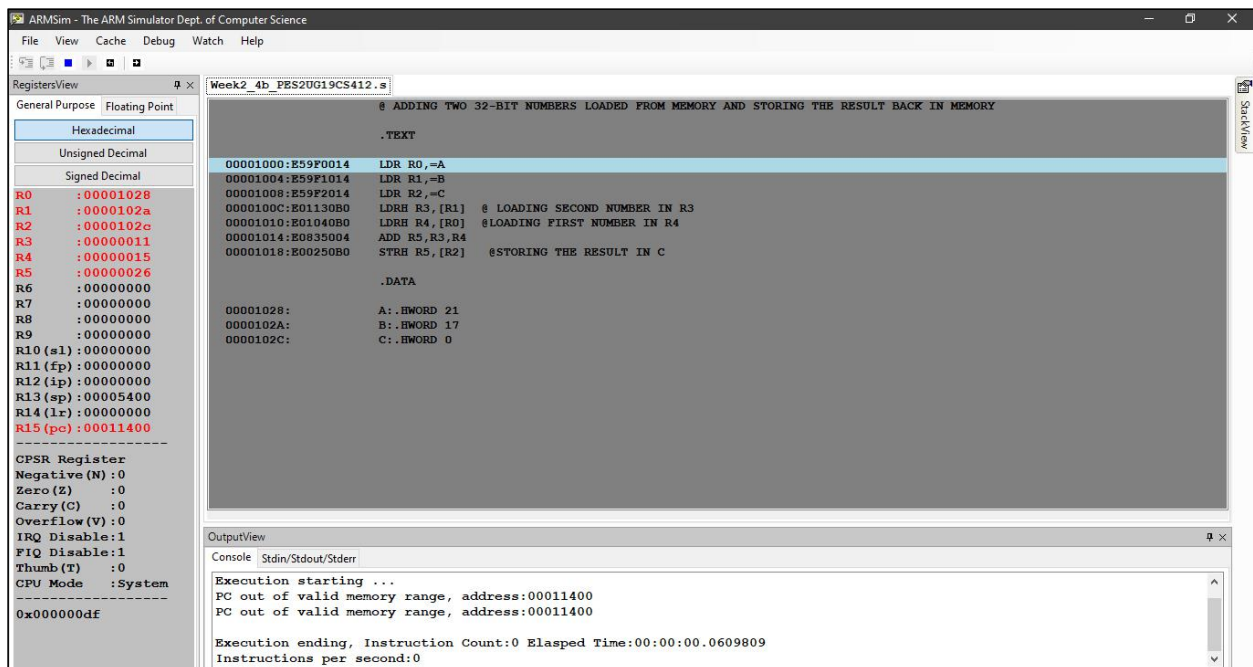
.TEXT

LDR R0,=A
LDR R1,=B
LDR R2,=C
LDRH R3,[R1] @ LOADING SECOND NUMBER IN R3
LDRH R4,[R0] @LOADING FIRST NUMBER IN R4
ADD R5,R3,R4
STRH R5,[R2] @STORING THE RESULT IN C

.DATA

A: .HWORD 21
B: .HWORD 17
C: .HWORD 0
```

2. Output Screenshot



3 . Input -Output Table for each program

| | A=0x15, B=0x11 |
|------------|--|
| R0 | Address of A=0x28 |
| R1 | Address of B=0x2a |
| R2 | Address of C=0x2c |
| R3 | 0x11=Decimal 17=Content of Location B |
| R4 | 0x15=Decimal 21= Content of Location A |
| R5 | 0x26=Decimal 38 |
| Location C | 0x2c=Decimal 38 |

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Week# 2

Program Number: 5a

Title of the Program :

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

1. ARM Assembly Code for each program

