MPCA LAB WEEK-5

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ROLL NO.: 55
SECTION : K
DATE : 26-02-2022

PROGRAM 1 : Write a program in ARM7TDMI-ISA to multiply 2 matrices of order3. i.e., implement c[i][j]=c[i][j] + a[i][j] x b[i][j].

a. Use MLA instruction :

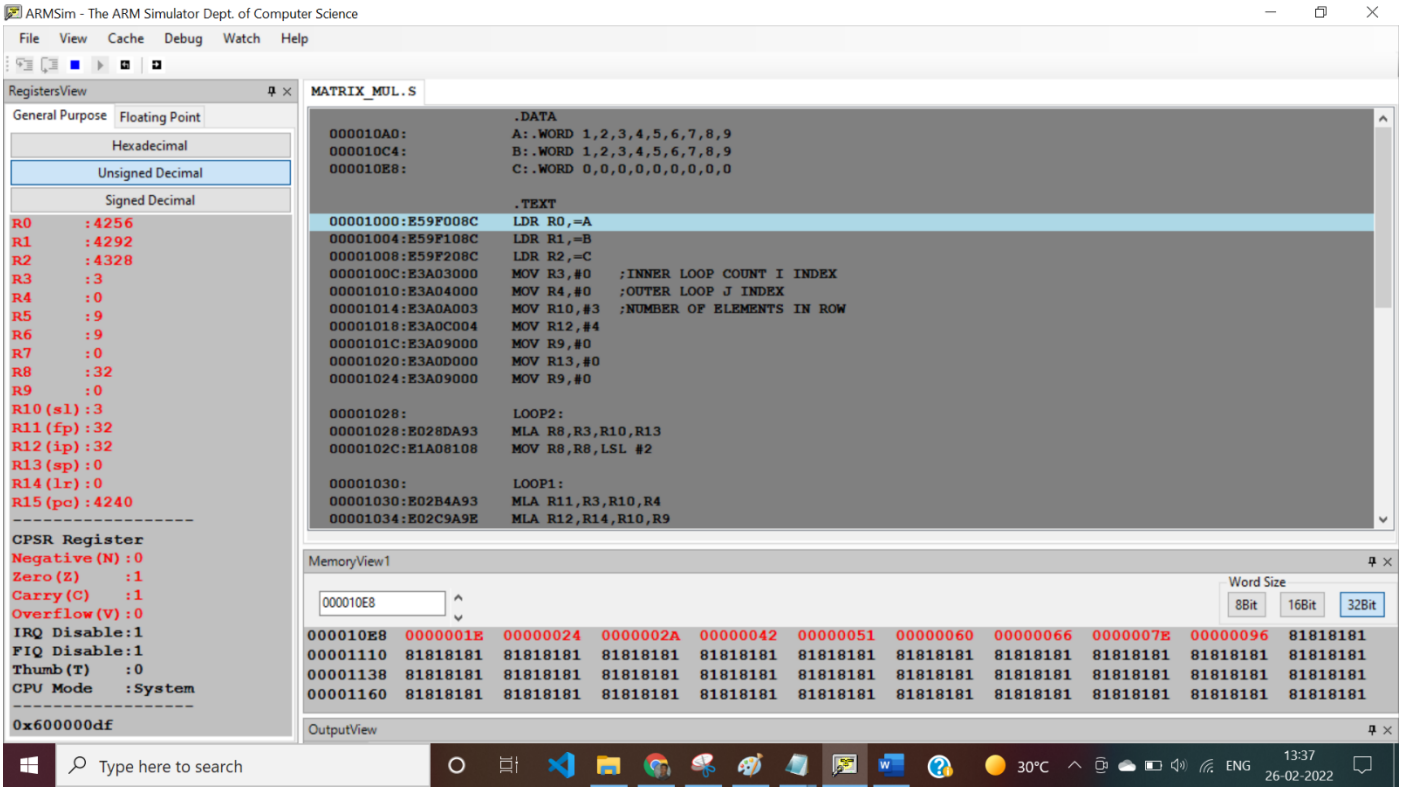
CODE :

