PES UNIVERSITY

Department of Computer Science & Engineering

Microprocessor & Computer Architecture

MPCA-Laboratory/Assignment/Hands-on/Project

UE20CS252

PES1UG20CS516 **Vrushank G** **Sec-I**

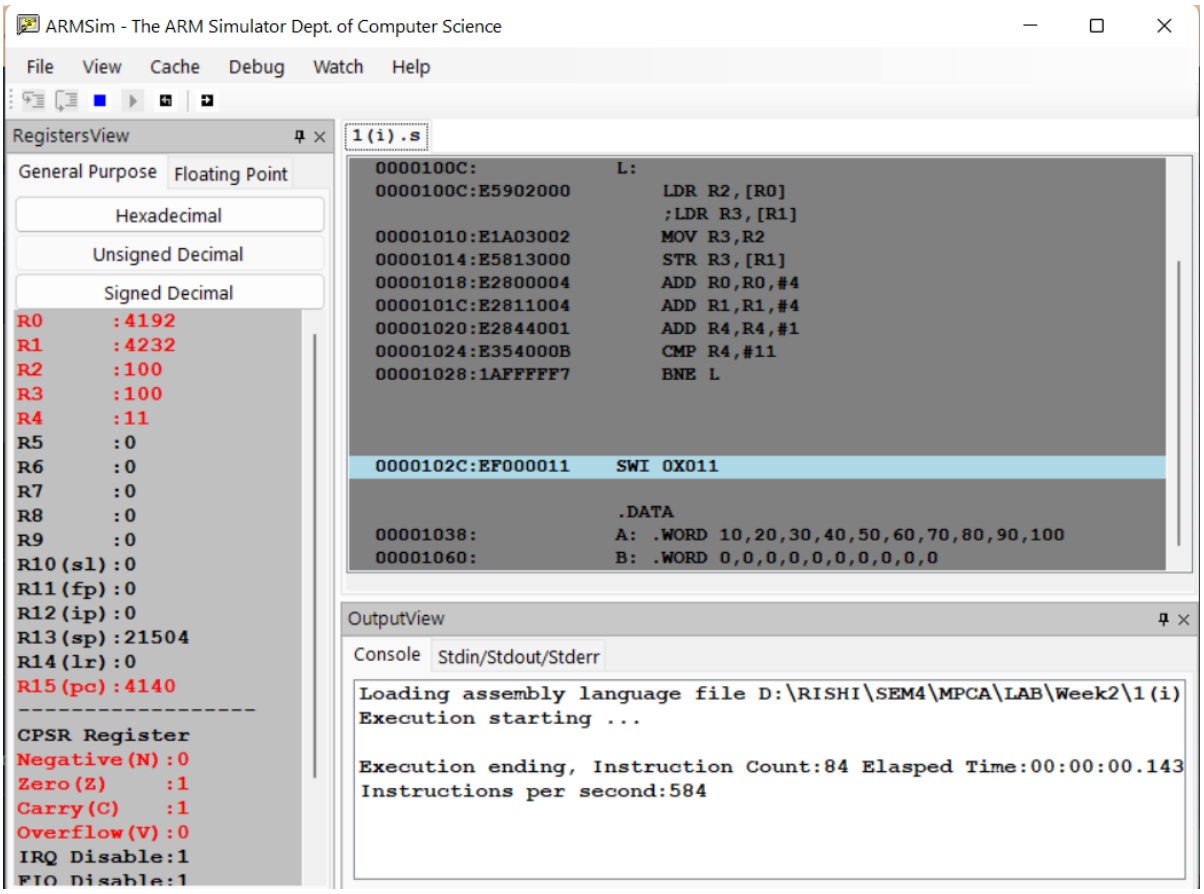
Sl. No.	Programs
Week No. 2	1. Write a program in ARM7TDMI–ISA to copy a block of N data items from Location A to Location B. a) Use Full word (.word directive)

1(i).s - Notepad PREVIEW

File Edit View

```
.TEXT
LDR R0, =A
LDR R1, =B
MOV R4,#1

L:
    LDR R2,[R0]
    ;LDR R3,[R1]
    MOV R3,R2
    STR R3,[R1]
    ADD R0,R0,#4
    ADD R1,R1,#4
    ADD R4,R4,#1
    CMP R4,#11
    BNE L



SWI 0X011

.DATA
A: .WORD 10,20,30,40,50,60,70,80,90,100
B: .WORD 0,0,0,0,0,0,0,0,0,0
```

Output:



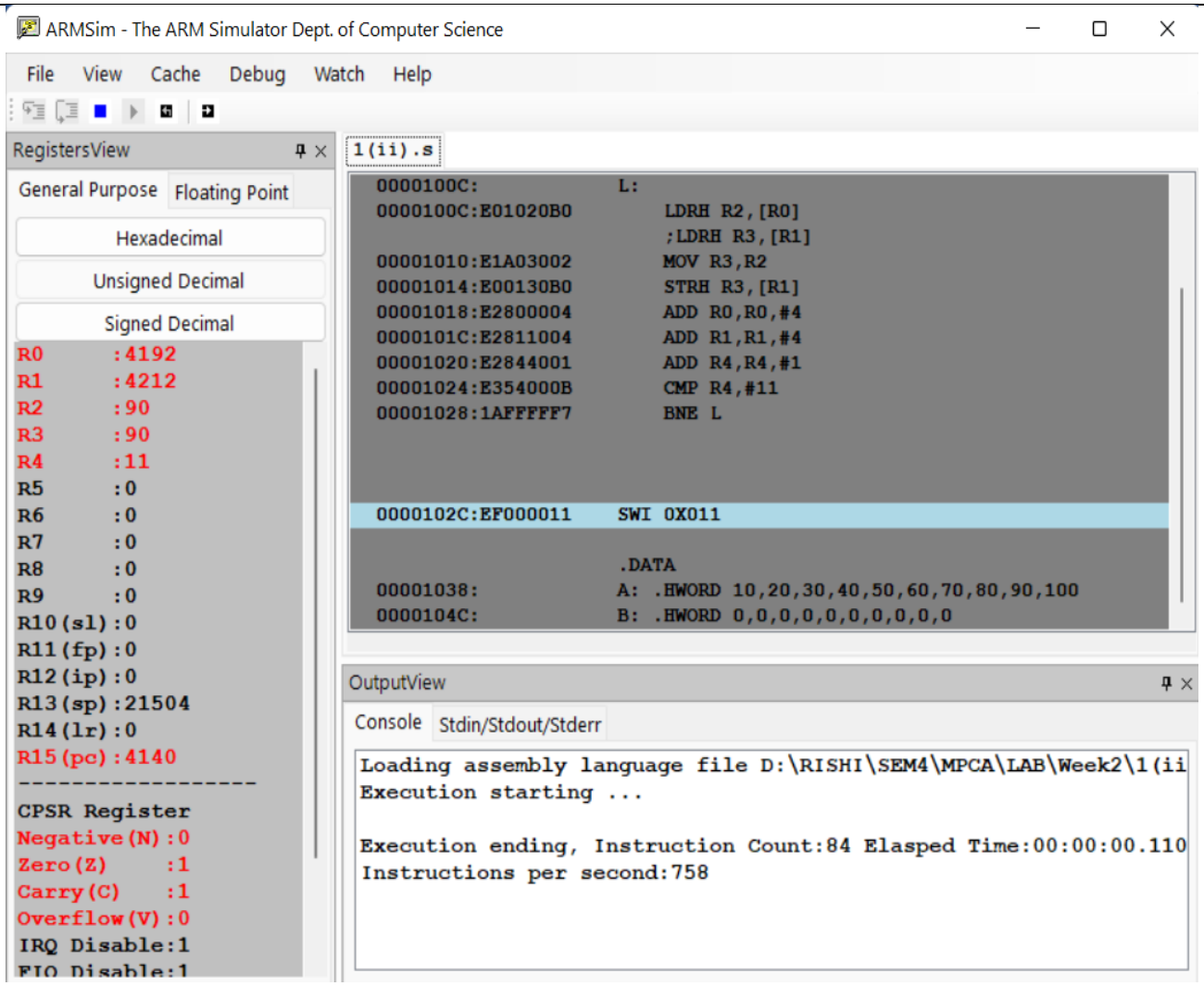
b) Use Half word(.Hword directive)

1(ii).s - Notepad PREVIEW

File Edit View

```
.TEXT
LDR R0, =A
LDR R1, =B
MOV R4,#1

L:
    LDRH R2,[R0]
    ;LDRH R3,[R1]
    MOV R3,R2
    STRH R3,[R1]
    ADD R0,R0,#4
    ADD R1,R1,#4
    ADD R4,R4,#1
    CMP R4,#11
    BNE L



SWI 0X011

.DATA
A: .HWORD 10,20,30,40,50,60,70,80,90,100
B: .HWORD 0,0,0,0,0,0,0,0,0,0
```

Output:



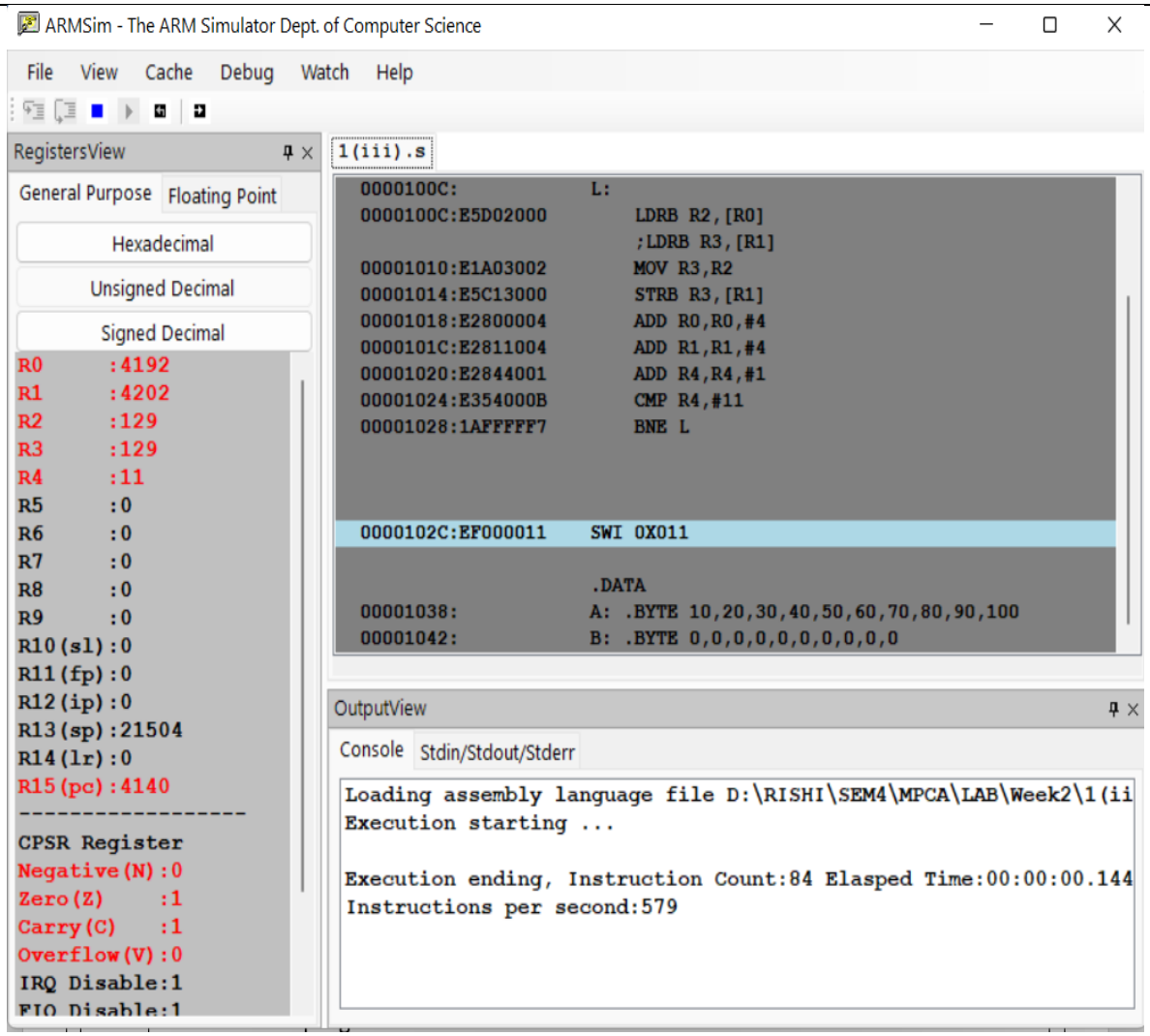
c) Use Byte wise (.Byte directive)