```
File Edit Format View Help
@ GCD OF TWO NUMBERS

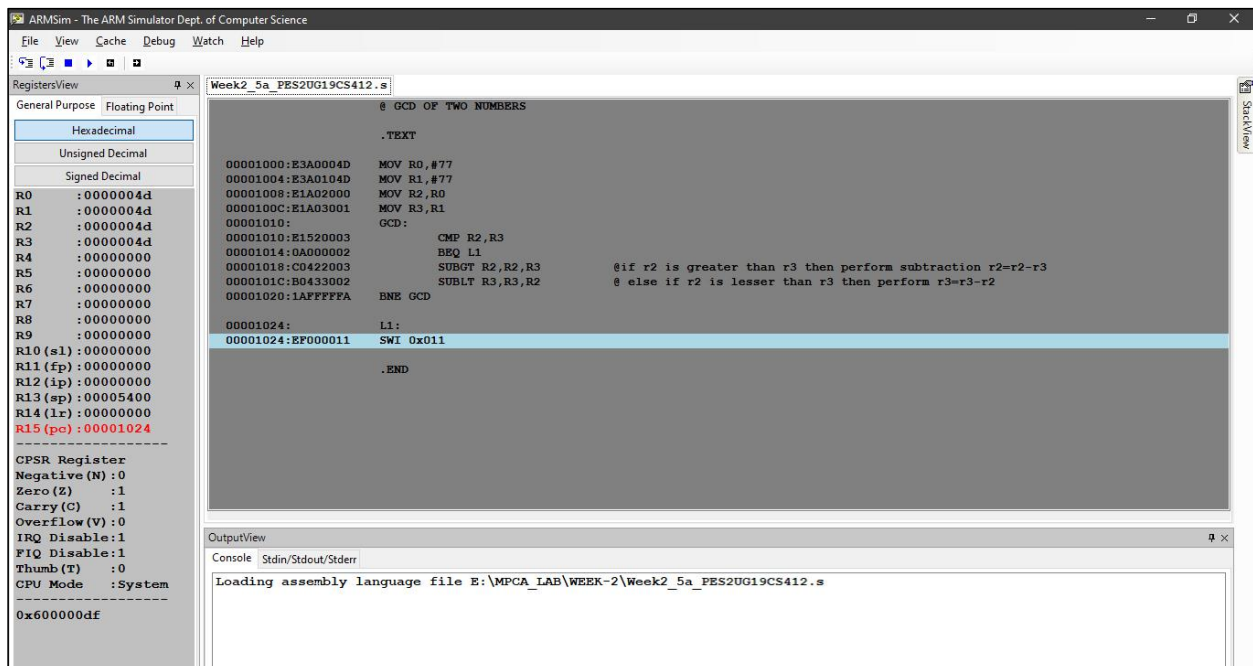
.TEXT

MOV R0,#77
MOV R1,#77
MOV R2,R0
MOV R3,R1
GCD:
    CMP R2,R3
    BEQ L1
    SUBGT R2,R2,R3    @if r2 is greater than r3 then perform subtraction r2=r2-r3
    SUBLT R3,R3,R2    @ else if r2 is lesser than r3 then perform r3=r3-r2
BNE GCD

L1:
SWI 0x011

.END
```

2. Output Screenshot



3. Input -Output Table for each program

| CASE 1 | R0 | 0x4d |
|------------------------------|--------------------------------------|------|
| | R1 | 0x4d |
| 1 st iteration | R2=0x4d R3=0x4d R3=0x4d GCD=77 | |

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Week# 2

Program Number: 5b

Title of the Program :

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

1. ARM Assembly Code for each program

```
File Edit Format View Help
@ GCD OF TWO NUMBERS

.TEXT

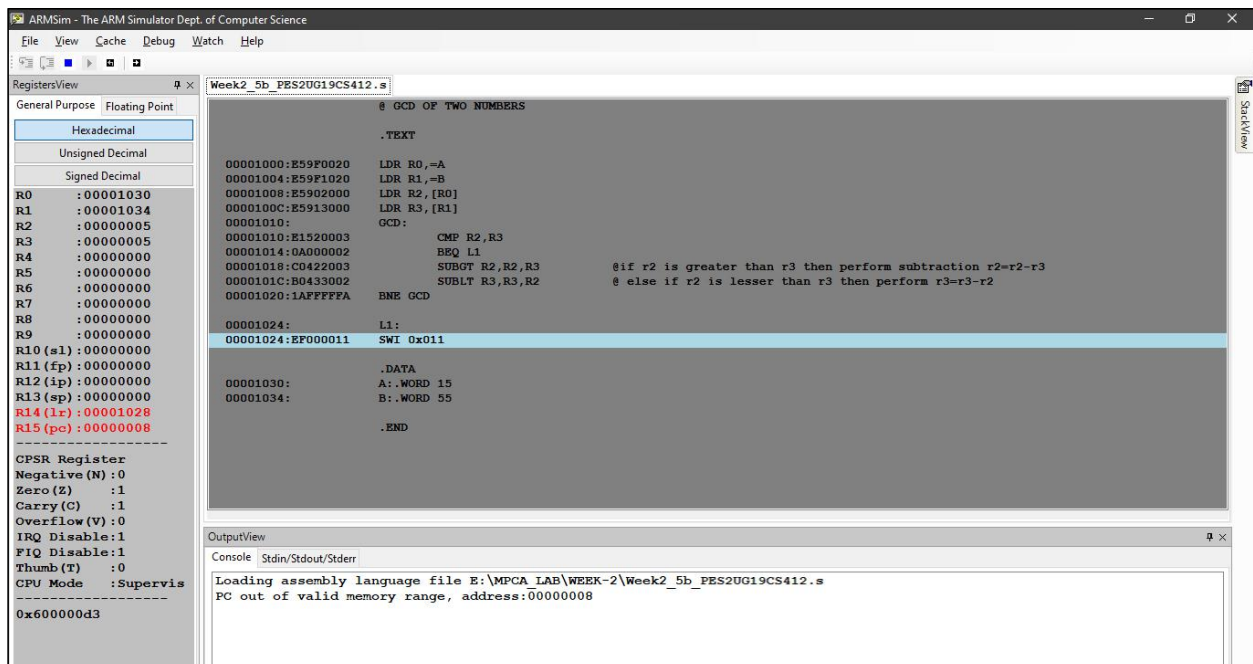
LDR R0,=A
LDR R1,=B
LDR R2,[R0]
LDR R3,[R1]
GCD:
    CMP R2,R3
    BEQ L1
    SUBGT R2,R2,R3    @if r2 is greater than r3 then perform subtraction r2=r2-r3
    SUBLT R3,R3,R2    @ else if r2 is lesser than r3 then perform r3=r3-r2
BNE GCD