MATRIX_MUL - Notepad

File Edit Format View Help

```
.DATA
A:.WORD 1,2,3,4,5,6,7,8,9
B:.WORD 1,2,3,4,5,6,7,8,9
C:.WORD 0,0,0,0,0,0,0,0,0

.TEXT
LDR R0,=A
LDR R1,=B
LDR R2,=C
MOV R3,#0   ;INNER LOOP COUNT I INDEX
MOV R4,#0   ;OUTER LOOP J INDEX
MOV R10,#3  ;NUMBER OF ELEMENTS IN ROW
MOV R12,#4
MOV R9,#0
MOV R13,#0
MOV R9,#0

LOOP2:
MLA R8,R3,R10,R13
MOV R8,R8,LSL #2

LOOP1:
MLA R11,R3,R10,R4
MLA R12,R14,R10,R9

MOV R11,R11,LSL #2
MOV R12,R12,LSL #2
LDR R5,[R0,R11]    ;RO value not updated
LDR R6,[R1,R12]    ;R1 value not updated
MLA R7,R5,R6,R7
ADD R4,R4,#1
ADD R14,R14,#1
CMP R4,#3
BNE LOOP1
STR R7,[R2,R8]
MOV R7,#0
MOV R4,#0
MOV R14,#0
ADD R9,R9,#1
ADD R13,R13,#1
CMP R13,#3
BNE LOOP2

MOV R9,#0
MOV R13,#0
ADD R3,R3,#1
CMP R3,#3
BNE LOOP2

SWI 0X11
```

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 :4256
R1 :4292
R2 :4328
R3 :3
R4 :0
R5 :9
R6 :9
R7 :0
R8 :32
R9 :0
R10(sl):3
R11(fp):32
R12(ip):32
R13(sp):0
R14(lr):0
R15(pc):4240
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
MATRIX_MUL.S
000010A0: .DATA
A:.WORD 1,2,3,4,5,6,7,8,9
000010C4: B:.WORD 1,2,3,4,5,6,7,8,9
000010E8: C:.WORD 0,0,0,0,0,0,0,0,0
.TEXT
00001000:E59F008C LDR R0,=A
00001004:E59F108C LDR R1,=B
00001008:E59F208C LDR R2,=C
0000100C:E3A03000 MOV R3,#0 ;INNER LOOP COUNT I INDEX
00001010:E3A04000 MOV R4,#0 ;OUTER LOOP J INDEX
00001014:E3A0A003 MOV R10,#3 ;NUMBER OF ELEMENTS IN ROW
00001018:E3A0C004 MOV R12,#4
0000101C:E3A09000 MOV R9,#0
00001020:E3A0D000 MOV R13,#0
00001024:E3A09000 MOV R9,#0
00001028: LOOP2:
00001028:E028DA93 MLA R8,R3,R10,R13
0000102C:E1A08108 MOV R8,R8,LSL #2
00001030: LOOP1:
00001030:E02B4A93 MLA R11,R3,R10,R4
00001034:E02C9A9E MLA R12,R14,R10,R9
MemoryView1
000010E8
Word Size
8Bit 16Bit 32Bit
000010E8 0000001E 00000024 0000002A 00000042 00000051 00000060 00000066 0000007E 00000096 81818181
00001110 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
00001138 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
00001160 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
OutputView
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30°C
ENG
13:37
26-02-2022

b. Use MUL instruction :

