Faculty of Computing and Informatics (FCI)

Multimedia University

Cyberjaya

CSN6114 – Computer Architecture & Organization

Trimester 2410

Assignment 2 Report

Submitted to:

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Group Members:

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PROBLEM STATEMENT

For Q6 to Q13 and Q15. The data is a signed integer of 32 bit. (include +ve and –ve numbers)

Q12. Sort the value in ascending order. Store the result in 2100 onwards.

ARM PROGRAM

```
1 ; Izza Nelly binti Mohd Nasir (1211111583 )
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3 ; Mohammad Hazman bin Khairil Anwar (1211110444)
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6
7         mov     r0,#0x11000000
8         mov     r1,#0x00110000
9         mov     r2,#0x00001100
10        mov     r3,#0x00000011
11        add     r0, r0, r1
12        add     r0, r0, r2
13        add     r0, r0, r3
14        mov     r8,#0x2000
15        str     r0, [r8]
16
17        ;       move r0,#0x22223333
18        mov     r0,#0x22000000
19        mov     r1,#0x00220000
20        mov     r2,#0x00003300
21        mov     r3,#0x00000033
22        add     r0, r0, r1
23        add     r0, r0, r2
24        add     r0, r0, r3
25        str     r0, [r8,#4]
```
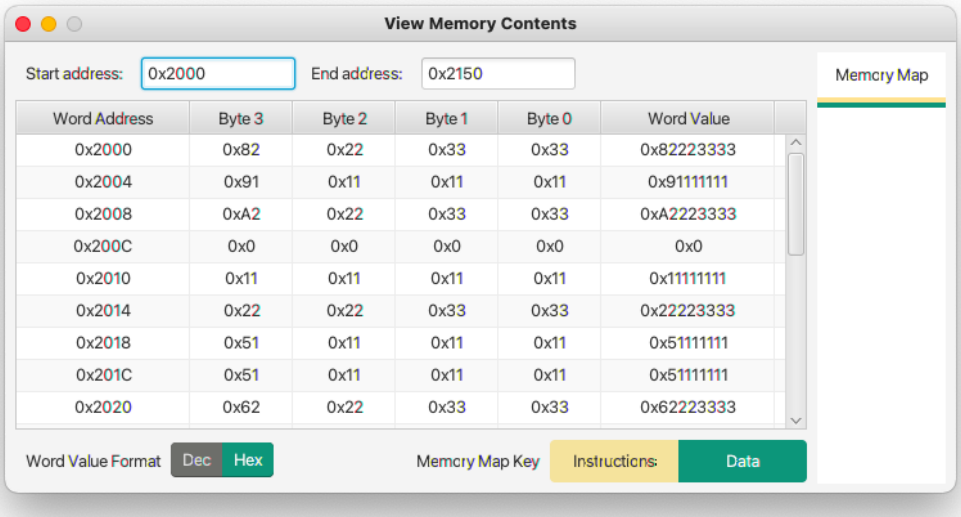

```
27        ;       move r0,#0x31111111
28        mov     r0,#0x31000000
29        mov     r1,#0x00110000
30        mov     r2,#0x00001100
31        mov     r3,#0x00000011
32        add     r0, r0, r1
33        add     r0, r0, r2
34        add     r0, r0, r3
35        str     r0, [r8,#8]
36
37        ;       move r0,#0x42223333
38        mov     r0,#0x42000000
39        mov     r1,#0x00220000
40        mov     r2,#0x00003300
41        mov     r3,#0x00000033
42        add     r0, r0, r1
43        add     r0, r0, r2
44        add     r0, r0, r3
45        str     r0, [r8,#12]
46
47        ;       move r0,#0x51111111
48        mov     r0,#0x51000000
49        mov     r1,#0x00110000
50        mov     r2,#0x00001100
51        mov     r3,#0x00000011
52        add     r0, r0, r1
53        add     r0, r0, r2
54        add     r0, r0, r3
55        str     r0, [r8,#8]
56        str     r0, [r8,#16]
```

