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Reg_no : 211039022

;**Q1) Assume a 32-bit number in 40000004H. Add nibble4 and nibble0 and store the result in 4000000CH.**

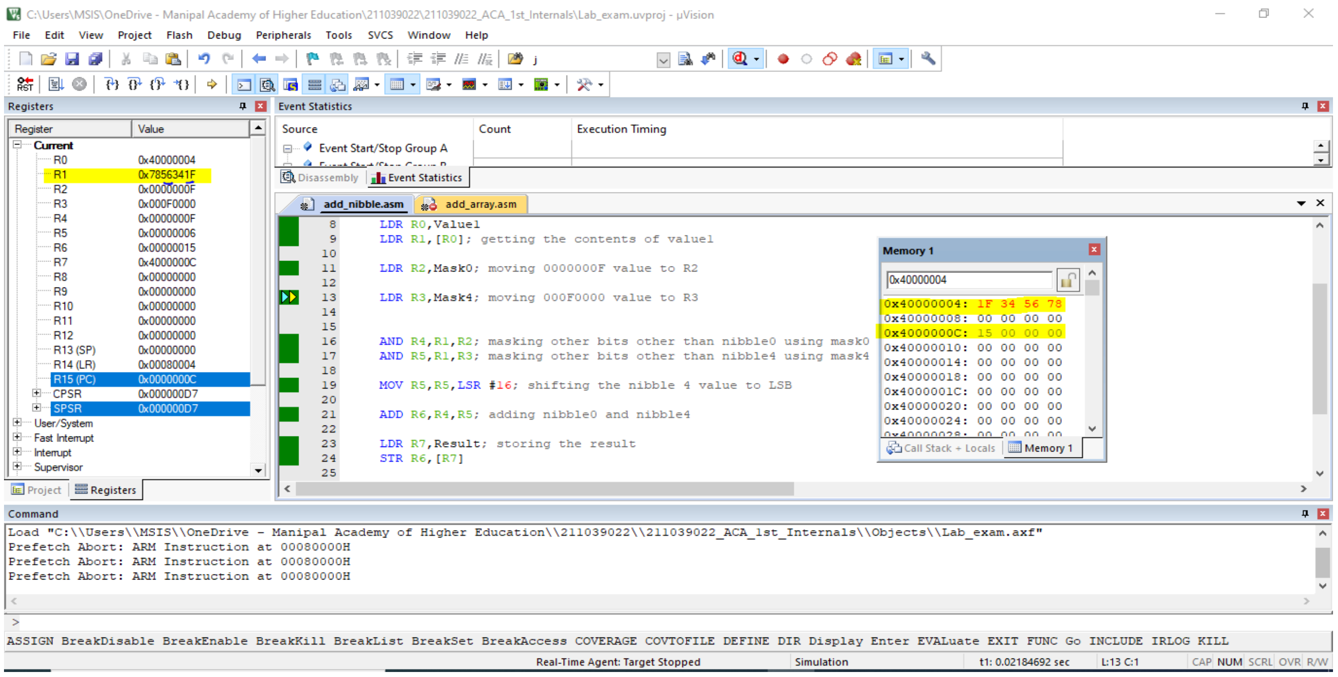
;Value1 stored in location 0x40000004

; Result stored in location 4000000C

Source Code :

```
        AREA nibble_add, CODE, READONLY
        ENTRY
Main
         LDR R0,Value1
         LDR R1,[R0]              ; getting the contents of value1

         LDR R2,Mask0             ; moving 0x0000000F value to R2

         LDR R3,Mask4             ; moving 0x000F0000 value to R3


         AND R4,R1,R2       ; masking other bits other than nibble0 using mask0
         AND R5,R1,R3       ; masking other bits other than nibble4 using mask4

         MOV R5,R5,LSR #16        ; shifting the nibble4 to LSB
        ADD R6,R4,R5            ; adding nibble0 and nibble4

        LDR R7,Result           ; storing the result
        STR R6,[R7]


Value1 DCD &40000004  ; Address from which Value is fetched
Mask0 DCD &0000000F   ;Mask0 to get the nibble0
Mask4 DCD &000F0000   ;Mask4 to get the nibble4
Result DCD &4000000C  ; Address in which Result is stored
       END
```

Output :



C:\Users\MSIS\OneDrive - Manipal Academy of Higher Education\211039022\211039022_ACA_1st_Internals\Lab_exam.uvproj - µVision