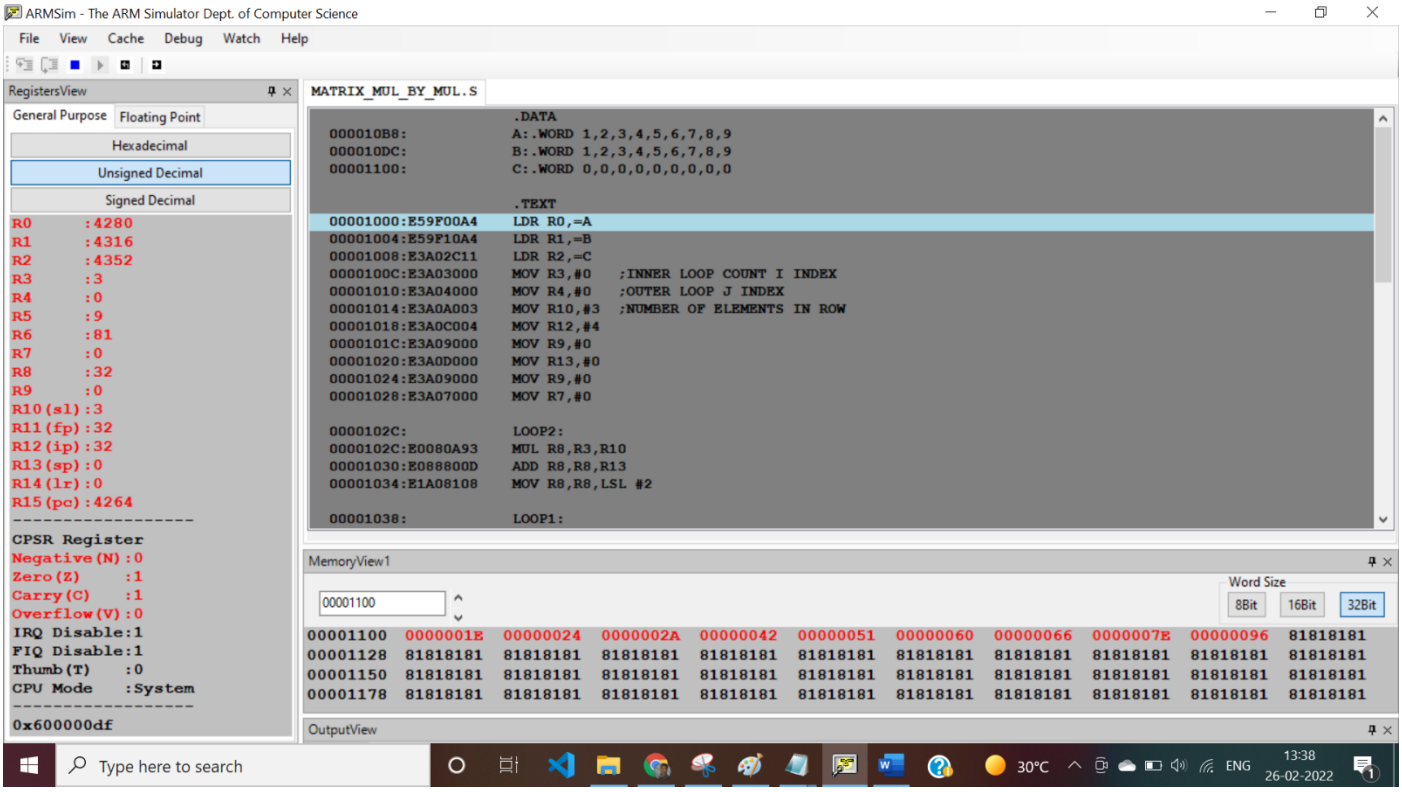
CODE :

MATRIX_MUL_BY_MUL - Notepad

File Edit Format View Help

```
.DATA
A:.WORD 1,2,3,4,5,6,7,8,9
B:.WORD 1,2,3,4,5,6,7,8,9
C:.WORD 0,0,0,0,0,0,0,0,0

.TEXT
LDR R0,=A
LDR R1,=B
LDR R2,=C
MOV R3,#0   ;INNER LOOP COUNT I INDEX
MOV R4,#0   ;OUTER LOOP J INDEX
MOV R10,#3  ;NUMBER OF ELEMENTS IN ROW
MOV R12,#4
MOV R9,#0
MOV R13,#0
MOV R9,#0
MOV R7,#0

LOOP2:
MUL R8,R3,R10
ADD R8,R8,R13
MOV R8,R8,LSL #2

LOOP1:
MUL R11,R3,R10
ADD R11,R11,R4
MUL R12,R14,R10
ADD R12,R12,R9
MOV R11,R11,LSL #2
MOV R12,R12,LSL #2
LDR R5,[R0,R11]    ;RO value not updated
LDR R6,[R1,R12]    ;R1 value not updated
STR R7,[R2,R8]

MUL R6,R5,R6
ADD R7,R7,R6

ADD R4,R4,#1
ADD R14,R14,#1
CMP R4,#3
BNE LOOP1

STR R7,[R2,R8]
MOV R7,#0
MOV R4,#0
MOV R14,#0
ADD R9,R9,#1
ADD R13,R13,#1
CMP R13,#3
BNE LOOP2

MOV R9,#0
MOV R13,#0
ADD R3,R3,#1
CMP R3,#3
BNE LOOP2

SWI 0X11
```

