Assignment Report 2

1. Assignment

Write a program starting at location x3000 in LC-3 assembly language that will:

1. Upon starting: Print "Type a name and press Enter:" on the screen and then wait for user to input a string. The input will be ended by pressing <Enter> (ASCII code x000A). Each name is a case-sensitive string of length between 1 to 15 characters.

2. After the user pressed the <Enter> key, your program will search the directory to find the room number based on that name. The address of the first node of the directory has been already stored in location x4000.

3. For each faculty whose first name or last name is the same as input, print his/her full-name and room number in one row. If none exists, print "No Entry". Each line should be terminated by a carriage return (ASCII x0A).

4. Clean up: Halt the machine.

2. Solution and Flow Chart

First, I use LEA and TRAP x22 instructions to put out a string of *"Type a name and press Enter:"* Then I set a loop to read and rewrite chars and save them in the position NAME. Here I used two sub-programs WRITECHAR and READCHAR. Second, after the program detected ENTER (x0A), it goes to the branch SEARCH, which searches the whole linked list to find a match. R6 is used to store whether there is one or more than one matches, so that when there are many matches, the program won't go wrong.

Then, the R0 begins to load its own value (just like a pointer). R2 load the data of names and R1 and R2 begin to compare in a sub-program. If there is a letter that is different then return and R3 is set 0, or R3 is 1. If R3 is 1 then the program goes into OUTPUT and puts out the last name and first name and the room number.

If there is no match and it puts out "No Entry".