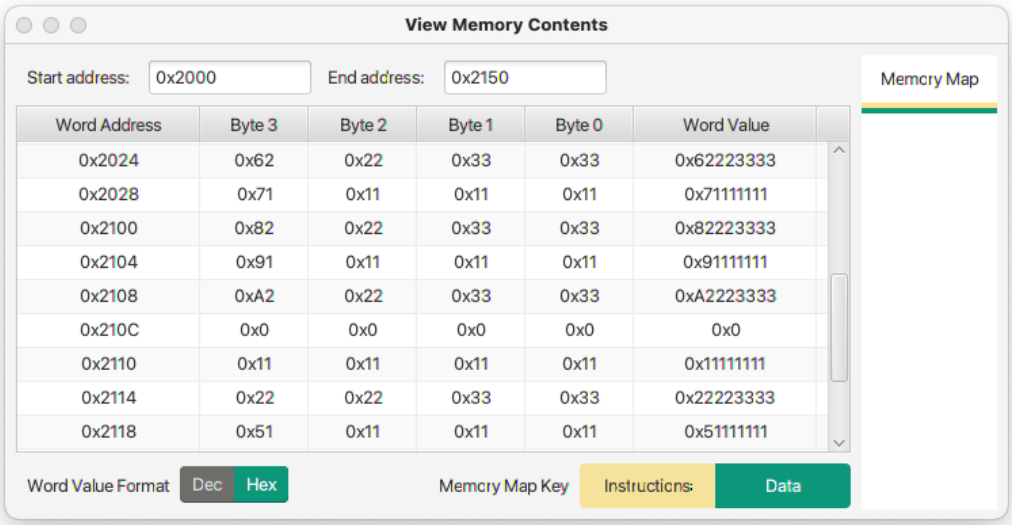
```
58          ;       move r0,#0x62223333
59          mov     r0,#0x62000000
60          mov     r1,#0x00220000
61          mov     r2,#0x00003300
62          mov     r3,#0x00000033
63          add     r0, r0, r1
64          add     r0, r0, r2
65          add     r0, r0, r3
66          str     r0, [r8,#12]
67          str     r0, [r8,#20]
68
69          ;       move r0,#0x71111111
70          mov     r0,#0x71000000
71          mov     r1,#0x00110000
72          mov     r2,#0x00001100
73          mov     r3,#0x00000011
74          add     r0, r0, r1
75          add     r0, r0, r2
76          add     r0, r0, r3
77          str     r0, [r8,#24]
78
79          ;       move r0,#0x82223333
80          mov     r0,#0x82000000
81          mov     r1,#0x00220000
82          mov     r2,#0x00003300
83          mov     r3,#0x00000033
84          add     r0, r0, r1
85          add     r0, r0, r2
86          add     r0, r0, r3
87          str     r0, [r8,#28]
```