Registers

Register	Value
R0	0x40000004
R1	0x7856341F
R2	0x0000000F
R3	0x000F0000
R4	0x0000000F
R5	0x00000006
R6	0x00000015
R7	0x4000000C
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00080004
R15 (PC)	0x0000000C
CPSR	0x000000D7
SPSR	0x000000D7

add_nibble.asm

```
        LDR R0,Value1
        LDR R1,[R0]; getting the contents of value1

        LDR R2,Mask0; moving 0000000F value to R2

        LDR R3,Mask4; moving 000F0000 value to R3


        AND R4,R1,R2; masking other bits other than nibble0 using mask0
        AND R5,R1,R3; masking other bits other than nibble4 using mask4

        MOV R5,R5,LSR #16; shifting the nibble 4 value to LSB

        ADD R6,R4,R5; adding nibble0 and nibble4

        LDR R7,Result; storing the result
        STR R6,[R7]
```

Memory 1

```
0x40000004
0x40000004: 1F 34 56 78
0x40000008: 00 00 00 00
0x4000000C: 15 00 00 00
0x40000010: 00 00 00 00
0x40000014: 00 00 00 00
0x40000018: 00 00 00 00
0x4000001C: 00 00 00 00
0x40000020: 00 00 00 00
0x40000024: 00 00 00 00
```

Command

```
Load "C:\\Users\\MSIS\\OneDrive - Manipal Academy of Higher Education\\211039022\\211039022_ACA_1st_Internals\\Objects\\Lab_exam.axf"
Prefetch Abort: ARM Instruction at 00080000H
Prefetch Abort: ARM Instruction at 00080000H
Prefetch Abort: ARM Instruction at 00080000H
```

Real-Time Agent: Target Stopped   Simulation   t1: 0.02184692 sec   L:13 C:1

The considered value is 0x7856341F, here the nibble0 is F and nibble4 is 6 , the sum of 0x0F and 0x06 is 0x15= 22(decimal) which is stored in the R6 and also stored at the Address 0x400000C0.

Hence, the Result contains sum of nibble0 and nibble4.

;Q2) Consider an array of number present from 40000000 H. Add only if the numbers are positive. 40000000 H has the count of the array.

