Faculty of Engineering & Technology
Electrical & Computer Engineering Department

Computer Organization and Microprocessor
ENCS2380
Assembly Assignment

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Section: 1

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Procedure

Declare an array

Declare an array of at least 10 8-bit unsigned integer numbers in the memory with initial values.

e.g. 34, 56, 27, 156, 200, 68, 128,235, 17, 45

Code

```
    AREA RESET, DATA, READONLY
        EXPORT __Vectors

__Vectors DCD 0x20001000
                DCD Reset_Handler

               ALIGN
       AREA MYRAM, DATA, READWRITE
SUM  DCD 0
       AREA MYCODE, CODE, READONLY
        ENTRY
        EXPORT Reset_Handler
Reset_Handler

    LDR R1,=Array; R1 pointer to the array
    MOV R2,#10;STORE ARRAY IN R2 THE NUMBER 10 MEANS THE ELEMENT IN ARRAY IS 10

loop LDR R0,[R1],#8;STORE 8 BYTE FROM R1 TO R0
    SUB R2,R2,#01; SUBTRACT (R2=R2-#01)
    CMP R2,#00;COMPERE IF R2=0 TO EXIST THE LOOP

Array DCB 34, 56, 27, 156, 200, 68, 128,235, 17, 45; declare the array

here B here
end
```

Figure1:code for part A

Register

Register	Value
Core	
R0	0x9C1B3822
R1	0x00000020
R2	0x00000009
R3	0x00000000
R4	0x00000000
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20001000
R14 (LR)	0xFFFFFFFF
R15 (PC)	0x00000022
xPSR	0x21000000

Figure2:Register for part A

Memory

Memory 2

Address: 0x016

```
0x00000016: 00 2A 22 38 1B 9C C8 44 80 EB 11 2D FE E7 18 00 00 00 00 00 00
0x0000002B: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00000040: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00000055: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0000006A: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x0000007F: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x00000094: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x000000A9: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x000000BE: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x000000D3: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x000000E8: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x000000FD: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Figure3:Memory for part A

Sum of all elements

Find the sum of all elements of the array and store it in the memory, e.g. variable SUM.

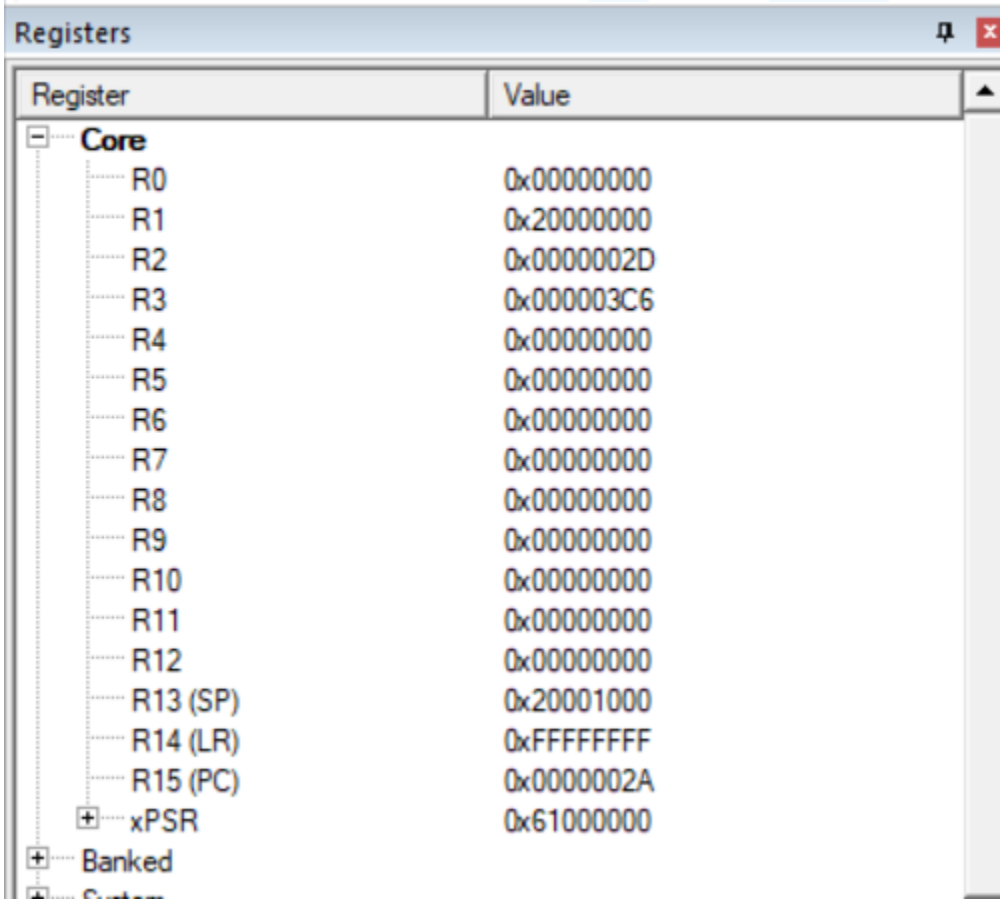
code