3. Source Code

```
1   .ORIG x3000
2   LEA R0, S1
3   TRAP x22
4   ;
5       LEA R1,NAME
6   INPUT   GETC
7       OUT
8       LD R3,NEWLINE
9       NOT R3,R3
10      ADD R3,R3,#1
11      ADD R3,R3,R0
12      BRz SEARCH
13      STR R0,R1,#0
14      ADD R1,R1,#1
15      BRnzp INPUT
16  ;input the number
17  ;if Enter is detected
18  ;then search the names
19  TRAP x25
20  ;
```

```
21  SEARCH
22      ADD R0,R0,xFFF6
23      STR R0,R1,#0
24      LEA R1,NAME
25      LD R0,PTR
26      LDR R0,R0,#0
27      AND R6,R6,#0
28  LOOP
29      LDR R2,R0,#2
30      JSR COMPARE
31      ADD R3,R3,xFFFF
32      BRz OUTPUT
33      LDR R2,R0,#3
34      JSR COMPARE
35      ADD R3,R3,xFFFF
36      BRz OUTPUT
37  HERE LDR R0,R0,#0
38      BRz FAIL
39      BRnzp LOOP
40  ;compare every element
41  ;of the linked list
42  ;if find a match
43  ;then output the names
```

```
44  COMPARE AND R3,R3,#0
45      ADD R3,R3,#1
46      ST R1,SR1
47      ST R2,SR2
48      ST R6,SR6
49  LOOP2 LDR R4,R1,#0
50      LDR R5,R2,#0
51      NOT R4,R4
52      ADD R4,R4,#1
53      ADD R4,R4,R5
54      BRnp NMATCH
55      BRz MATCH
56  NMATCH  ADD R3,R3,#-1
57      LD R1,SR1
58      LD R2,SR2
59      LD R6,SR6
60      RET
61  MATCH LDR R6,R1,#0
62      BRz N
63      ADD R1,R1,#1
64      ADD R2,R2,#1
65      BRnzp LOOP2
66  N   LD R1,SR1
67      LD R2,SR2
68      LD R6,SR6
69      RET
70  ;compare each char
71  ;if there is a
72  ;difference then
73  ;return with 0
```

```
74   OUTPUT ADD R6,R6,#1
75       ST R6,SR6
76       AND R6,R6,#0
77       ADD R6,R6,R0
78       LDR R0,R6,#3
79       TRAP x22
80       LEA R0,SPACE
81       TRAP x22
82       LDR R0,R6,#2
83       TRAP x22
84       LEA R0,SPACE
85       TRAP x22
86       LDR R0,R6,#1
87       TRAP x22
88       LD R0,NEWLINE
89       TRAP x21
90       AND R0,R0,#0
91       ADD R0,R0,R6
92       LD R6,SR6
93       BRnzp HERE
94   ;put out the names
95   FAIL
96       ADD R6,R6,#0
97       BRp EXIT
98       LEA R0,S2
99       TRAP x22
100      LD R0,NEWLINE
101      TRAP x21
102      BRnzp EXIT
103  ;if there is no match
104  ;R6 = 0 ,then output
105  ;No Entry
```

```
106  DSR .FILL xFE04
107  DDR .FILL xFE06
108  KBSR .FILL xFE00
109  KBDR .FILL xFE02
110  NEWLINE .FILL x000A
111  PTR .FILL x4000
112  EXIT TRAP x25
113  S1 .STRINGZ "Type a name and press Enter:"
114  S2 .STRINGZ "No Entry"
115  NAME .BLKW 16
116  SR1 .BLKW 1
117  SR2 .BLKW 1
118  SR6 .BLKW 1
119  SPACE .FILL #32
120  ;
121  .END
```

```
.ORIG x3000

LEA R0, S1

TRAP x22

;

    LEA R1,NAME

INPUT    GETC

    OUT

    LD R3,NEWLINE

    NOT R3,R3

    ADD R3,R3,#1

    ADD R3,R3,R0

    BRz SEARCH

    STR R0,R1,#0

    ADD R1,R1,#1

    BRnzp INPUT

;input the number

;if Enter is detected

;then search the names

TRAP x25

;

SEARCH

    ADD R0,R0,xFFF6
```

```
        STR R0,R1,#0
        LEA R1,NAME
        LD R0,PTR
        LDR R0,R0,#0
        AND R6,R6,#0
LOOP
        LDR R2,R0,#2
        JSR COMPARE
        ADD R3,R3,xFFFF
        BRz OUTPUT
        LDR R2,R0,#3
        JSR COMPARE
        ADD R3,R3,xFFFF
        BRz OUTPUT
HERE LDR R0,R0,#0
        BRz FAIL
        BRnzp LOOP
;compare every element
;of the linked list
;if find a match
;then output the names
COMPARE AND R3,R3,#0
        ADD R3,R3,#1
        ST R1,SR1
        ST R2,SR2
        ST R6,SR6
LOOP2 LDR R4,R1,#0
        LDR R5,R2,#0
        NOT R4,R4
        ADD R4,R4,#1
        ADD R4,R4,R5
        BRnp NMATCH
        BRz MATCH
NMATCH   ADD R3,R3,#-1
        LD R1,SR1
        LD R2,SR2
        LD R6,SR6
        RET
MATCH LDR R6,R1,#0
        BRz N
        ADD R1,R1,#1
        ADD R2,R2,#1
        BRnzp LOOP2
N     LD R1,SR1
```

```
    LD R2,SR2
    LD R6,SR6
    RET
;compare each char
;if there is a
;difference then
;return with 0
OUTPUT ADD R6,R6,#1
    ST R6,SR6
    AND R6,R6,#0
    ADD R6,R6,R0
    LDR R0,R6,#3
    TRAP x22
    LEA R0,SPACE
    TRAP x22
    LDR R0,R6,#2
    TRAP x22
    LEA R0,SPACE
    TRAP x22
    LDR R0,R6,#1
    TRAP x22
    LD R0,NEWLINE
    TRAP x21
    AND R0,R0,#0
    ADD R0,R0,R6
    LD R6,SR6
    BRnzp HERE
;put out the names
FAIL
    ADD R6,R6,#0
    BRp EXIT
    LEA R0,S2
    TRAP x22
    LD R0,NEWLINE
    TRAP x21
    BRnzp EXIT
;if there is no match
;R6 = 0 ,then output
;No Entry
DSR .FILL xFE04
DDR .FILL xFE06
KBSR .FILL xFE00
KBDR .FILL xFE02
NEWLINE .FILL x000A
```

PTR .FILL x4000

EXIT TRAP x25

S1 .STRINGZ "Type a name and press Enter:"

S2 .STRINGZ "No Entry"

NAME .BLKW 16

SR1 .BLKW 1

SR2 .BLKW 1

SR6 .BLKW 1

SPACE .FILL #32

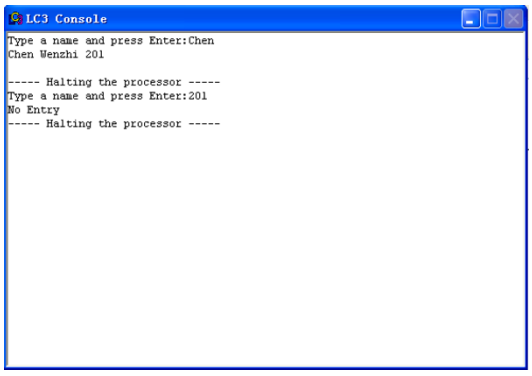
;

.END

本次实验唯一问题就在于直接给了 15 位储存空间，而没有考虑 15 位满的数据后面还要放一个 ‘\0’ 的情况。

4. Snapshots

Example1：easy test case：



Example2：test case from TA：