1(iii).s - Notepad PREVIEW

File Edit View

```
.TEXT
LDR R0, =A
LDR R1, =B
MOV R4,#1

L:
    LDRB R2,[R0]
    ;LDRB R3,[R1]
    MOV R3,R2
    STRB R3,[R1]
    ADD R0,R0,#4
    ADD R1,R1,#4
    ADD R4,R4,#1
    CMP R4,#11
    BNE L



SWI 0X011

.DATA
A: .BYTE 10,20,30,40,50,60,70,80,90,100
B: .BYTE 0,0,0,0,0,0,0,0,0,0
```

Output:



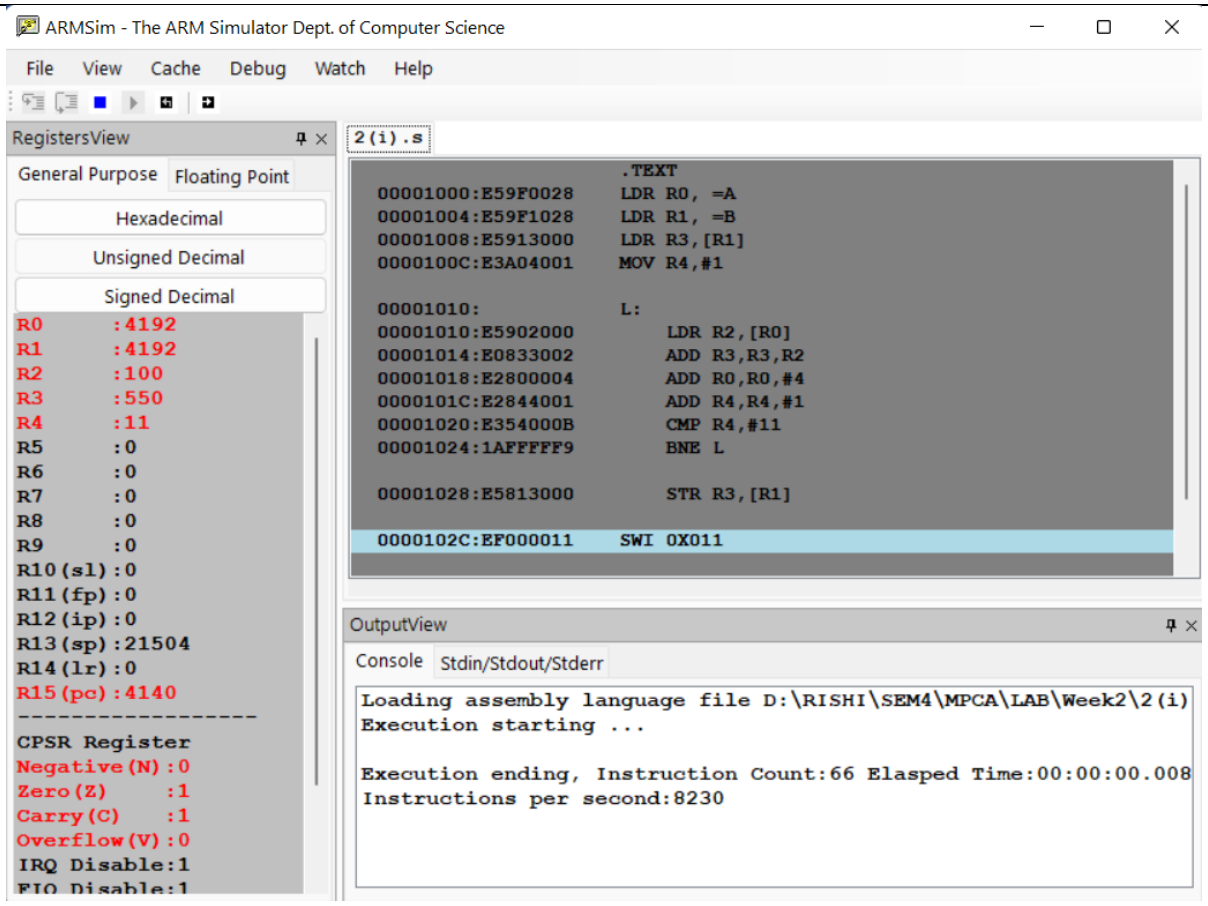
2. Write a program in ARM7TDMI–ISA to find the sum of N data items in the memory. Store the result in the memory location.
   a) Use Full word (.word directive)

2(i).s - Notepad PREVIEW

File Edit View

```
.TEXT
LDR R0, =A
LDR R1, =B
LDR R3,[R1]
MOV R4,#1

L:
    LDR R2,[R0]
    ADD R3,R3,R2
    ADD R0,R0,#4
    ADD R4,R4,#1
    CMP R4,#11
    BNE L

    STR R3,[R1]

SWI 0X011

.DATA
A: .WORD 10,20,30,40,50,60,70,80,90,100
B: .WORD 0
```

Output:



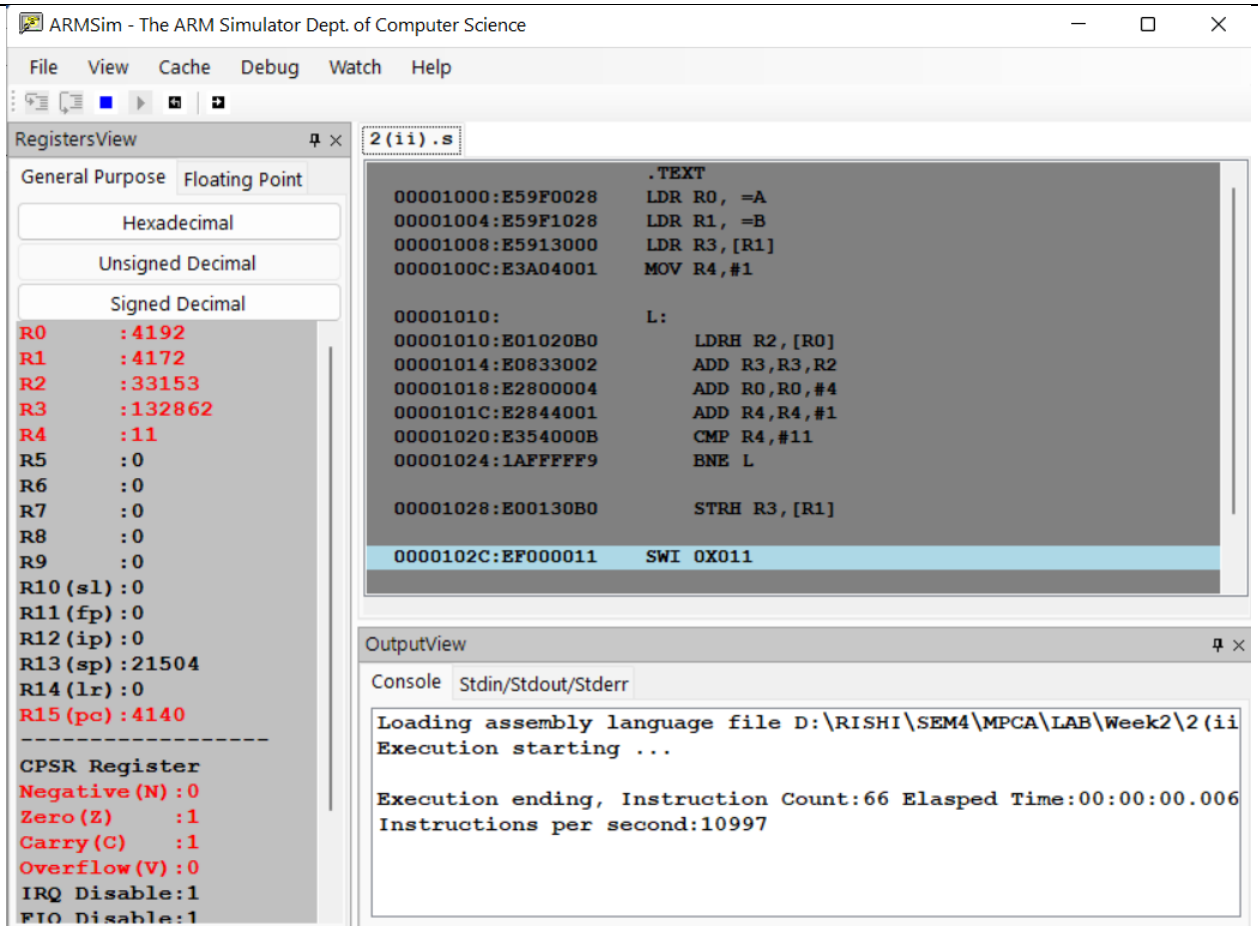
b) Use Half word(.Hword directive)

2(ii).s - Notepad PREVIEW

File Edit View

```
.TEXT
LDR R0, =A
LDR R1, =B
LDR R3,[R1]
MOV R4,#1

L:
    LDRH R2,[R0]
    ADD R3,R3,R2
    ADD R0,R0,#4
    ADD R4,R4,#1
    CMP R4,#11
    BNE L

    STRH R3,[R1]

SWI 0X011

.DATA
A: .HWORD 10,20,30,40,50,60,70,80,90,100
B: .HWORD 0
```

Output:



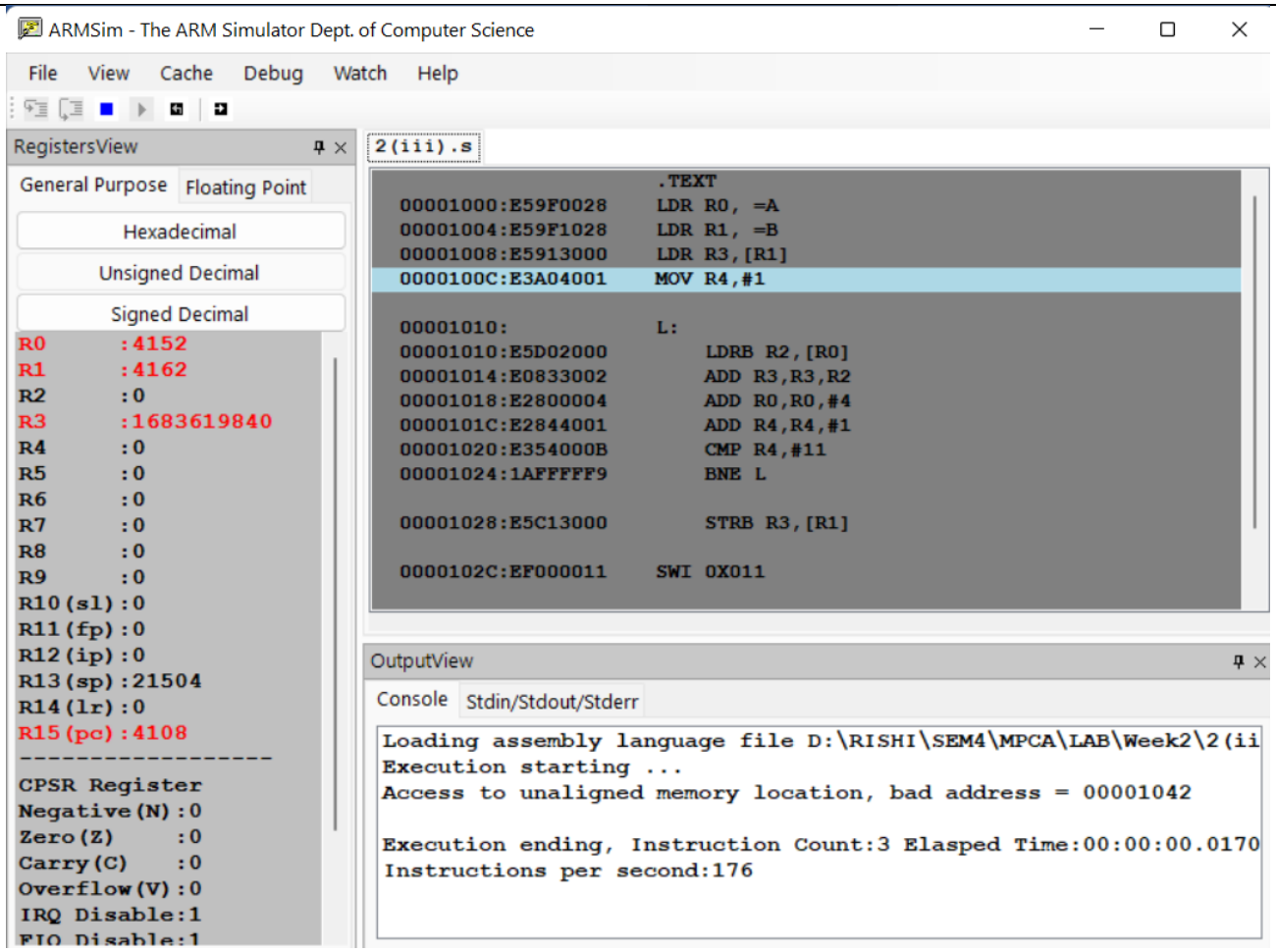
c) Use Byte wise (.Byte directive)