L1:
SWI 0x011

.DATA
A:.WORD 15
B:.WORD 55

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| CASE 1 | A=0x0F,B=0x37 |
|---------------------------|--|
| 1 st iteration | R2=0x0f=Decimal 20 R3=0x28 R2=0x14-0x04=0x10 |
| 2 nd iteration | R2=0x10=Decimal 15 R3=0x04 R2=0x10-0x04=0xA |
| 3 rd iteration | R2=0x0f=Decimal 15 R3=0x0a R2=0x0f-0x0a=0x05 |
| 4th iteration | R2=0x05 R3=0x0a R2=0x05-0x0a=0x05 |
| 5th iteration | R2=0x05 R3=0x05 R2=0x05-0x05=0x00 |
| 6 TH iteration | R2=0x05 R3=0x05 |

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Week# 2

Program Number: 6a

Title of the Program :

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

1. ARM Assembly Code for each program

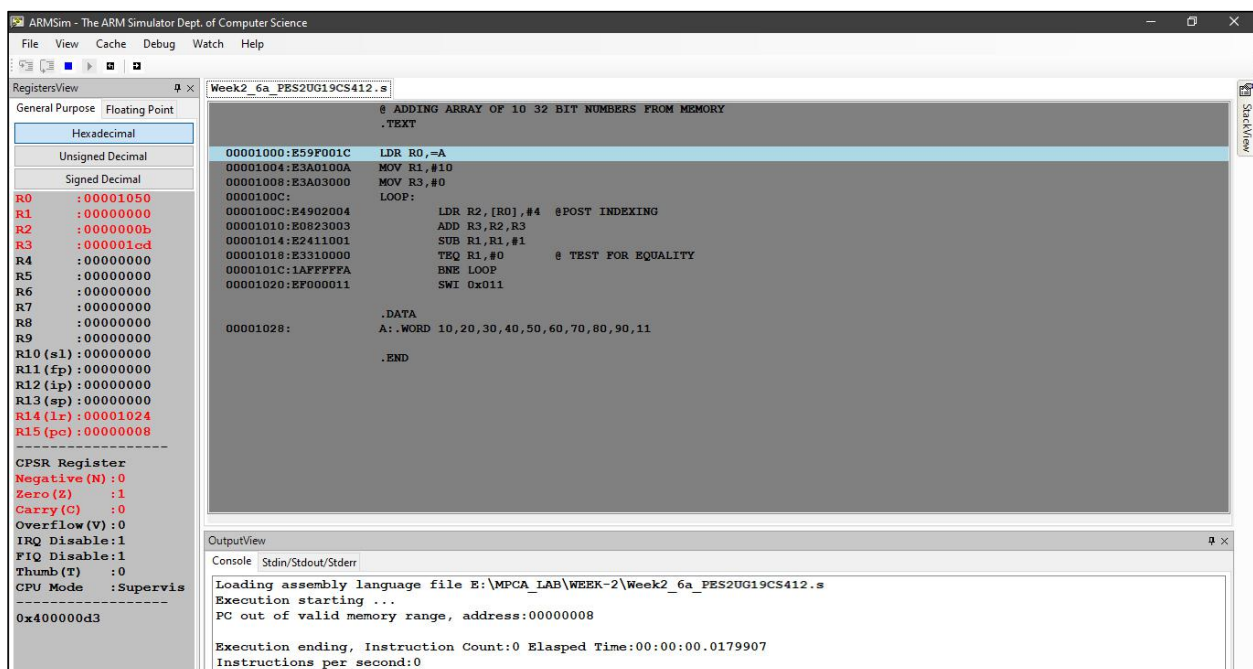
```
File Edit Format View Help
@ ADDING ARRAY OF 10 32 BIT NUMBERS FROM MEMORY
.TEXT

LDR R0,=A
MOV R1,#10
MOV R3,#0
LOOP:
    LDR R2,[R0],#4 @POST INDEXING
    ADD R3,R2,R3
    SUB R1,R1,#1
    TEQ R1,#0      @ TEST FOR EQUALITY
    BNE LOOP
    SWI 0x011

.DATA
A: .WORD 10,20,30,40,50,60,70,80,90,11

