Alexandria University
Faculty of Engineering
Computer and Systems Engineering
Department
CSE 233: Computer Organization

Lab 6: assembly

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QUESTION1)

PROBLEM STATEMENT:

Write an assembly code that reverses the order of the sequence of a given 10 items array.

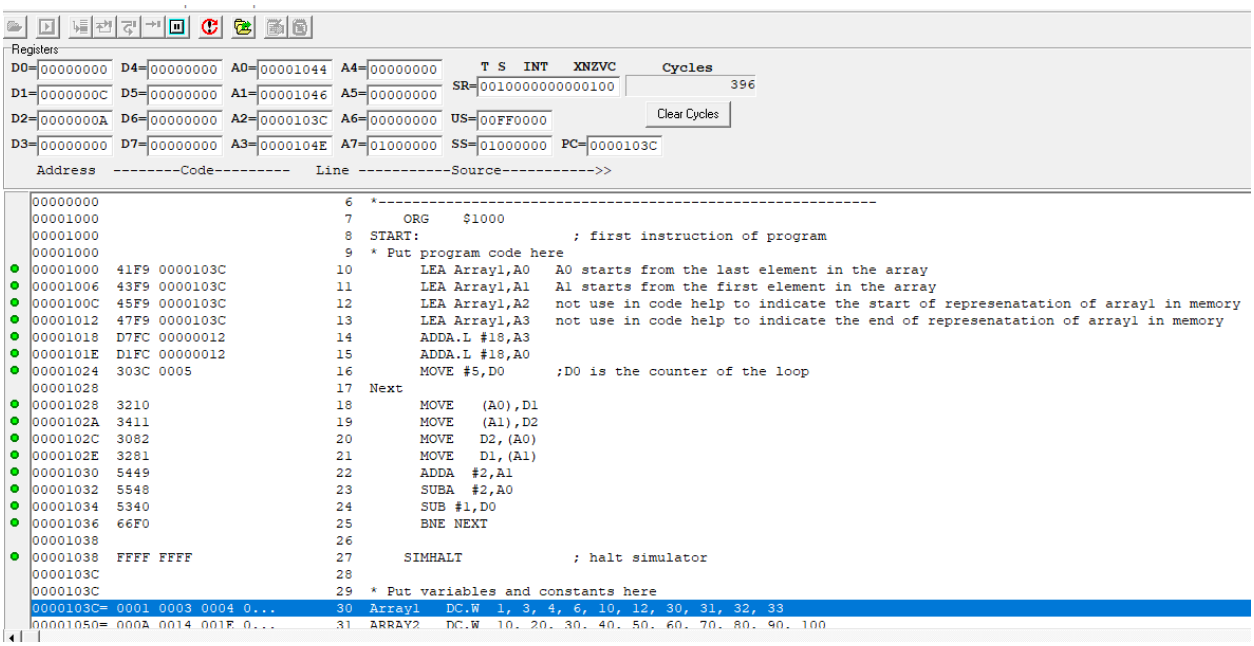
- XSEQ = [1, 3, 4, 6, 10, 12, 30, 31, 32, 33]
- XSEQ = [10, 20, 30, 40, 50, 60, 70, 80, 90, 100]

Code:

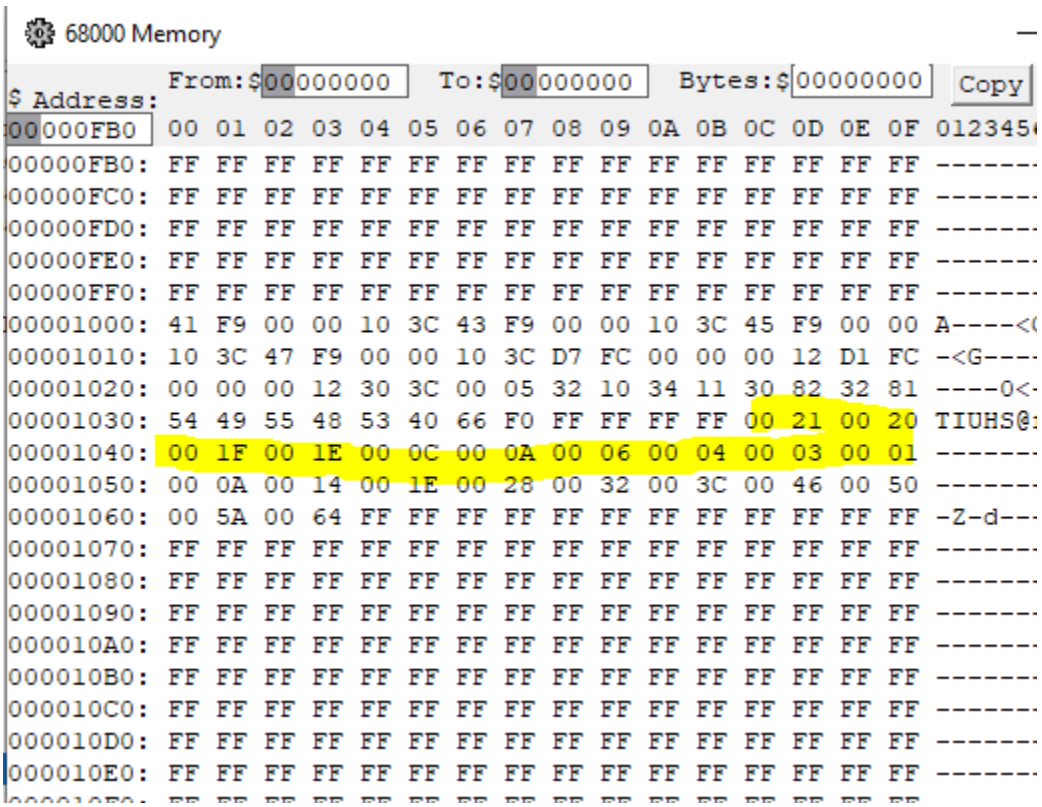
```
*-----------------------------------------------------------
    ORG    $1000
START:                  ; first instruction of program
* Put program code here
      LEA Array1,A0   A0 starts from the last element in the array
      LEA Array1,A1   A1 starts from the first element in the array
      LEA Array1,A2   not use in code help to indicate the start of represenatation of array1 in memory
      LEA Array1,A3   not use in code help to indicate the end of represenatation of array1 in memory
      ADDA.L #18,A3
      ADDA.L #18,A0
      MOVE #5,D0      ;D0 is the counter of the loop
Next
      MOVE    (A0),D1
      MOVE    (A1),D2
      MOVE    D2,(A0)
      MOVE    D1,(A1)
      ADDA   #2,A1
      SUBA   #2,A0
      SUB #1,D0
      BNE NEXT

    SIMHALT             ; halt simulator

* Put variables and constants here
Array1    DC.W   1, 3, 4, 6, 10, 12, 30, 31, 32, 33
ARRAY2    DC.W   10, 20, 30, 40, 50, 60, 70, 80, 90, 100

    END    START        ; last line of source
```

SAMPLE RUNS:

1:

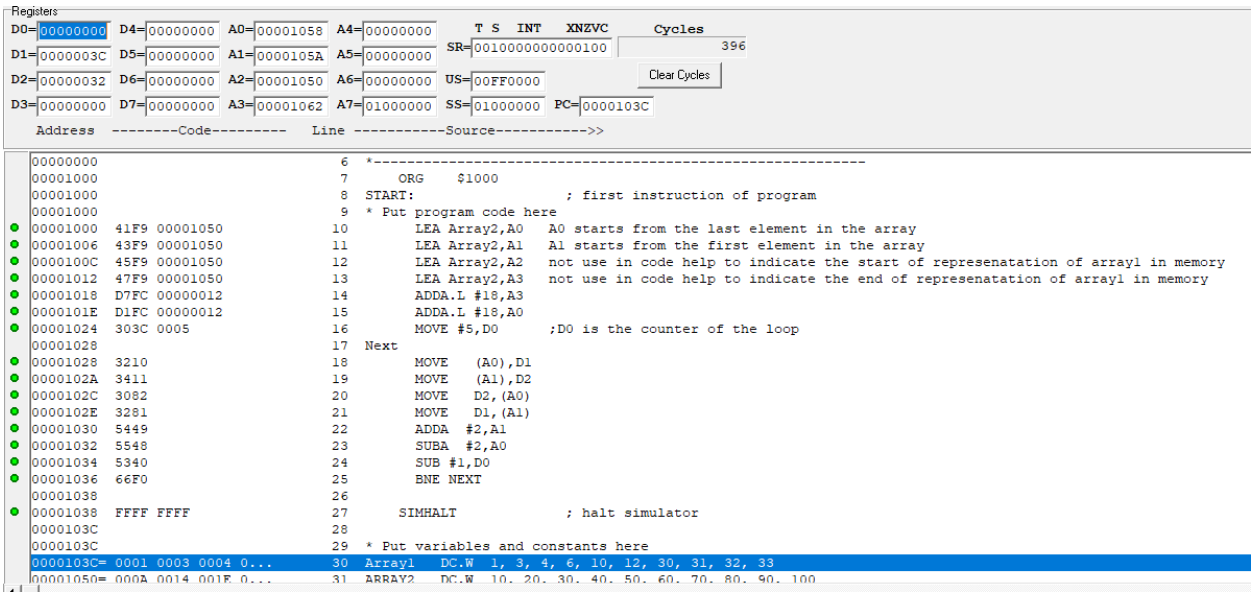


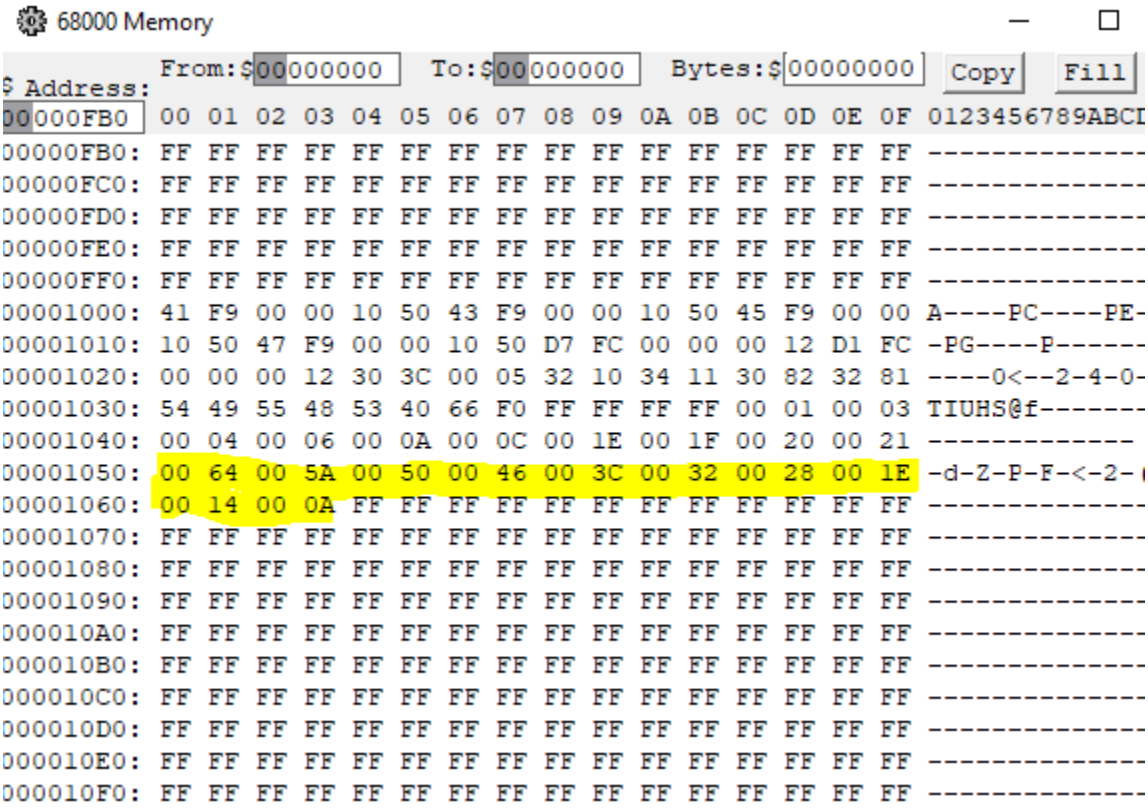
```
Registers
D0=00000000 D4=00000000 A0=00001044 A4=00000000     T S  INT   XNZVC      Cycles
D1=0000000C D5=00000000 A1=00001046 A5=00000000 SR=0010000000000100            396
D2=0000000A D6=00000000 A2=0000103C A6=00000000 US=00FF0000     Clear Cycles
D3=00000000 D7=00000000 A3=0000104E A7=01000000 SS=01000000 PC=0000103C
   Address  --------Code---------   Line -----------Source----------->>

00000000                             6  *-----------------------------------------------------------
00001000                             7      ORG    $1000
00001000                             8  START:                  ; first instruction of program
00001000                             9  * Put program code here
00001000  41F9 0000103C            10        LEA Array1,A0   A0 starts from the last element in the array
00001006  43F9 0000103C            11        LEA Array1,A1   A1 starts from the first element in the array
0000100C  45F9 0000103C            12        LEA Array1,A2   not use in code help to indicate the start of represenatation of array1 in memory
00001012  47F9 0000103C            13        LEA Array1,A3   not use in code help to indicate the end of represenatation of array1 in memory
00001018  D7FC 00000012            14        ADDA.L #18,A3
0000101E  D1FC 00000012            15        ADDA.L #18,A0
00001024  303C 0005                16        MOVE #5,D0      ;D0 is the counter of the loop
00001028                           17  Next
00001028  3210                     18        MOVE   (A0),D1
0000102A  3411                     19        MOVE   (A1),D2
0000102C  3082                     20        MOVE   D2,(A0)
0000102E  3281                     21        MOVE   D1,(A1)
00001030  5449                     22        ADDA  #2,A1
00001032  5548                     23        SUBA  #2,A0
00001034  5340                     24        SUB #1,D0
00001036  66F0                     25        BNE NEXT
00001038                           26
00001038  FFFF FFFF                27      SIMHALT             ; halt simulator
0000103C                           28
0000103C                           29  * Put variables and constants here
0000103C= 0001 0003 0004 0...      30  Array1   DC.W  1, 3, 4, 6, 10, 12, 30, 31, 32, 33
00001050= 000A 0014 001E 0...      31  ARRAY2   DC.W  10, 20, 30, 40, 50, 60, 70, 80, 90, 100
```



```
68000 Memory
From:$00000000  To:$00000000  Bytes:$00000000  Copy
$ Address:
00000FB0  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 012345
00000FB0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00000FC0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00000FD0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00000FE0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00000FF0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00001000: 41 F9 00 00 10 3C 43 F9 00 00 10 3C 45 F9 00 00 A----<(
00001010: 10 3C 47 F9 00 00 10 3C D7 FC 00 00 00 12 D1 FC -<G----
00001020: 00 00 00 12 30 3C 00 05 32 10 34 11 30 82 32 81 ----0<-
00001030: 54 49 55 48 53 40 66 F0 FF FF FF FF 00 21 00 20 TIUHS@:
00001040: 00 1F 00 1E 00 0C 00 0A 00 06 00 04 00 03 00 01 -------
00001050: 00 0A 00 14 00 1E 00 28 00 32 00 3C 00 46 00 50 -------
00001060: 00 5A 00 64 FF FF FF FF FF FF FF FF FF FF FF FF -Z-d---
00001070: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00001080: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
00001090: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
000010A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
000010B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
000010C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
000010D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
000010E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF -------
```