2(iii).s - Notepad PREVIEW

File Edit View

```
.TEXT
LDR R0, =A
LDR R1, =B
LDR R3,[R1]
MOV R4,#1

L:
    LDRB R2,[R0]
    ADD R3,R3,R2
    ADD R0,R0,#4
    ADD R4,R4,#1
    CMP R4,#11
    BNE L

    STRB R3,[R1]

SWI 0X011

.DATA
A: .BYTE 10,20,30,40,50,60,70,80,90,100
B: .BYTE 0
```

Output:



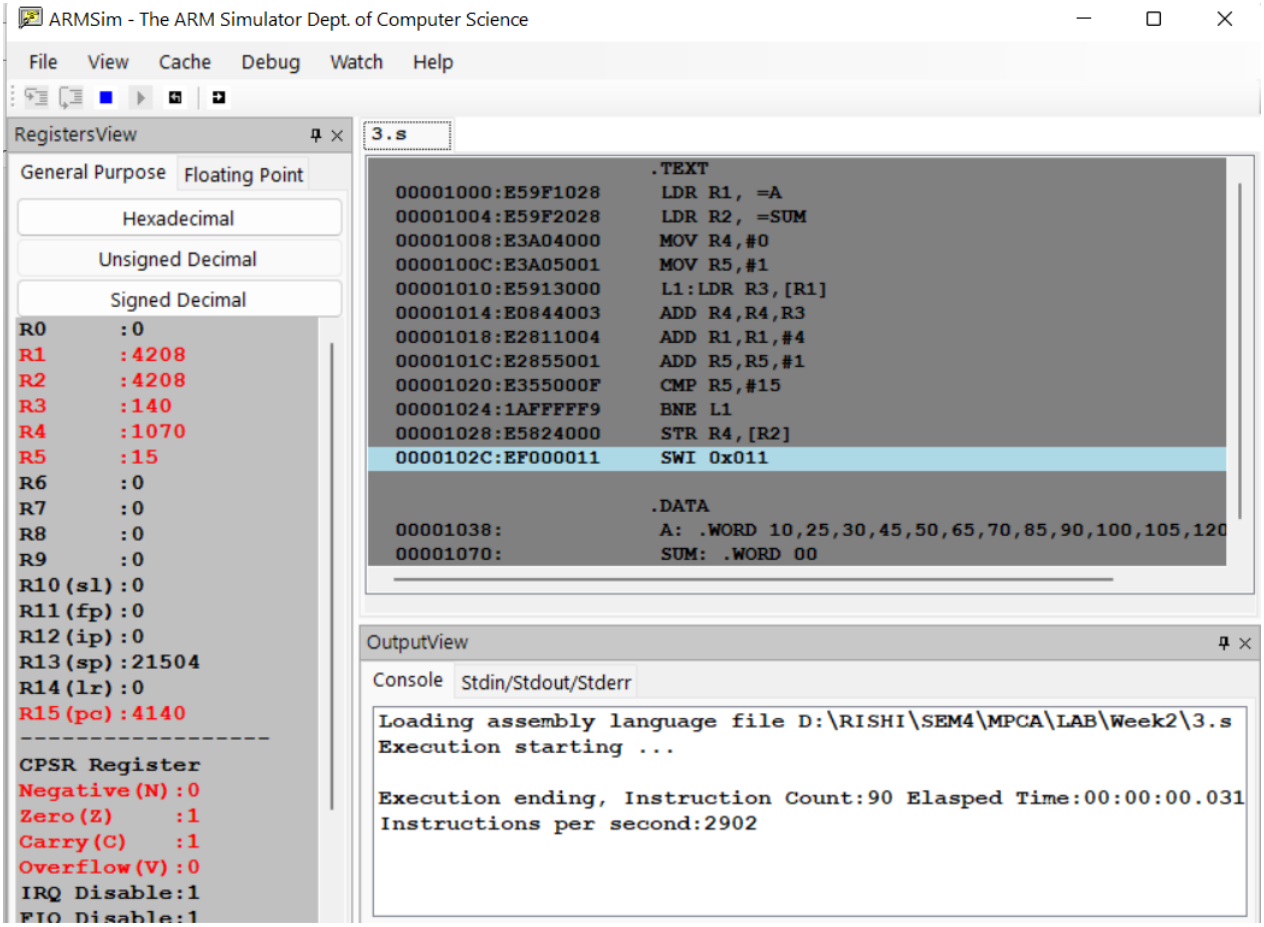
3. Write a program in ARM7TDMI–ISA to find the sum of N natural numbers. Store the result in the memory location.

3.s - Notepad PREVIEW

File Edit View

```
.TEXT
 LDR R1, =A
 LDR R2, =SUM
 MOV R4,#0
 MOV R5,#1
 L1:LDR R3,[R1]
 ADD R4,R4,R3
 ADD R1,R1,#4
 ADD R5,R5,#1
 CMP R5,#15
 BNE L1
 STR R4,[R2]
 SWI 0x011

.DATA
 A: .WORD 10,25,30,45,50,65,70,85,90,100,105,120,135,140
 SUM: .WORD 00
```

Output:



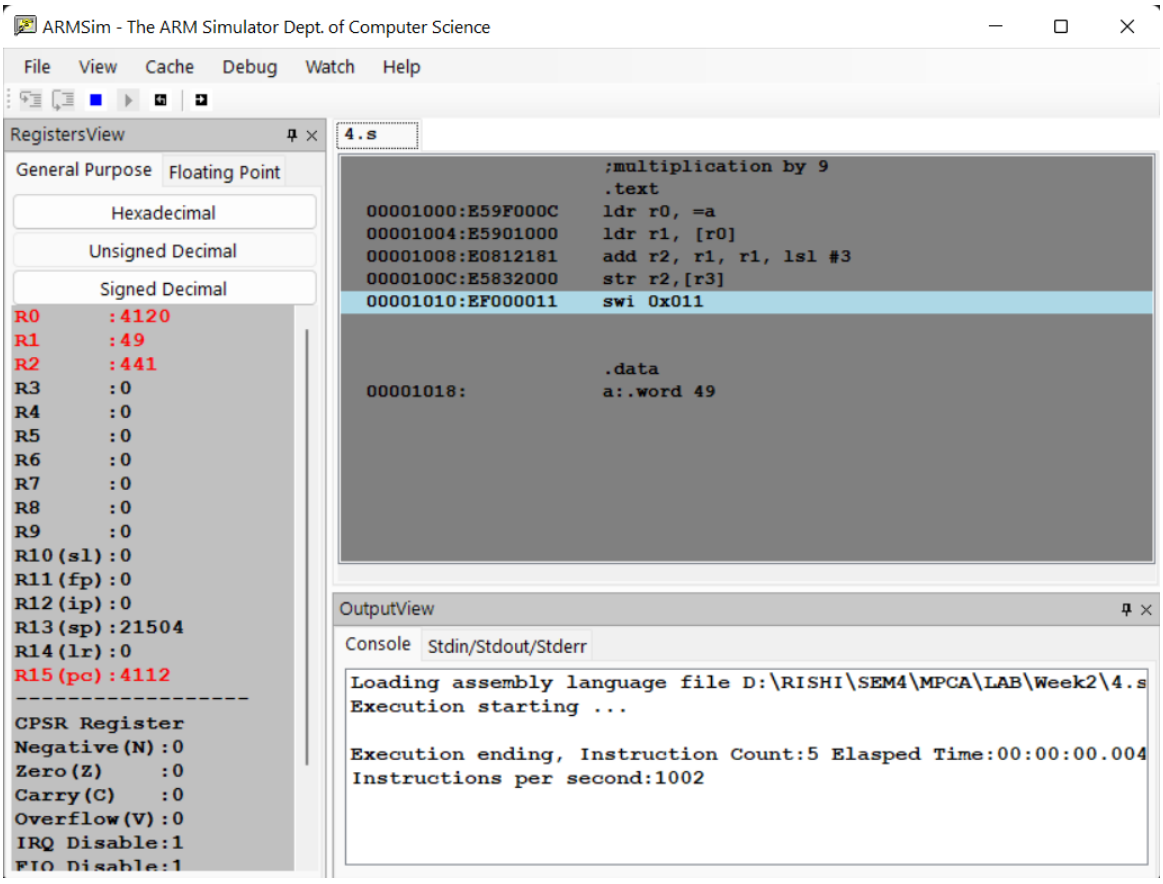
4. Write a program in ARM7TDMI–ISA to find the product of two 32–bit numbers using barrel shifter.

4.s - Notepad PREVIEW

File Edit View

```
;multiplication by 9
.text
ldr r0, =a
ldr r1, [r0]
add r2, r1, r1, lsl #3
str r2,[r3]
swi 0x011


.data
a:.word 49
```

Output:



5. Convert the following statement in C language into an ALP using ARM7TDMI – ISA.

   IF([A]==[B]) then C=[A]+[B];

   ELSE IF ([B]==[C]) D=[A]-[B];

   ELSE E=[A]*[B]

   Where A,B, C, D & E are memory locations.

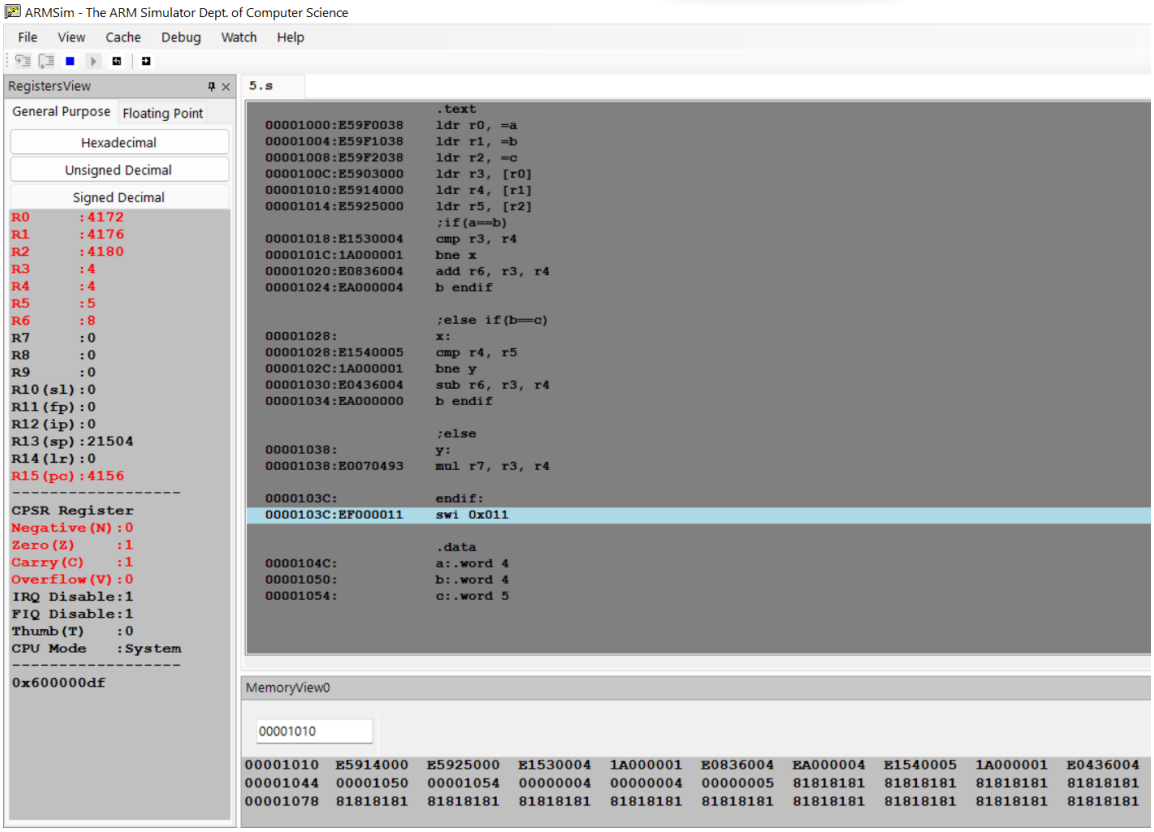
   Case1:

5.s - Notepad PREVIEW

File Edit View

```
.text
ldr r0, =a
ldr r1, =b
ldr r2, =c
ldr r3, [r0]
ldr r4, [r1]
ldr r5, [r2]
;if(a==b)
cmp r3, r4
bne x
add r6, r3, r4
b endif

;else if(b==c)
x:
cmp r4, r5
bne y
sub r6, r3, r4
b endif

;else
y:
mul r7, r3, r4

endif:
swi 0x011

.data
a:.word 4
b:.word 4
c:.word 5
```

Output:



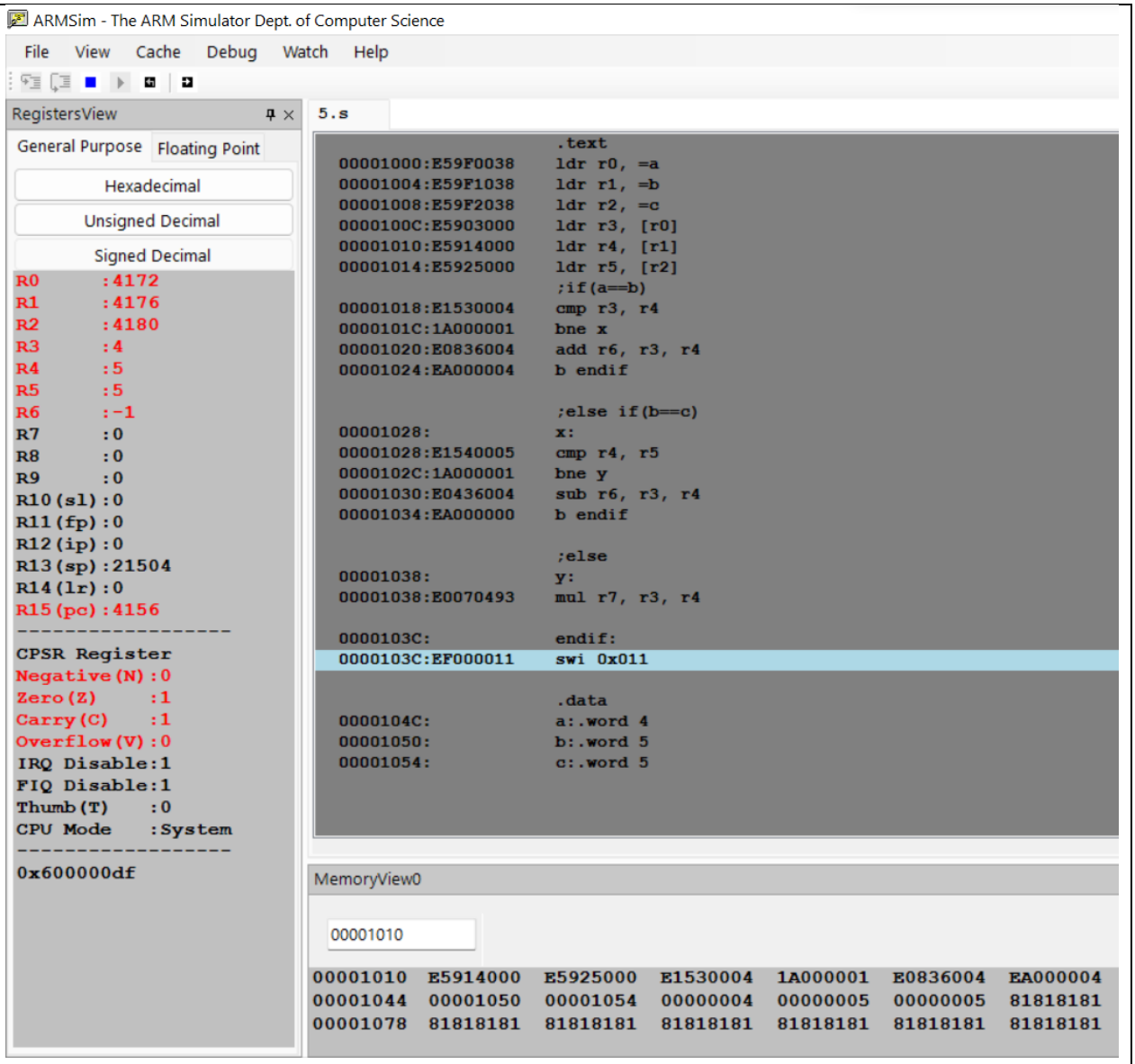
Case 2:

5.s - Notepad PREVIEW

File Edit View

```
.text
ldr r0, =a
ldr r1, =b
ldr r2, =c
ldr r3, [r0]
ldr r4, [r1]
ldr r5, [r2]
;if(a==b)
cmp r3, r4
bne x
add r6, r3, r4
b endif

;else if(b==c)
x:
cmp r4, r5
bne y
sub r6, r3, r4
b endif

;else
y:
mul r7, r3, r4

endif:
swi 0x011

.data
a:.word 4
b:.word 5
c:.word 5
```

Output:


ARMSim - The ARM Simulator Dept. of Computer Science
File View Cache Debug Watch Help
RegistersView
General Purpose Floating Point
Hexadecimal
Unsigned Decimal
Signed Decimal
R0 :4172
R1 :4176
R2 :4180
R3 :4
R4 :5
R5 :5
R6 :-1
R7 :0
R8 :0
R9 :0
R10(sl):0
R11(fp):0
R12(ip):0
R13(sp):21504
R14(lr):0
R15(pc):4156
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
5.s
.text
00001000:E59F0038 ldr r0, =a
00001004:E59F1038 ldr r1, =b
00001008:E59F2038 ldr r2, =c
0000100C:E5903000 ldr r3, [r0]
00001010:E5914000 ldr r4, [r1]
00001014:E5925000 ldr r5, [r2]
;if(a==b)
00001018:E1530004 cmp r3, r4
0000101C:1A000001 bne x
00001020:E0836004 add r6, r3, r4
00001024:EA000004 b endif
;else if(b==c)
00001028: x:
00001028:E1540005 cmp r4, r5
0000102C:1A000001 bne y
00001030:E0436004 sub r6, r3, r4
00001034:EA000000 b endif
;else
00001038: y:
00001038:E0070493 mul r7, r3, r4
0000103C: endif:
0000103C:EF000011 swi 0x011
.data
0000104C: a:.word 4
00001050: b:.word 5
00001054: c:.word 5
MemoryView0
00001010
00001010 E5914000 E5925000 E1530004 1A000001 E0836004 EA000004
00001044 00001050 00001054 00000004 00000005 00000005 81818181
00001078 81818181 81818181 81818181 81818181 81818181 81818181