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 :4280
R1 :4316
R2 :4352
R3 :3
R4 :0
R5 :9
R6 :81
R7 :0
R8 :32
R9 :0
R10(sl):3
R11(fp):32
R12(ip):32
R13(sp):0
R14(lr):0
R15(pc):4264
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
MATRIX_MUL_BY_MUL.S
.DATA
000010B8: A:.WORD 1,2,3,4,5,6,7,8,9
000010DC: B:.WORD 1,2,3,4,5,6,7,8,9
00001100: C:.WORD 0,0,0,0,0,0,0,0,0
.TEXT
00001000:E59F00A4 LDR R0,=A
00001004:E59F10A4 LDR R1,=B
00001008:E3A02C11 LDR R2,=C
0000100C:E3A03000 MOV R3,#0 ;INNER LOOP COUNT I INDEX
00001010:E3A04000 MOV R4,#0 ;OUTER LOOP J INDEX
00001014:E3A0A003 MOV R10,#3 ;NUMBER OF ELEMENTS IN ROW
00001018:E3A0C004 MOV R12,#4
0000101C:E3A09000 MOV R9,#0
00001020:E3A0D000 MOV R13,#0
00001024:E3A09000 MOV R9,#0
00001028:E3A07000 MOV R7,#0
0000102C: LOOP2:
0000102C:E0080A93 MUL R8,R3,R10
00001030:E088800D ADD R8,R8,R13
00001034:E1A08108 MOV R8,R8,LSL #2
00001038: LOOP1:
MemoryView1
00001100
Word Size
8Bit 16Bit 32Bit
00001100 0000001E 00000024 0000002A 00000042 00000051 00000060 00000066 0000007E 00000096 81818181
00001128 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
00001150 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
00001178 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
OutputView
Type here to search
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ENG
13:38
26-02-2022

PROGRAM 2 : Write a program in ARM7TDMI-ISA to find the NORM of a square matrix of order n.

CODE :

NORM - Notepad

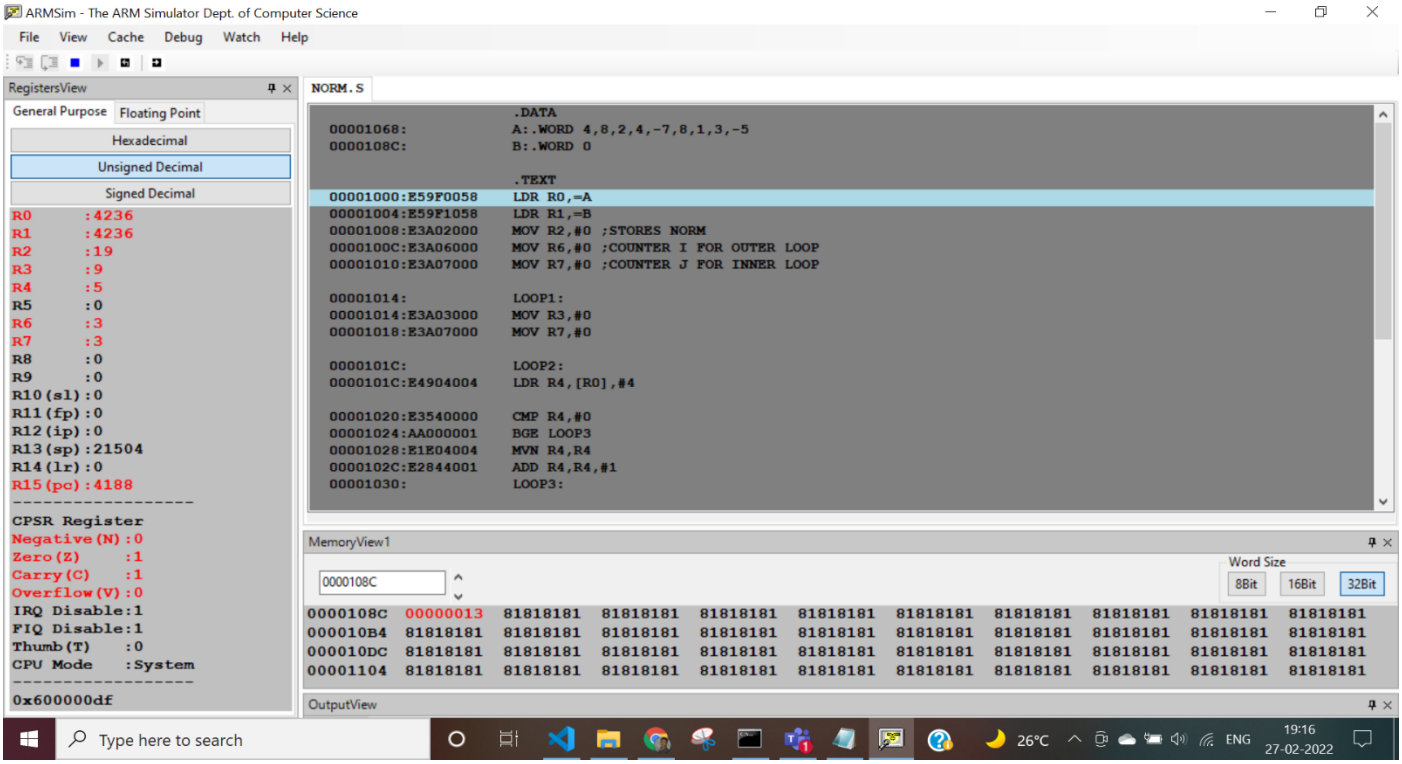
File Edit Format View Help

```
.DATA
A:.WORD 4,8,2,4,-7,8,1,3,-5
B:.WORD 0
.TEXT
LDR R0,=A
LDR R1,=B
MOV R2,#0 ;STORES NORM
MOV R6,#0 ;COUNTER I FOR OUTER LOOP
MOV R7,#0 ;COUNTER J FOR INNER LOOP

LOOP1:
MOV R3,#0
MOV R7,#0
LOOP2:
LDR R4,[R0],#4
CMP R4,#0
BGE LOOP3
MVN R4,R4
ADD R4,R4,#1
LOOP3:
ADD R7,R7,#1
ADD R3,R3,R4
CMP R7,#3
BNE LOOP2
CMP R2,R3
BGE LOOP4
MOV R2,R3
LOOP4:
ADD R6,R6,#1
CMP R6,#3
BNE LOOP1

STR R2,[R1]
SWI 0x11
```