```
      AREA RESET, DATA, READONLY;NAME:MAHA MAHER MALI/ID=1200746
        EXPORT __Vectors
__Vectors  DCD 0x20001000
                DCD Reset_Handler
      align
      area myRam, data, readwrite
sum DCD 0
      area mycode, code, readonly
       ENTRY
       EXPORT Reset_Handler
Reset_Handler

       LDR R1, =Array
       MOV R0,#10
       LDR R1,=Array
       LDR R3,=0;R3
       LDR R2,=0;R2
loop1  LDRB R2,[R1],#1
       ADD R3,R3,R2
       SUB R0,R0,#1  SUBTRACT (R0=R0-#01)
       CMP R0,#00  COMPERE IF R0=00 TO EXIST THE LOOP
       BNE loop1
       LDR R1,=sum;LOAD SUM TP R1
       STR R3 ,[R1] ;STORE R1 IN R3
here B here
Array DCB 34, 56, 27, 156, 200, 68, 128,235, 17, 45
    end
```

Figure4: for part B

Register

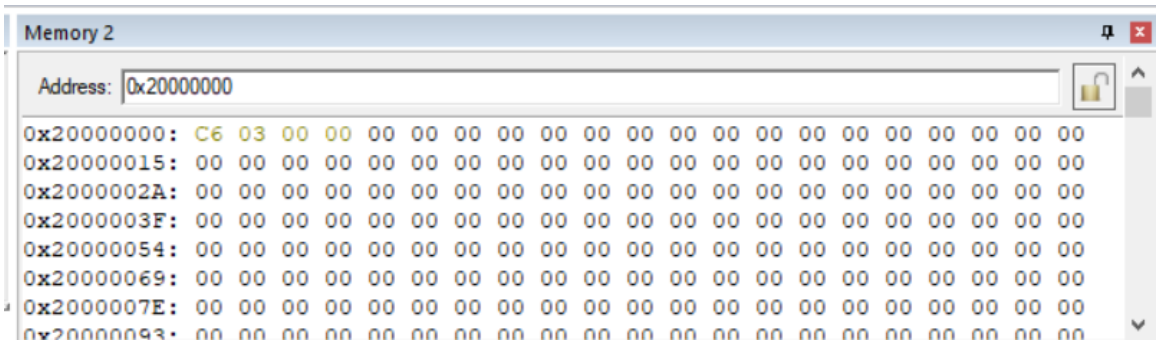


Registers

Register	Value
Core	
R0	0x00000000
R1	0x20000000
R2	0x0000002D
R3	0x000003C6
R4	0x00000000
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20001000
R14 (LR)	0xFFFFFFFF
R15 (PC)	0x0000002A
xPSR	0x61000000
Banked	

Figure5:Register for part B

Memory



Memory 2

Address: 0x20000000

```
0x20000000: C6 03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000015: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000002A: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000003F: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000054: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000069: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000007E: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000093: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Figure6:Memory for part B

Sum of even elements

find the sum of the even numbers in this array and store it in the memory, e.g. variable EVEN

Code

```
    AREA RESET, DATA, READONLY;NAME:MAHA MAHER MALI/ID:1200746
        EXPORT __Vectors
__Vectors  DCD 0x20001000
                DCD Reset_Handler
      align
      area myRam, data, readwrite
SUM DCD 0
EVEN DCD 0
      area mycode, code, readonly
       ENTRY
       EXPORT Reset_Handler
Reset_Handler
       LDR R1, =Array
       MOV R0,#10
       LDR R1,=Array
       LDR R3,=0
       LDR R2,=0
loop1  LDRB R2,[R1],#1
       ADD R3,R3,R2
       SUB R0,R0,#1
       TST R2, #1
       ADDEQ R5,R2
       CMP R0,#00
       BNE loop1
       LDR R1,=SUM;LOAD  R1 TO  VARAIBLE SUM
       STR R3 ,[R1];STORE R1 IN R3

       LDR R1,=EVEN ;LOAD  R1 TO  VARAIBLE EVEN
       STR R5 ,[R1];STORE R1 IN R5
here B here
Array DCB 34, 56, 27, 156, 200, 68, 128,235, 17, 45

    end
```

Figure7:code for part C

Register

Register	Value
Core	
R0	0x00000000
R1	0x20000004
R2	0x0000002D
R3	0x000003C6
R4	0x00000000
R5	0x00000282
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20001000
R14 (LR)	0xFFFFFFFF
R15 (PC)	0x00000036
xPSR	0x61000000