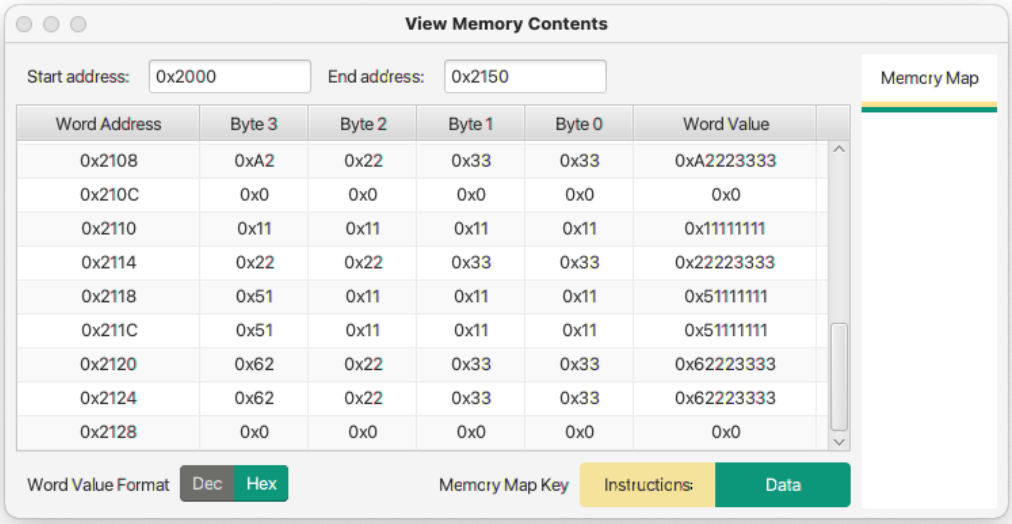
```
89          ;       move r0,#0x91111111
90          mov     r0,#0x91000000
91          mov     r1,#0x00110000
92          mov     r2,#0x00001100
93          mov     r3,#0x00000011
94          add     r0, r0, r1
95          add     r0, r0, r2
96          add     r0, r0, r3
97          str     r0, [r8,#32]
98
99          ;       move r0,#0xA2223333
100         mov     r0,#0xA2000000
101         mov     r1,#0x00220000
102         mov     r2,#0x00003300
103         mov     r3,#0x00000033
104         add     r0, r0, r1
105         add     r0, r0, r2
106         add     r0, r0, r3
107         str     r0, [r8,#36]
```

```
ENTRY

start_sort
        mov     r9, #10          ; Number of elements
        ldr     r8, =0x2000          ; Base address of data array

bubble_sort
        mov     r4, #0           ; loop_outer index i
        mov     r5, r9           ; r5 will keep track of n-i-1 for loop_inner

loop_outer
        cmp     r4, r9           ; COMPARE loop_outer index with number of elements
        beq     transfer_data        ; IF all elements have been processed, call transfer_data

        mov     r6, #0           ; loop_inner index j
        mov     r7, r8           ; Pointer to  first element

loop_inner
        ldr     r0,[r7]          ; LOAD current element
        ldr     r1, [r7, #4]       ; LOAD next element
        cmp     r0, r1           ; COMPARE current element with next element
        ble     no_swap            ; IF in order, CALL no_swap

        ;       Swap elements
        str     r1, [r7]
        str     r0, [r7, #4]

no_swap
        add     r7, r7, #4         ; Move to next element
        add     r6,r6, #1        ; INCREMENT loop_inner index
        cmp     r6,r5            ; COMPARE loop_inner index with n-i-1
        blt     loop_inner           ; IF j < n-i-1, CONTINUE loop_inner

        add     r4, r4, #1         ; INCREMENT loop_outer index
        sub     r5, r5, #1         ; DECREMENT comparison count for next pass
        b     loop_outer           ; REPEAT loop_outer

transfer_data
        ldr     r10, =0x2100         ; Base address for storing sorted data
        mov     r6,#0            ; RESET loop_inner index for transfer loop
        mov     r7,r8            ; Source base address (original sorted array)

copy_loop
        cmp     r6,r9            ; COMPARE loop_inner index with number of elements
        beq     done             ; IF all elements are copied, FINISH
        ldr     r0, [r7], #4       ; LOAD from source and post-increment address
        str     r0,[r10], #4       ; STORE to destination and post-increment address
        add     r6, r6, #1         ; INCREMENT loop_inner index
        b     copy_loop          ; REPEAT copy_loop

done
```

MEMORY CONTENTS






View Memory Contents
Start address: 0x2000
End address: 0x2150
Memory Map
Word Address | Byte 3 | Byte 2 | Byte 1 | Byte 0 | Word Value
0x2108 | 0xA2 | 0x22 | 0x33 | 0x33 | 0xA2223333
0x210C | 0x0 | 0x0 | 0x0 | 0x0 | 0x0
0x2110 | 0x11 | 0x11 | 0x11 | 0x11 | 0x11111111
0x2114 | 0x22 | 0x22 | 0x33 | 0x33 | 0x22223333
0x2118 | 0x51 | 0x11 | 0x11 | 0x11 | 0x51111111
0x211C | 0x51 | 0x11 | 0x11 | 0x11 | 0x51111111
0x2120 | 0x62 | 0x22 | 0x33 | 0x33 | 0x62223333
0x2124 | 0x62 | 0x22 | 0x33 | 0x33 | 0x62223333
0x2128 | 0x0 | 0x0 | 0x0 | 0x0 | 0x0
Word Value Format
Dec
Hex
Memory Map Key
Instructions
Data