OUTPUT :



PROGRAM 3 : Write a program in ARM7TDMI-ISA to find the ROWSUM of a matrix.

CODE :

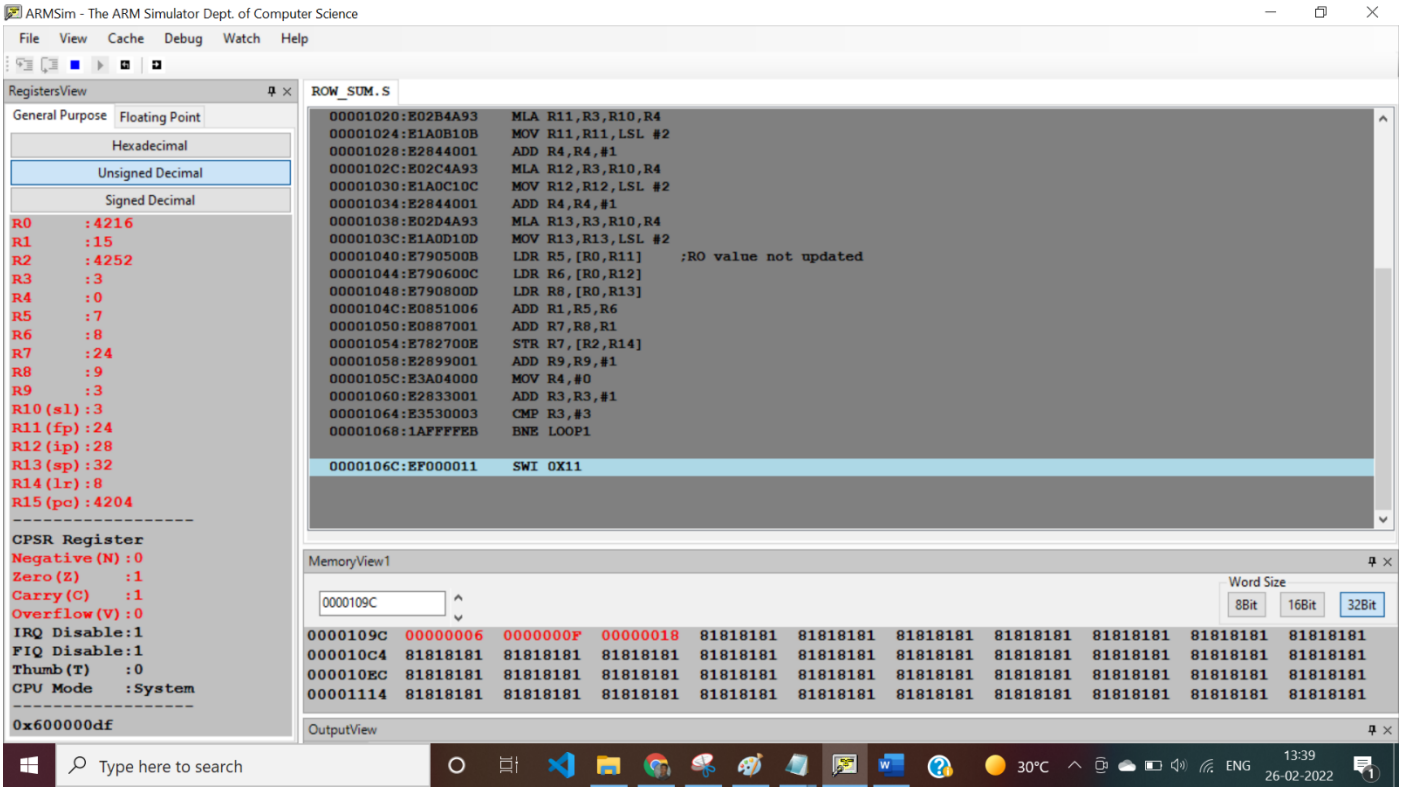
*ROW_SUM - Notepad

File Edit Format View Help

```
.DATA
A:.WORD 1,2,3,4,5,6,7,8,9
C:.WORD 0,0,0
.TEXT
LDR R0,=A
LDR R2,=C
MOV R3,#0   ;INNER LOOP COUNT I INDEX
MOV R4,#0   ;OUTER LOOP J INDEX
MOV R10,#3  ;NUMBER OF ELEMENTS IN ROW
MOV R12,#4
MOV R9,#0

LOOP1:MOV R14,R9,LSL #2
MLA R11,R3,R10,R4
MOV R11,R11,LSL #2
ADD R4,R4,#1
MLA R12,R3,R10,R4
MOV R12,R12,LSL #2
ADD R4,R4,#1
MLA R13,R3,R10,R4
MOV R13,R13,LSL #2
LDR R5,[R0,R11]    ;RO value not updated
LDR R6,[R0,R12]
LDR R8,[R0,R13]
ADD R1,R5,R6
ADD R7,R8,R1
STR R7,[R2,R14]
ADD R9,R9,#1
MOV R4,#0
ADD R3,R3,#1
CMP R3,#3
BNE LOOP1
SWI 0X11
```

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 :4216
R1 :15
R2 :4252
R3 :3
R4 :0
R5 :7
R6 :8
R7 :24
R8 :9
R9 :3
R10(sl):3
R11(fp):24
R12(ip):28
R13(sp):32
R14(lr):8
R15(pc):4204
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
ROW_SUM.S
00001020:E02B4A93 MLA R11,R3,R10,R4
