Data Science PB22051087 YufengPeng 2023.11.4

Code

```
0011000000000000     .ORIG  x3000

0101110110100000    AND R6,  R6,  #0
0001110110100111    ADD R6,  R6,  #7
0101111111100000    AND R7,  R7,  #0
0001111111100001    ADD R7,  R7,  #1

0011110011111100    ST  R6,  #252
0010000011111010    LD  R0,  #250
0000010000000101    BRz  #5

0101001000000111    AND  R1,  R0,  R7
0000001000000011    BRp  #3

1001000000111111    NOT  R0,  R0
0001000000100001    ADD  R0,  R0,  #1
0000111000000001    BRnzp  #1

0001110110100001    ADD  R6,  R6,  #1
0101001000000111    AND  R1,  R0,  R7
0000001000000001    BRp  #1
0001110110100001    ADD  R6,  R6,  #1
0001111111000111    ADD  R7,  R7,  R7
0000011111111011    BRzp  #–5

0011110011101111    ST  R6,  #239
1111000000100101    TRAP  x25
                     .END
```

Procedure

Step1: Init: Add the last bit of my ID to R6 and store R6 to x3101 Load the number to R0 from x3100(If input is “0”, jump to calculate)

Step2: Detect the last bit of the input number

Step3: if ODD: R6 += 1;
if EVEN: Do nothing.

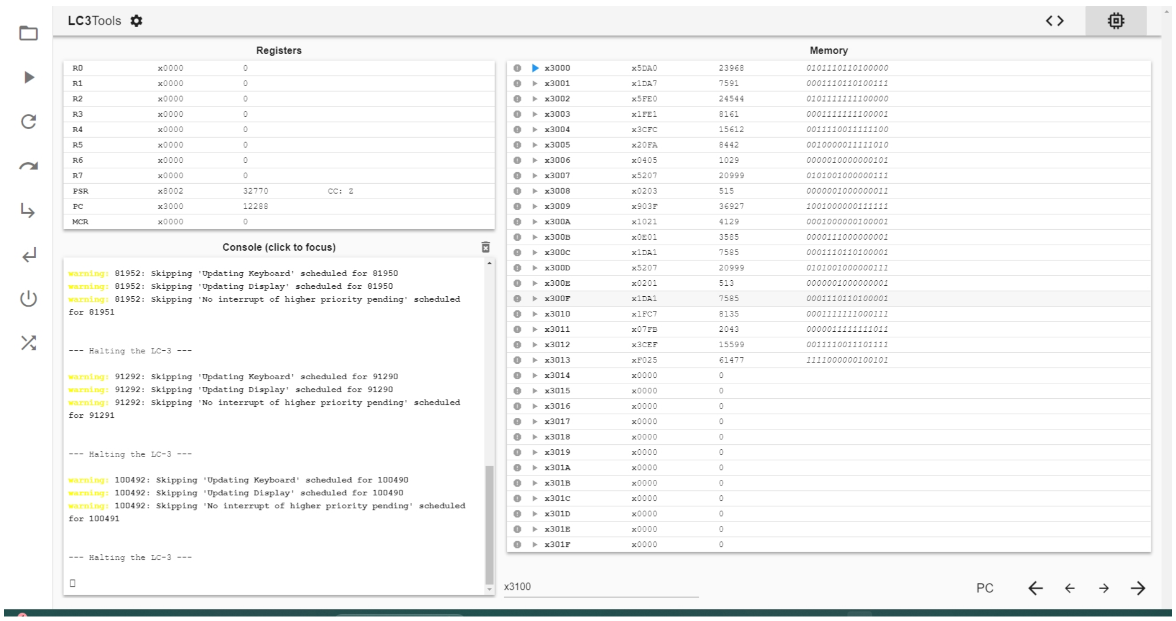
Step4: Calculate: Using R7 as bit mask, AND R7 with the number so that we can fetch the specific bit that we want to process. If the bit we fetched is 0, than we ADD R6 by 1, esle we do nothing. Then we ADD R7 by itself, which can make the “1” in bit mask move to the left (e.g. $00010 + 00010 = 00100$). LOOP this step until R7 is negative.

Step5: Sotre the final result to x3102

Result

My ID is PB22051087, which means the last bit of my ID is “7”. So if the number that I input is 5, the output will be $14 + 7 = 21$. If the input is 100, the output will be $4 + 7 = 11$. If the input is “0”, the output should be $16 + 7 = 23$.

Now I’ll attach the results of my run in the emulator.