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| A:.word 10,20,30,40,50,60,70,80,90,11 | | | | | | | | | | |
|---------------------------------------|------|------|------|------|------|------|-------|-------|-------|-------|
| R1 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| R0 | A | A+4 | A+8 | A+12 | A+16 | A+20 | A+24 | A+28 | A+32 | A+36 |
| R2 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 11 |
| R3 | 0 | 10 | 30 | 60 | 100 | 150 | 210 | 280 | 360 | 450 |
| R3 (After Executio n) | 10 | 30 | 60 | 100 | 150 | 210 | 280 | 360 | 450 | 461 |
| Values in hex | 0x0A | 0x1E | 0x4C | 0x64 | 0x96 | 0xD2 | 0x118 | 0x168 | 0x1C2 | 0x1CD |

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Week# 2

Program Number: 6b

Title of the Program :

Add array of ten 8 bit numbers taking data from memory location (use .byte to store the data instead of .word)

1. ARM Assembly Code for each program

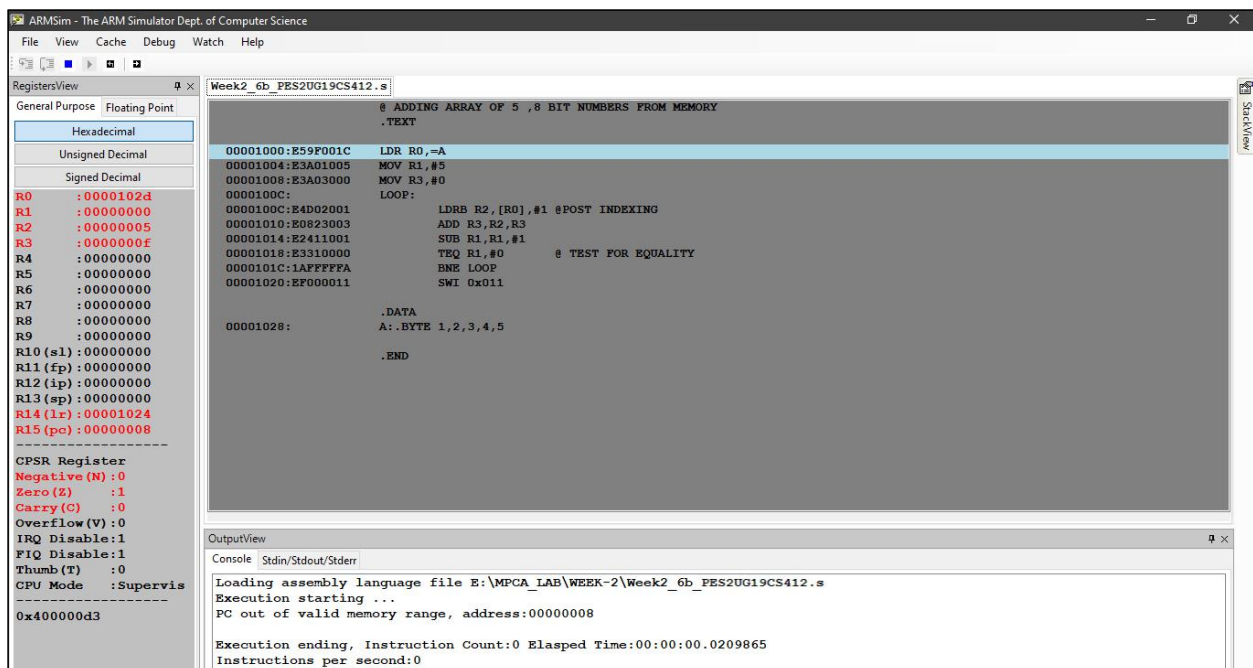
```
File Edit Format View Help
@ ADDING ARRAY OF 5 ,8 BIT NUMBERS FROM MEMORY
.TEXT