00001024:E1A0B10B MOV R11,R11,LSL #2
00001028:E2844001 ADD R4,R4,#1
0000102C:E02C4A93 MLA R12,R3,R10,R4
00001030:E1A0C10C MOV R12,R12,LSL #2
00001034:E2844001 ADD R4,R4,#1
00001038:E02D4A93 MLA R13,R3,R10,R4
0000103C:E1A0D10D MOV R13,R13,LSL #2
00001040:E790500B LDR R5,[R0,R11] ;R0 value not updated
00001044:E790600C LDR R6,[R0,R12]
00001048:E790800D LDR R8,[R0,R13]
0000104C:E0851006 ADD R1,R5,R6
00001050:E0887001 ADD R7,R8,R1
00001054:E782700E STR R7,[R2,R14]
00001058:E2899001 ADD R9,R9,#1
0000105C:E3A04000 MOV R4,#0
00001060:E2833001 ADD R3,R3,#1
00001064:E3530003 CMP R3,#3
00001068:1AFFFFEB BNE LOOP1
0000106C:EF000011 SWI 0X11
MemoryView1
0000109C
Word Size
8Bit 16Bit 32Bit
0000109C 00000006 0000000F 00000018 81818181 81818181 81818181 81818181 81818181 81818181 81818181
000010C4 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
000010EC 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
00001114 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181 81818181
OutputView
Type here to search
30°C
ENG
13:39
26-02-2022