Figure8:register for part C

Memory

Memory 2

Address: 0x20000004

```
0x20000004: 82 02 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000019: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000002E: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000043: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000058: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000006D: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000082: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Figure9:Memory for part C

Find the largest power

d) Find the largest power of 2 divisor that divides into a number exactly for each element in the array and store it in another array in the memory. You have to use a procedure (function), **POW2**, which takes an integer as an input parameter and return its largest power of 2. For example, POW(52) would return 4, where POW(56) would return 8, and so on.

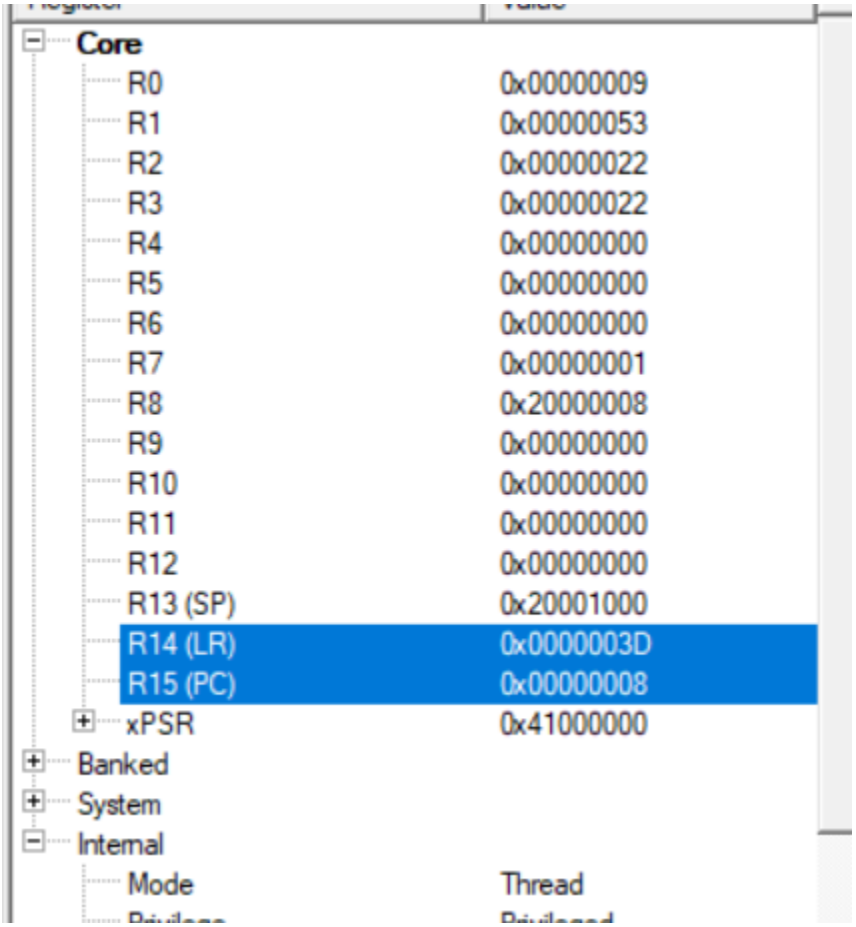
Code

```
    AREA RESET, DATA, READONLY;NAME:MAHA MAHER MALI/ID:1200746
        EXPORT __Vectors
__Vectors  DCD 0x20001000
                DCD Reset_Handler
      align
      area myRam, data, readwrite
SUM DCD 0
EVEN DCD 0
Array2 DCB 0, 0, 0, 0, 0, 0, 0, 0, 0, 0
      area mycode, code, readonly
       ENTRY
       EXPORT Reset_Handler
POW2   PROC;DEFINE FUNCTION
       TST R7,R2
       LSLEQ R7,#1
       BEQ POW2
       BX LR
       ENDP;END OF FUNCTION
Reset_Handler
       LDR R1, =Array
       MOV R0,#10
       LDR R8,=Array2
       LDR R1,=Array
       LDR R3,=0
       LDR R2,=0
loop1  LDRB R2,[R1],#1
       ADD R3,R3,R2
       SUB R0,R0,#1
       TST R2, #1
       MOV R7 ,#1
       BL POW2
```

```
        STRB R7,[R8],#1
        ADDEQ R5,R2
        CMP R0,#00
        BNE loop1
        LDR R1,=SUM
        STR R3 ,[R1]
        LDR R1,=EVEN
        STR R5 ,[R1]
here B here
Array DCB 34, 56, 27, 156, 200, 68, 128,235, 17, 45
    end
```

Figure10:code for part d

Register



Core	
R0	0x00000009
R1	0x00000053
R2	0x00000022
R3	0x00000022
R4	0x00000000
R5	0x00000000
R6	0x00000000
R7	0x00000001
R8	0x20000008
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x20001000
R14 (LR)	0x0000003D
R15 (PC)	0x00000008
xPSR	0x41000000
Banked	
System	
Internal	
Mode	Thread

Figure11:register for part d

Memory

Memory 2

Address: 0x20000008

```
0x20000008: 02 08 01 04 08 04 80 01 01 01 00 00 00 00 00 00 00 00 00 00
0x2000001D: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000032: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000047: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000005C: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000071: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000086: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000009B: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x200000B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x200000C5: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x200000DA: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x200000EF: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000104: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x20000119: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x2000012E: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Figure 12:memory for part d