LDR R0,=A
MOV R1,#5
MOV R3,#0
LOOP:
    LDRB R2,[R0],#1 @POST INDEXING
    ADD R3,R2,R3
    SUB R1,R1,#1
    TEQ R1,#0        @ TEST FOR EQUALITY
    BNE LOOP
    SWI 0x011

.DATA
A:.BYTE 1,2,3,4,5

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| A:.byte 1,2,3,4,5 | | | | | |
|----------------------------|----------|----------|----------|----------|----------|
| R1 | 5 | 4 | 3 | 2 | 1 |
| R0 | A | A+1 | A+2 | A+3 | A+4 |
| R3 | 0 | 1 | 3 | 6 | 10 |
| R4 | 1 | 2 | 3 | 4 | 5 |
| R3 (After Execution) | 1 | 3 | 6 | 10 | 15 |
| Values in hex | 0x 01 | 0x 03 | 0x 06 | 0x 0A | 0x 0F |

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Week# 2

Program Number: 7

Title of the Program :

Write an ALP to multiply 35*R0

*Use LSL instruction for multiplication

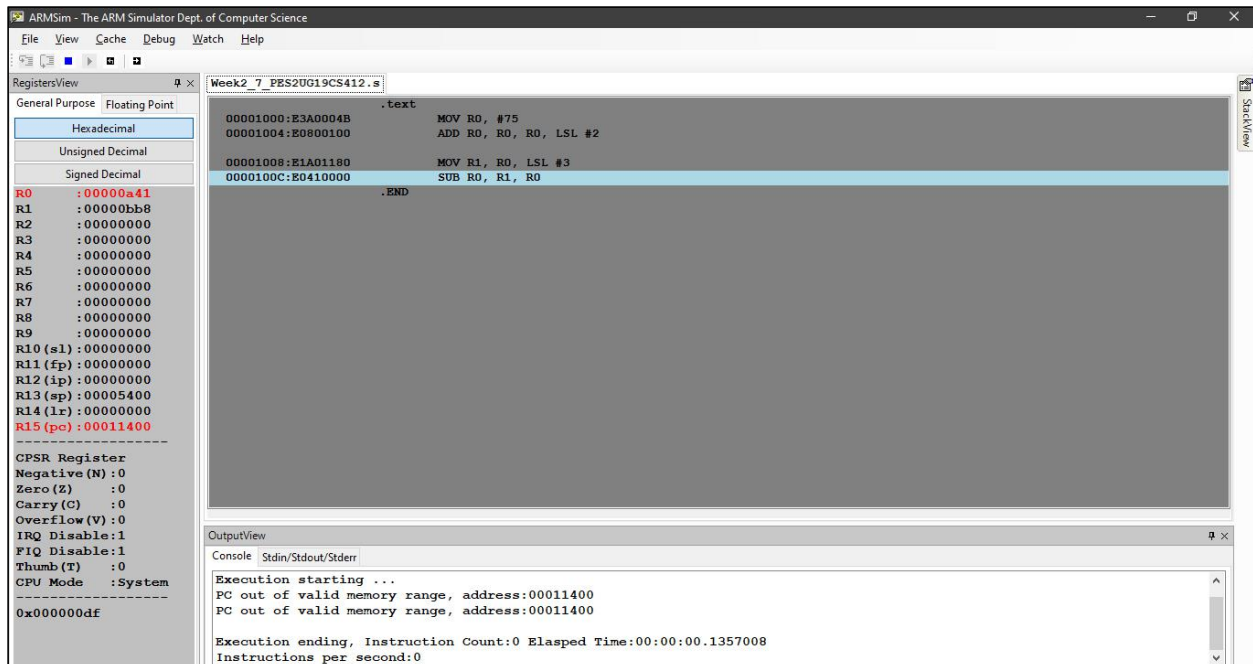
1. ARM Assembly Code for each program

```
File Edit Format View Help
.text
    MOV R0, #75
    ADD R0, R0, R0, LSL #2

    MOV R1, R0, LSL #3
    SUB R0, R1, R0

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| | Decimal | Hexadecimal |
|---|----------------|-------------|
| R0(1 st line of the Program) | 75 | 4b |
| R0(2 nd line of the Program | 4R0=300 | 12C |
| | 4R0+R0=5R0=750 | 2EE |
