

Lab 4

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1.

The screenshot displays the LC3Tools v2.0.2 application interface. The window title is "LC3Tools v2.0.2". The interface is divided into three main sections: Registers, Memory, and Console.

Registers:

Register	Value	Comment
R0	x036F	879
R1	x7FFF	32767
R2	x0000	0
R3	x0000	0
R4	x0000	0
R5	x0000	0
R6	x2FFE	12286
R7	x0000	0
PSR	x0002	2 CC: Z
PC	x0368	872
MCR	x0000	0

Memory:

Address	Value	Comment
x0366	x0008	57352 LEA R0, TRAP_HALT_MSG
x0367	x0022	61474 PUTS
x0368	x0004	40964 LDI R0, OS_MCR
x0369	x2294	8708 LD R1, MASK_HI
x036A	x0001	20481 AND R0, R0, R1
x036B	x0001	45057 STI R0, OS_MCR
x036C	x00F9	4009 BRnzp TRAP_HALT
x036D	x00FE	65534 OS_MCR .FILL x00FE
x036E	x7FFF	32767 MASK_HI .FILL x7FFF
x036F	x000A	10
x0370	x000A	10
x0371	x002D	45 -
x0372	x002D	45 -
x0373	x002D	45 -
x0374	x0020	32
x0375	x0048	72 H
x0376	x0061	97 a
x0377	x006C	108 i
x0378	x0074	116 t
x0379	x0069	105 i
x037A	x006E	110 n
x037B	x0067	103 g
x037C	x0020	32
x037D	x0074	116 t
x037E	x0068	104 h
x037F	x0065	101 e
x0380	x0020	32
x0381	x004C	76 L
x0382	x0043	67 C
x0383	x002D	45 -
x0384	x0033	51 3

Console (click to focus):

```
--- Halting the LC-3 ---  
  
--- Halting the LC-3 ---  
  
warning: 34354: Skipping 'Updating Keyboard' scheduled for 34350  
warning: 34354: Skipping 'Updating Display' scheduled for 34350  
warning: 34354: Skipping 'No interrupt of higher priority pending'  
scheduled for 34351  
!!jello world  
  
--- Halting the LC-3 ---  
  
--- Halting the LC-3 ---  
  
--- Halting the LC-3 ---  
  
0
```

At the bottom of the console, there is a "Jump To Location" field and navigation buttons: PC, ←, →, ↶, ↷.

2.

ApplicationEditView

LC3Tools v2.0.2

LC3Tools

<>⚙

Registers

R0	x300A	12298
R1	x0000	0
R2	x0000	0
R3	x0000	0
R4	x0000	0
R5	x0000	0
R6	x0000	0
R7	x0000	0
PSR	x0002	32770CC: Z
PC	x3002	12290
MCR	x0000	0

Console (click to focus)

```
warning: 132756: Skipping 'Updating Keyboard' scheduled for 132750
warning: 132756: Skipping 'Updating Display' scheduled for 132750
warning: 132756: Skipping 'No interrupt of higher priority
pending' scheduled for 132751
!!jello world

--- Privilege violation ---

--- Halting the LC-3 ---

warning: 152556: Skipping 'Updating Keyboard' scheduled for 152550
warning: 152556: Skipping 'Updating Display' scheduled for 152550
warning: 152556: Skipping 'No interrupt of higher priority
pending' scheduled for 152551
warning: 152572: Skipping 'Updating Keyboard' scheduled for 152570
warning: 152572: Skipping 'Updating Display' scheduled for 152570
warning: 152572: Skipping 'No interrupt of higher priority
pending' scheduled for 152571
!!jello world[]
```

Memory

▶ x3000	x0000	57353	lea r0, mymsg
▶ x3001	x0022	61474	trap x22
▶ x3002	x0025	61477	trap x25
▶ x3003	x0000	0	.blkw 7
▶ x3004	x0000	0	.blkw 7
▶ x3005	x0000	0	.blkw 7
▶ x3006	x0000	0	.blkw 7
▶ x3007	x0000	0	.blkw 7
▶ x3008	x0000	0	.blkw 7
▶ x3009	x0000	0	.blkw 7
▶ x300A	x0021	33	mysmsg .fill x21
▶ x300B	x0021	33	.fill x21
▶ x300C	x006A	106	j
▶ x300D	x0065	101	e
▶ x300E	x006C	108	l
▶ x300F	x006C	108	l
▶ x3010	x006F	111	o
▶ x3011	x0020	32	
▶ x3012	x0077	119	w
▶ x3013	x006F	111	o
▶ x3014	x0072	114	r
▶ x3015	x006C	108	l
▶ x3016	x0064	100	d
▶ x3017	x0000	0	.stringz "jello world"
▶ x3018	x0000	0	
▶ x3019	x0000	0	
▶ x301A	x0000	0	
▶ x301B	x0000	0	
▶ x301C	x0000	0	
▶ x301D	x0000	0	
▶ x301E	x0000	0	

x3000

PC<<>>

3.