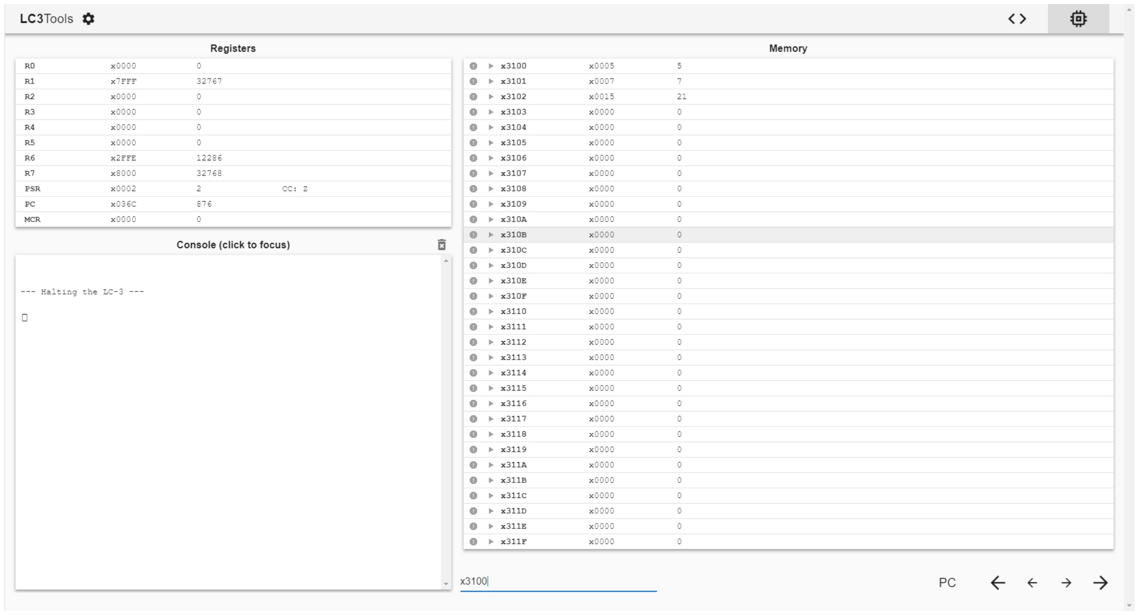
```
R0      x0000   0
R1      x0000   0
R2      x0000   0
R3      x0000   0
R4      x0000   0
R5      x0000   0
R6      x0000   0
R7      x0000   0
PSR     x8002   32770       CC: Z
PC      x3000   12288
MCR     x0000   0
```

```
warning: 81952: Skipping 'Updating Keyboard' scheduled for 81950
warning: 81952: Skipping 'Updating Display' scheduled for 81950
warning: 81952: Skipping 'No interrupt of higher priority pending' scheduled
for 81951


--- Halting the LC-3 ---

warning: 91292: Skipping 'Updating Keyboard' scheduled for 91290
warning: 91292: Skipping 'Updating Display' scheduled for 91290
warning: 91292: Skipping 'No interrupt of higher priority pending' scheduled
for 91291


--- Halting the LC-3 ---

warning: 100492: Skipping 'Updating Keyboard' scheduled for 100490
warning: 100492: Skipping 'Updating Display' scheduled for 100490
warning: 100492: Skipping 'No interrupt of higher priority pending' scheduled
for 100491


--- Halting the LC-3 ---
```

```
x3000   x5DA0   23968   0101110110100000
x3001   x1DA7   7591    0001110110100111
x3002   x5FE0   24544   0101111111100000
x3003   x1FE1   8161    0001111111100001
x3004   x3CFC   15612   0011110011111100
x3005   x20FA   8442    0010000011111010
x3006   x0405   1029    0000010000000101
x3007   x5207   20999   0101001000000111
x3008   x0203   515     0000001000000011
x3009   x903F   36927   1001000000111111
x300A   x1021   4129    0001000000100001
x300B   x0E01   3585    0000111000000001
x300C   x1DA1   7585    0001110110100001
x300D   x5207   20999   0101001000000111
x300E   x0201   513     0000001000000001
x300F   x1DA1   7585    0001110110100001
x3010   x1FC7   8135    0001111111000111
x3011   x07FB   2043    0000011111111011
x3012   x3CEF   15599   0011110011101111
x3013   xF025   61477   1111000000100101
x3014   x0000   0
x3015   x0000   0
x3016   x0000   0
x3017   x0000   0
x3018   x0000   0
x3019   x0000   0
x301A   x0000   0
x301B   x0000   0
x301C   x0000   0
x301D   x0000   0
x301E   x0000   0
x301F   x0000   0
```