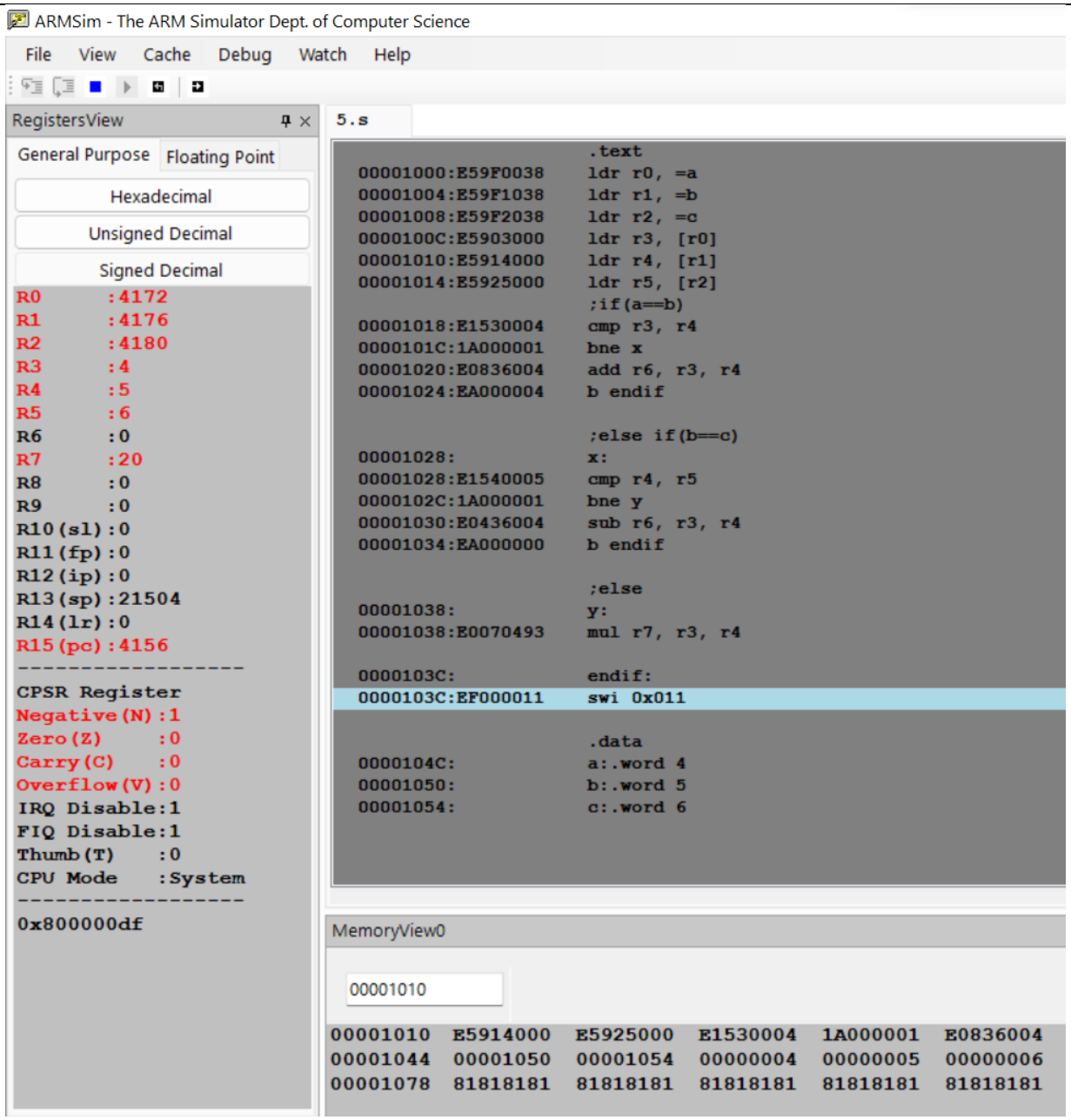
Case 3:

5.s - Notepad PREVIEW

File Edit View

```
.text
ldr r0, =a
ldr r1, =b
ldr r2, =c
ldr r3, [r0]
ldr r4, [r1]
ldr r5, [r2]
;if(a==b)
cmp r3, r4
bne x
add r6, r3, r4
b endif

;else if(b==c)
x:
cmp r4, r5
bne y
sub r6, r3, r4
b endif

;else
y:
mul r7, r3, r4

endif:
swi 0x011

.data
a:.word 4
b:.word 5
c:.word 6
```

Output:


ARMSim - The ARM Simulator Dept. of Computer Science
File View Cache Debug Watch Help
RegistersView
General Purpose Floating Point
Hexadecimal
Unsigned Decimal
Signed Decimal
R0 :4172
R1 :4176
R2 :4180
R3 :4
R4 :5
R5 :6
R6 :0
R7 :20
R8 :0
R9 :0
R10(sl):0
R11(fp):0
R12(ip):0
R13(sp):21504
R14(lr):0
R15(pc):4156
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
5.s
.text
00001000:E59F0038 ldr r0, =a
00001004:E59F1038 ldr r1, =b
00001008:E59F2038 ldr r2, =c
0000100C:E5903000 ldr r3, [r0]
00001010:E5914000 ldr r4, [r1]
00001014:E5925000 ldr r5, [r2]
;if(a==b)
00001018:E1530004 cmp r3, r4
0000101C:1A000001 bne x
00001020:E0836004 add r6, r3, r4
00001024:EA000004 b endif
;else if(b==c)
00001028: x:
00001028:E1540005 cmp r4, r5
0000102C:1A000001 bne y
00001030:E0436004 sub r6, r3, r4
00001034:EA000000 b endif
;else
00001038: y:
00001038:E0070493 mul r7, r3, r4
0000103C: endif:
0000103C:EF000011 swi 0x011
.data
0000104C: a:.word 4
00001050: b:.word 5
00001054: c:.word 6
MemoryView0
00001010
00001010 E5914000 E5925000 E1530004 1A000001 E0836004
00001044 00001050 00001054 00000004 00000005 00000006
00001078 81818181 81818181 81818181 81818181 81818181