2:


Registers
D0=00000000 D4=00000000 A0=00001058 A4=00000000
D1=0000003C D5=00000000 A1=0000105A A5=00000000
D2=00000032 D6=00000000 A2=00001050 A6=00000000
D3=00000000 D7=00000000 A3=00001062 A7=01000000
T S INT XNZVC Cycles
SR=0010000000000100 396
US=00FF0000
SS=01000000 PC=0000103C
Clear Cycles
Address --------Code--------- Line ----------Source---------->>
00000000 6 *---
00001000 7 ORG $1000
00001000 8 START: ; first instruction of program
00001000 9 * Put program code here
00001000 41F9 00001050 10 LEA Array2,A0 A0 starts from the last element in the array
00001006 43F9 00001050 11 LEA Array2,A1 A1 starts from the first element in the array
0000100C 45F9 00001050 12 LEA Array2,A2 not use in code help to indicate the start of represenatation of array1 in memory
00001012 47F9 00001050 13 LEA Array2,A3 not use in code help to indicate the end of represenatation of array1 in memory
00001018 D7FC 00000012 14 ADDA.L #18,A3
0000101E D1FC 00000012 15 ADDA.L #18,A0
00001024 303C 0005 16 MOVE #5,D0 ;D0 is the counter of the loop
00001028 17 Next
00001028 3210 18 MOVE (A0),D1
0000102A 3411 19 MOVE (A1),D2
0000102C 3082 20 MOVE D2,(A0)
0000102E 3281 21 MOVE D1,(A1)
00001030 5449 22 ADDA #2,A1
00001032 5548 23 SUBA #2,A0
00001034 5340 24 SUB #1,D0
00001036 66F0 25 BNE NEXT
00001038 26
00001038 FFFF FFFF 27 SIMHALT ; halt simulator
0000103C 28
0000103C 29 * Put variables and constants here
0000103C= 0001 0003 0004 0... 30 Array1 DC.W 1, 3, 4, 6, 10, 12, 30, 31, 32, 33
00001050= 000A 0014 001E 0... 31 ARRAY2 DC.W 10, 20, 30, 40, 50, 60, 70, 80, 90, 100