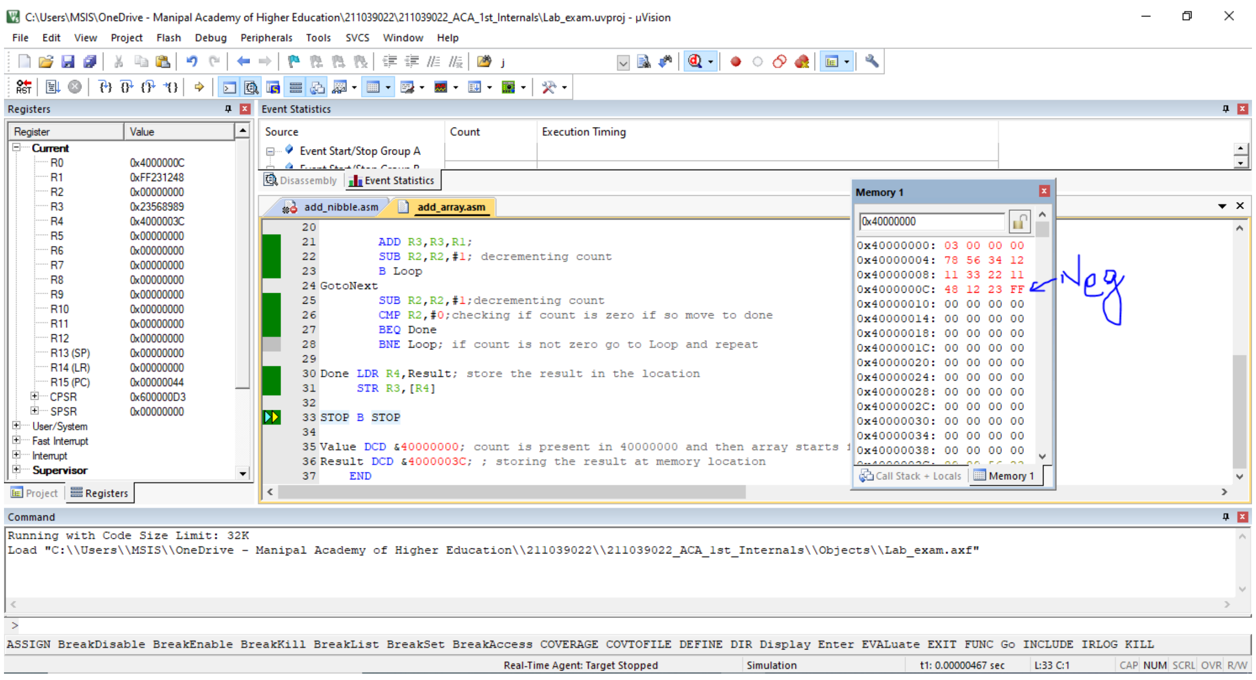
; 0x40000000 stores the count of Array

; 0x40000004 is the starting address of the Array

Source Code:

```
  AREA add_positive,CODE,READONLY
    ENTRY
main
      LDR R0,Value
      LDR R2,[R0]              ; count stored at address of Value is loaded to R2

      EOR R3,R3,R3             ; clearing the R3, perform XOR

Loop   CMP R2,#0               ; count is compared with 0, which performs (R2-0)
      BEQ Done                 ; if Count is equal to zero store result as 0

      LDR R1,[R0,#4]!          ; load R1 with R0+4 address, address where array
                               elements starts
      CMP R1,#0                  ; checking if the number is positive


      BMI GotoNext               ; Branch if negative go to the label GotoNext


      ADD R3,R3,R1;              ;If number is not negative Add the number
      SUB R2,R2,#1               ; decrementing count
      B Loop                     ; go to Loop to continue the scanning
GotoNext                         ; enter this block if number is negative
      SUB R2,R2,#1               ;decrementing count
      CMP R2,#0                  ;checking if count is zero if so move to done
      BEQ Done
      BNE Loop                   ; if count is not zero go to Loop and repeat


Done LDR R4,Result               ; store the result in the location
    STR R3,[R4]


STOP B STOP


Value DCD &40000000              ; count is present in 0x40000000 and then array
                                 starts from 0x40000004
Result DCD &4000003C             ; storing the result at memory location
   END
```

Output:


C:\Users\MSIS\OneDrive - Manipal Academy of Higher Education\211039022\211039022_ACA_1st_Internals\Lab_exam.uvproj - µVision
File Edit View Project Flash Debug Peripherals Tools SVCS Window Help
Registers
Event Statistics
Disassembly
Event Statistics
add_nibble.asm
add_array.asm
Memory 1
Call Stack + Locals
Memory 1
Project
Registers
Command
Neg

Register	Value
Current	
R0	0x4000000C
R1	0xFF231248
R2	0x00000000
R3	0x23568989
R4	0x4000003C
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000044
CPSR	0x600000D3
SPSR	0x00000000
User/System	
Fast Interrupt	
Interrupt	
Supervisor	

Source	Count	Execution Timing
Event Start/Stop Group A		

```

        ADD R3,R3,R1;
        SUB R2,R2,#1; decrementing count
        B Loop
GotoNext
        SUB R2,R2,#1;decrementing count
        CMP R2,#0;checking if count is zero if so move to done
        BEQ Done
        BNE Loop; if count is not zero go to Loop and repeat

Done LDR R4,Result; store the result in the location
     STR R3,[R4]

STOP B STOP

Value DCD &40000000; count is present in 40000000 and then array starts i
Result DCD &4000003C; ; storing the result at memory location
     END
```

```
0x40000000
0x40000000: 03 00 00 00
0x40000004: 78 56 34 12
0x40000008: 11 33 22 11
0x4000000C: 48 12 23 FF
0x40000010: 00 00 00 00
0x40000014: 00 00 00 00
0x40000018: 00 00 00 00
0x4000001C: 00 00 00 00
0x40000020: 00 00 00 00
0x40000024: 00 00 00 00
0x40000028: 00 00 00 00
0x4000002C: 00 00 00 00
0x40000030: 00 00 00 00
0x40000034: 00 00 00 00
0x40000038: 00 00 00 00
```

```
Running with Code Size Limit: 32K
Load "C:\\Users\\MSIS\\OneDrive - Manipal Academy of Higher Education\\211039022\\211039022_ACA_1st_Internals\\Objects\\Lab_exam.axf"

>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE COVTOFILE DEFINE DIR Display Enter EVALuate EXIT FUNC Go INCLUDE IRLOG KILL
```

Real-Time Agent: Target Stopped | Simulation | t1: 0.00000467 sec | L:33 C:1 | CAP NUM SCRL OVR R/W