x3100

Figure 1: Before



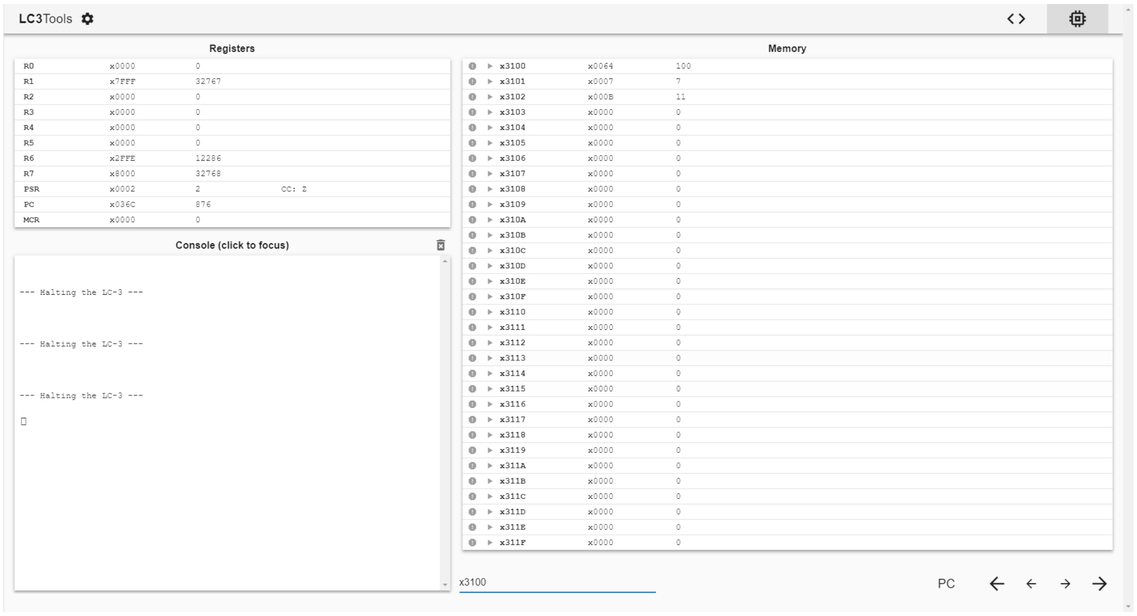
```
R0      x0000   0
R1      x7FFF   32767
R2      x0000   0
R3      x0000   0
R4      x0000   0
R5      x0000   0
R6      x2FFE   12286
R7      x8000   32768
PSR     x0002   2           CC: Z
PC      x036C   876
MCR     x0000   0
```

```
--- Halting the LC-3 ---
```

```
x3100   x0005   5
x3101   x0007   7
x3102   x0015   21
x3103   x0000   0
x3104   x0000   0
x3105   x0000   0
x3106   x0000   0
x3107   x0000   0
x3108   x0000   0
x3109   x0000   0
x310A   x0000   0
x310B   x0000   0
x310C   x0000   0
x310D   x0000   0
x310E   x0000   0
x310F   x0000   0
x3110   x0000   0
x3111   x0000   0
x3112   x0000   0
x3113   x0000   0
x3114   x0000   0
x3115   x0000   0
x3116   x0000   0
x3117   x0000   0
x3118   x0000   0
x3119   x0000   0
x311A   x0000   0
x311B   x0000   0
x311C   x0000   0
x311D   x0000   0
x311E   x0000   0
x311F   x0000   0
```

x3100

Figure 2: Input: 5



LC3Tools

Registers

R0	x0000	0	
R1	x7FFF	32767	
R2	x0000	0	
R3	x0000	0	
R4	x0000	0	
R5	x0000	0	
R6	x2FFE	12286	
R7	x8000	32768	
PSR	x0002	2	CC: Z
PC	x036C	876	
MCR	x0000	0	

Console (click to focus)