| R0(3 rd line of the Program | 8R0=750*8=6000 | 0x1770 |
| | 8R0-R0=5250 | 1482 |

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Week# 2

Program Number: 8

Title of the Program :

Write an ALP to evaluate the expression $(A+B) + (5*B)$,
where A and B are available in memory location.

* Use LSL instruction for multiplication

1. ARM Assembly Code for each program

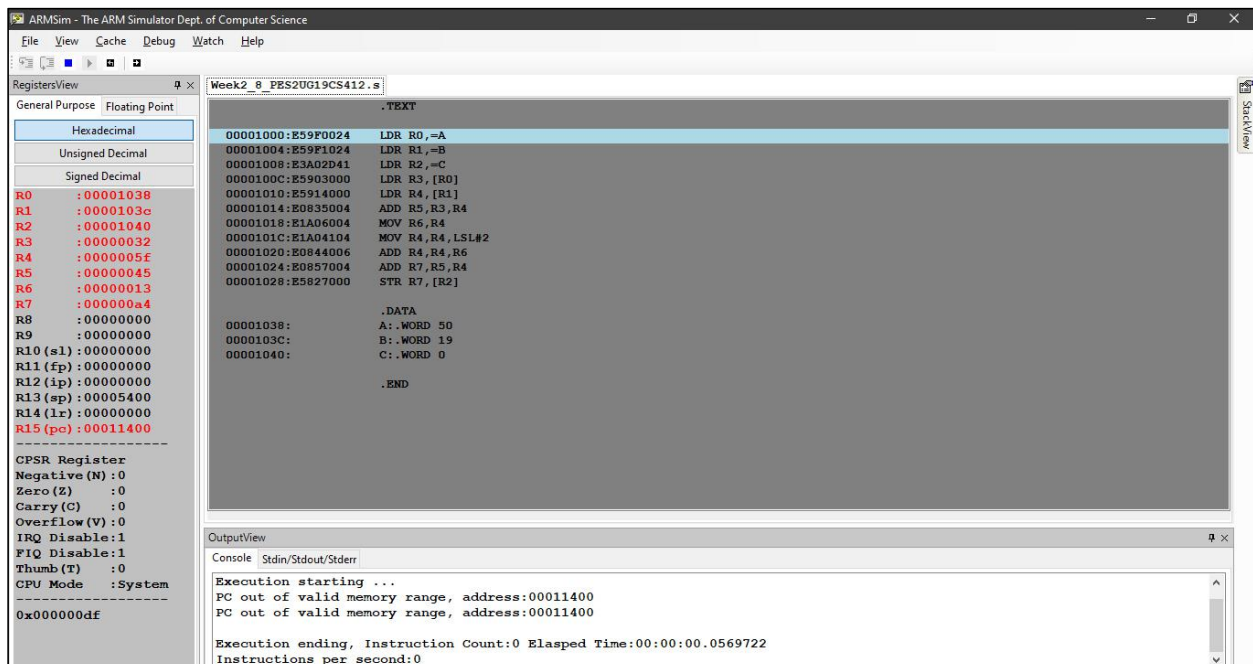
```
File Edit Format View Help
|.TEXT

LDR R0,=A
LDR R1,=B
LDR R2,=C
LDR R3,[R0]
LDR R4,[R1]
ADD R5,R3,R4
MOV R6,R4
MOV R4,R4,LSL#2
ADD R4,R4,R6
ADD R7,R5,R4
STR R7,[R2]

.DATA
A:.WORD 50
B:.WORD 19
C:.WORD 0

.END
```

2. Output Screenshot



3 . Input -Output Table for each program

| A=Decimal 50,B=Decimal 19 | | |
|----------------------------------|-----------|-------------|
| | Decimal | Hexadecimal |
| R3 | 50 | 32 |
| R4 | 19 | 13 |
| R5 =R3+R4 =A+B | 69 | 45 |
| Calculate 4*B | 19*4=76 | 4C |
| Calculate 5*B | 76+19=95 | 5F |
| Calculate (A+B)+5*B | 69+95=164 | A4 |

Disclaimer:

- 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.
- If found plagiarized, I will abide with the disciplinary action of the University.

Signature: suhanb

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