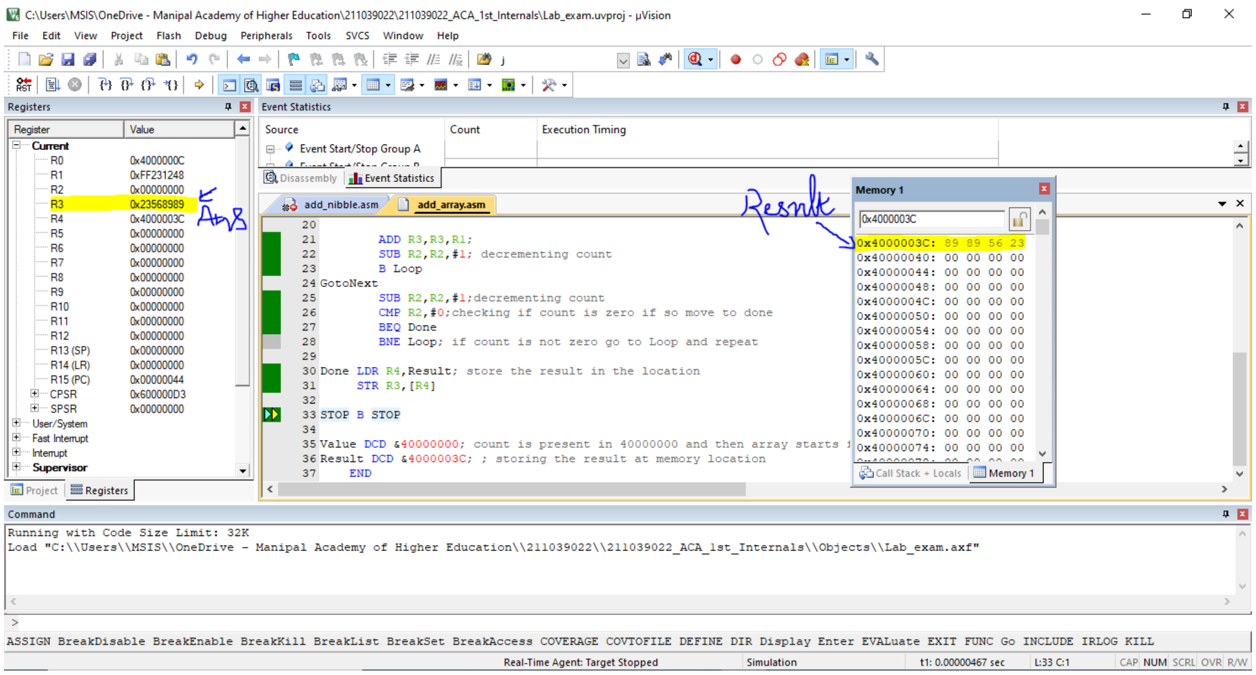
The Count is taken as 03, hence 3 array elements are considered.

Value1= 0x12345678

Value2 =0x11223311

Value3=0xFF231248

The Value3 is the negative value which contains 1 in the MSB bit and hence it is not considered for the Addition.


C:\Users\MSIS\OneDrive - Manipal Academy of Higher Education\211039022\211039022_ACA_1st_Internals\Lab_exam.uvproj - µVision

Register	Value
Current	
R0	0x4000000C
R1	0xFF231248
R2	0x00000000
R3	0x23568989
R4	0x4000003C
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00000000
R15 (PC)	0x00000044
CPSR	0x600000D3
SPSR	0x00000000
User/System	
Fast Interrupt	
Interrupt	
Supervisor	

Ans

```

        ADD R3,R3,R1;
        SUB R2,R2,#1; decrementing count
        B Loop
GotoNext
        SUB R2,R2,#1;decrementing count
        CMP R2,#0;checking if count is zero if so move to done
        BEQ Done
        BNE Loop; if count is not zero go to Loop and repeat

Done LDR R4,Result; store the result in the location
     STR R3,[R4]

STOP B STOP

Value DCD &40000000; count is present in 40000000 and then array starts i
Result DCD &4000003C; ; storing the result at memory location
    END
```

Result

```
0x4000003C
0x4000003C: 89 89 56 23
0x40000040: 00 00 00 00
0x40000044: 00 00 00 00
0x40000048: 00 00 00 00
0x4000004C: 00 00 00 00
0x40000050: 00 00 00 00
0x40000054: 00 00 00 00
0x40000058: 00 00 00 00
0x4000005C: 00 00 00 00
0x40000060: 00 00 00 00
0x40000064: 00 00 00 00
0x40000068: 00 00 00 00
0x4000006C: 00 00 00 00
0x40000070: 00 00 00 00
0x40000074: 00 00 00 00
```

```
Running with Code Size Limit: 32K
Load "C:\\Users\\MSIS\\OneDrive - Manipal Academy of Higher Education\\211039022\\211039022_ACA_1st_Internals\\Objects\\Lab_exam.axf"
```

```
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet BreakAccess COVERAGE COVTOFILE DEFINE DIR Display Enter EVALuate EXIT FUNC Go INCLUDE IRLOG KILL
```

Real-Time Agent: Target Stopped   Simulation   t1: 0.00000467 sec   L:33 C:1

The Result hence contains 0x23568989 which is the Addition of 0x12345678 and 0x11223311.

The Result can be seen at R3 and also stored at the location 0x4000003C.