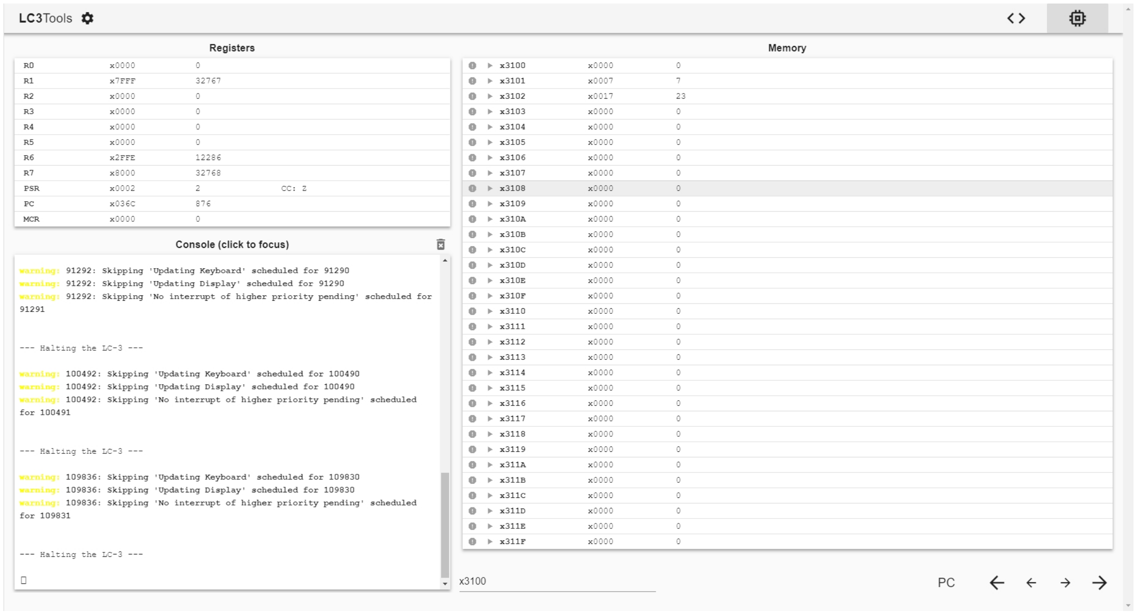
```
--- Halting the LC-3 ---


--- Halting the LC-3 ---


--- Halting the LC-3 ---

```

Memory

x3100	x0064	100
x3101	x0007	7
x3102	x000B	11
x3103	x0000	0
x3104	x0000	0
x3105	x0000	0
x3106	x0000	0
x3107	x0000	0
x3108	x0000	0
x3109	x0000	0
x310A	x0000	0
x310B	x0000	0
x310C	x0000	0
x310D	x0000	0
x310E	x0000	0
x310F	x0000	0
x3110	x0000	0
x3111	x0000	0
x3112	x0000	0
x3113	x0000	0
x3114	x0000	0
x3115	x0000	0
x3116	x0000	0
x3117	x0000	0
x3118	x0000	0
x3119	x0000	0
x311A	x0000	0
x311B	x0000	0
x311C	x0000	0
x311D	x0000	0
x311E	x0000	0
x311F	x0000	0

x3100 PC

Figure 3: Input: 100



LC3Tools

Registers

R0	x0000	0	
R1	x7FFF	32767	
R2	x0000	0	
R3	x0000	0	
R4	x0000	0	
R5	x0000	0	
R6	x2FFE	12286	
R7	x8000	32768	
PSR	x0002	2	CC: Z
PC	x036C	876	
MCR	x0000	0	

Console (click to focus)

```
warning: 91292: Skipping 'Updating Keyboard' scheduled for 91290
warning: 91292: Skipping 'Updating Display' scheduled for 91290
warning: 91292: Skipping 'No interrupt of higher priority pending' scheduled for
91291


--- Halting the LC-3 ---

warning: 100492: Skipping 'Updating Keyboard' scheduled for 100490
warning: 100492: Skipping 'Updating Display' scheduled for 100490
warning: 100492: Skipping 'No interrupt of higher priority pending' scheduled
for 100491


--- Halting the LC-3 ---

warning: 109836: Skipping 'Updating Keyboard' scheduled for 109830
warning: 109836: Skipping 'Updating Display' scheduled for 109830
warning: 109836: Skipping 'No interrupt of higher priority pending' scheduled
for 109831


--- Halting the LC-3 ---

```

Memory

x3100	x0000	0
x3101	x0007	7
x3102	x0017	23
x3103	x0000	0
x3104	x0000	0
x3105	x0000	0
x3106	x0000	0
x3107	x0000	0
x3108	x0000	0
x3109	x0000	0
x310A	x0000	0
x310B	x0000	0
x310C	x0000	0
x310D	x0000	0
x310E	x0000	0
x310F	x0000	0
x3110	x0000	0
x3111	x0000	0
x3112	x0000	0
x3113	x0000	0
x3114	x0000	0
x3115	x0000	0
x3116	x0000	0
x3117	x0000	0
x3118	x0000	0
x3119	x0000	0
x311A	x0000	0
x311B	x0000	0
x311C	x0000	0
x311D	x0000	0
x311E	x0000	0
x311F	x0000	0

x3100 PC

Figure 4: Input: 0