68000 Memory
From:$00000000 To:$00000000 Bytes:$00000000 Copy Fill
$ Address:
00000FB0: 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 0123456789ABCD
00000FB0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00000FC0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00000FD0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00000FE0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00000FF0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00001000: 41 F9 00 00 10 50 43 F9 00 00 10 50 45 F9 00 00 A----PC----PE-
00001010: 10 50 47 F9 00 00 10 50 D7 FC 00 00 00 12 D1 FC -PG----P------
00001020: 00 00 00 12 30 3C 00 05 32 10 34 11 30 82 32 81 ----0<--2-4-0-
00001030: 54 49 55 48 53 40 66 F0 FF FF FF FF 00 01 00 03 TIUHS@f-------
00001040: 00 04 00 06 00 0A 00 0C 00 1E 00 1F 00 20 00 21 ----------
00001050: 00 64 00 5A 00 50 00 46 00 3C 00 32 00 28 00 1E -d-Z-P-F-<-2-(
00001060: 00 14 00 0A FF FF FF FF FF FF FF FF FF FF FF FF ----------
00001070: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00001080: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
00001090: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
000010A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
000010B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
000010C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
000010D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
000010E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------
000010F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------

QUESTION2)

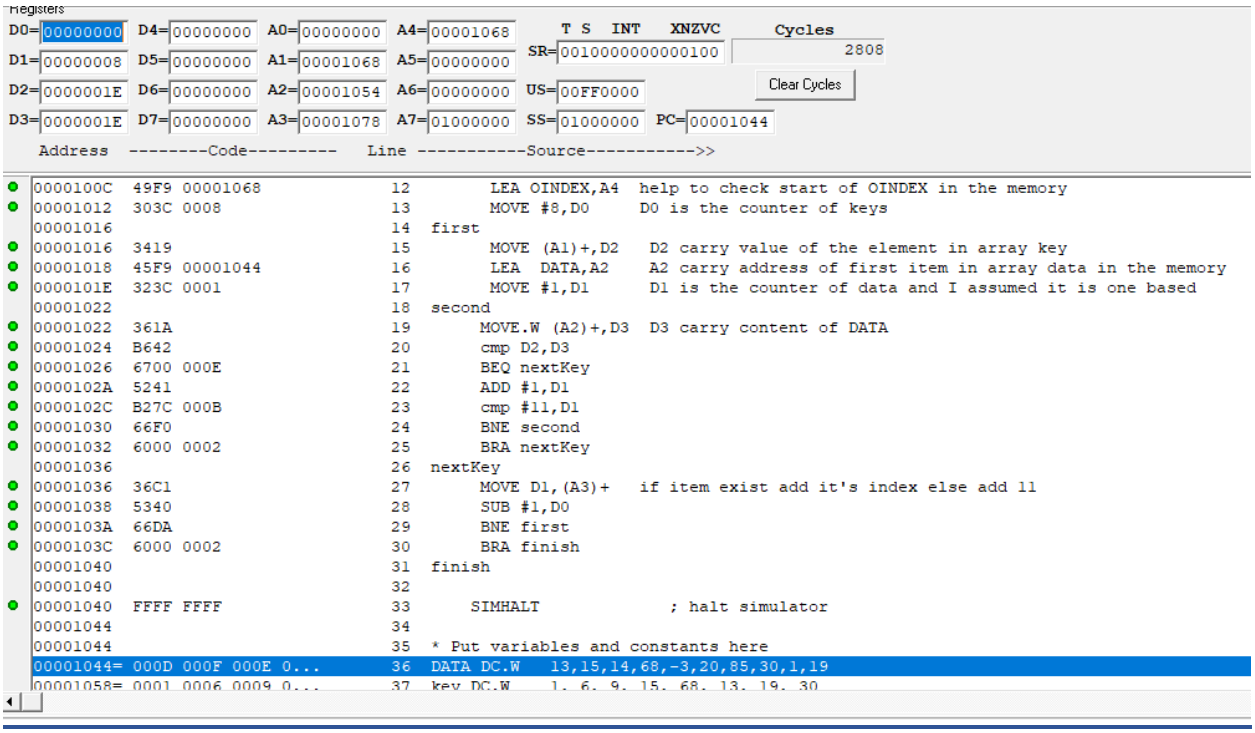
PROBLEM STATEMENT:

Search for the elements in the key in the data array.

Code:

```
    ORG    $1000
START:                  ; first instruction of program
* Put program code here
      LEA key,A1
      LEA OINDEX,A3  A3 is the pointer to OINDEX
      LEA OINDEX,A4  help to check start of OINDEX in the memory
      MOVE #8,D0     D0 is the counter of keys
first
      MOVE (A1)+,D2   D2 carry value of the element in array key
      LEA  DATA,A2    A2 carry address of first item in array data in the memory
      MOVE #1,D1      D1 is the counter of data and I assumed it is one based
second
     MOVE.W (A2)+,D3  D3 carry content of DATA
     cmp D2,D3
     BEQ nextKey
     ADD #1,D1
     cmp #11,D1
     BNE second
     BRA nextKey
nextKey
     MOVE D1,(A3)+   if item exist add it's index else add 11
     SUB #1,D0
     BNE first
     BRA finish
finish

    SIMHALT             ; halt simulator

* Put variables and constants here
DATA DC.W   13,15,14,68,-3,20,85,30,1,19
key DC.W    1, 6, 9, 15, 68, 13, 19, 30
OINDEX DS.W 8

    END    START
```

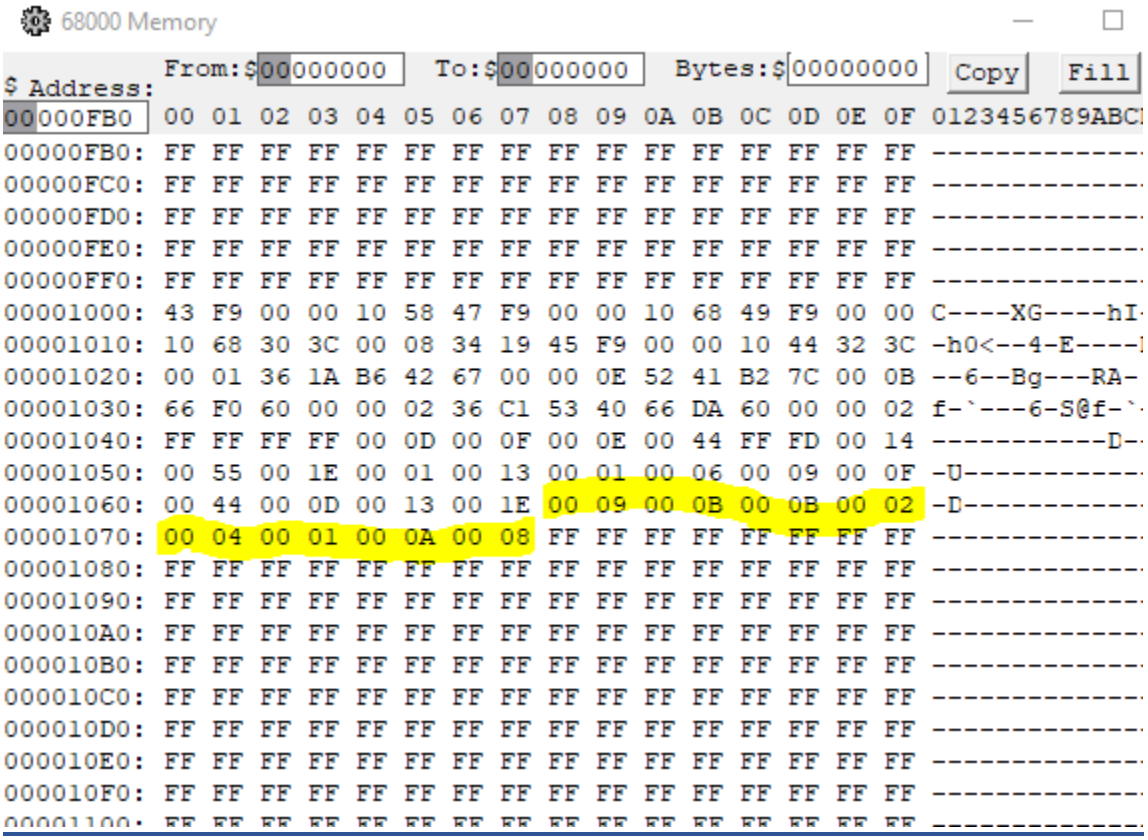
SAMPLE RUN:



Registers

```
D0=00000000  D4=00000000  A0=00000000  A4=00001068     T S  INT   XNZVC     Cycles
D1=00000008  D5=00000000  A1=00001068  A5=00000000  SR=0010000000000100          2808
D2=0000001E  D6=00000000  A2=00001054  A6=00000000  US=00FF0000   [Clear Cycles]
D3=0000001E  D7=00000000  A3=00001078  A7=01000000  SS=01000000  PC=00001044
```

```
   Address  --------Code---------   Line -----------Source----------->>
0000100C  49F9 00001068            12        LEA OINDEX,A4  help to check start of OINDEX in the memory
00001012  303C 0008                13        MOVE #8,D0     D0 is the counter of keys
00001016                           14  first
00001016  3419                     15        MOVE (A1)+,D2   D2 carry value of the element in array key
00001018  45F9 00001044            16        LEA  DATA,A2    A2 carry address of first item in array data in the memory
0000101E  323C 0001                17        MOVE #1,D1      D1 is the counter of data and I assumed it is one based
00001022                           18  second
00001022  361A                     19       MOVE.W (A2)+,D3  D3 carry content of DATA
00001024  B642                     20       cmp D2,D3
00001026  6700 000E                21       BEQ nextKey
0000102A  5241                     22       ADD #1,D1
0000102C  B27C 000B                23       cmp #11,D1
00001030  66F0                     24       BNE second
00001032  6000 0002                25       BRA nextKey
00001036                           26  nextKey
00001036  36C1                     27       MOVE D1,(A3)+   if item exist add it's index else add 11
00001038  5340                     28       SUB #1,D0
0000103A  66DA                     29       BNE first
0000103C  6000 0002                30       BRA finish
00001040                           31  finish
00001040                           32
00001040  FFFF FFFF                33      SIMHALT             ; halt simulator
00001044                           34
00001044                           35  * Put variables and constants here
00001044= 000D 000F 000E 0...      36  DATA DC.W   13,15,14,68,-3,20,85,30,1,19
00001058= 0001 0006 0009 0...      37  key DC.W    1, 6, 9, 15, 68, 13, 19, 30
```



68000 Memory

From:$00000000 To:$00000000 Bytes:$00000000 Copy Fill

```
$ Address:  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 0123456789ABCD
00000FB0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00000FC0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00000FD0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00000FE0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00000FF0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00001000: 43 F9 00 00 10 58 47 F9 00 00 10 68 49 F9 00 00 C----XG----hI--
00001010: 10 68 30 3C 00 08 34 19 45 F9 00 00 10 44 32 3C -h0<--4-E----D2<
00001020: 00 01 36 1A B6 42 67 00 00 0E 52 41 B2 7C 00 0B --6--Bg---RA-|--
00001030: 66 F0 60 00 00 02 36 C1 53 40 66 DA 60 00 00 02 f-`---6-S@f-`---
00001040: FF FF FF FF 00 0D 00 0F 00 0E 00 44 FF FD 00 14 -----------D----
00001050: 00 55 00 1E 00 01 00 13 00 01 00 06 00 09 00 0F -U--------------
00001060: 00 44 00 0D 00 13 00 1E 00 09 00 0B 00 0B 00 02 -D--------------
00001070: 00 04 00 01 00 0A 00 08 FF FF FF FF FF FF FF FF ----------------
00001080: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00001090: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
000010A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
000010B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
000010C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
000010D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
000010E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
000010F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
00001100: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF ----------------
```