LC3Tools v2.0.2

Application Edit View

LC3Tools

Registers

Register	Value	Comment
R0	x0000	0
R1	x7FFF	32767
R2	x0000	0
R3	x0000	0
R4	x0000	0
R5	x0000	0
R6	x2FFC	12284
R7	x0000	0
PSR	x0002	2 CC: Z
PC	x036C	876
MCR	x0000	0

Memory

Address	Value	Comment
x036C	x0FF9	4889 BRnzp TRAP_HALT
x036D	xFFFE	65534 OS_MCR .FILL xFFFE
x036E	x7FFF	32767 MASK_HI .FILL x7FFF
x036F	x000A	10
x0370	x000A	10
x0371	x002D	45
x0372	x002D	45
x0373	x002D	45
x0374	x0020	32
x0375	x0048	72 H
x0376	x0061	97 a
x0377	x006C	108 l
x0378	x0074	116 t
x0379	x0069	105 i
x037A	x000E	10 n
x037B	x0067	103 g
x037C	x0020	32
x037D	x0074	116 t
x037E	x0068	104 h
x037F	x0065	101 e
x0380	x0020	32
x0381	x004C	76 L
x0382	x0043	67 C
x0383	x002D	45
x0384	x0033	51 3
x0385	x0020	32
x0386	x002D	45
x0387	x002D	45
x0388	x002D	45
x0389	x000A	10
x038A	x000A	10

Console (click to focus)

```
warning: 132756: Skipping 'Updating Keyboard' scheduled for 132756
warning: 132756: Skipping 'Updating Display' scheduled for 132756
warning: 132756: Skipping 'No interrupt of higher priority
pending' scheduled for 132751
!!jello world

--- Privilege violation ---

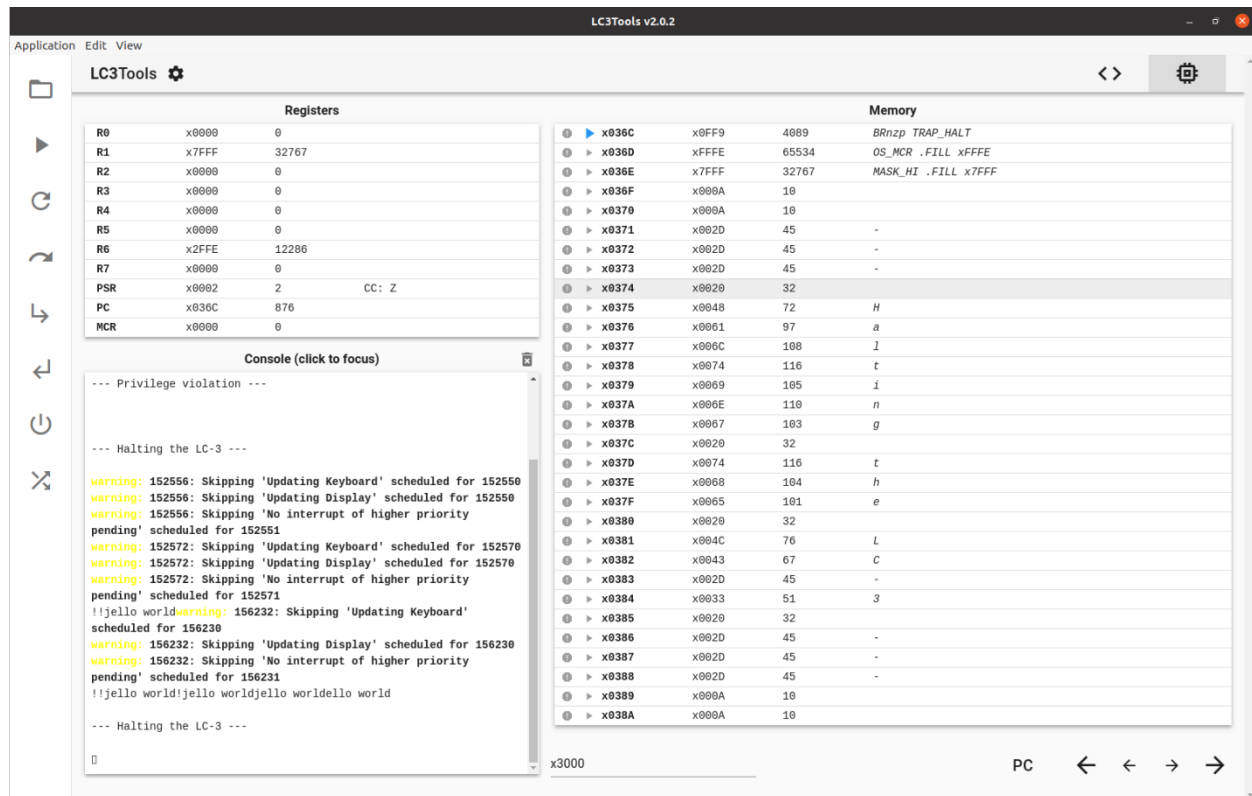
--- Halting the LC-3 ---

[]
```

PC x3000

← →

4.



the program starts off printing from the first location with the "!". we then dereference the contents of r0 storing into r2.

as long as the now contents of r2, are not divisible by 4 we keep incrementing r0 meaning every time we print we start from the next character

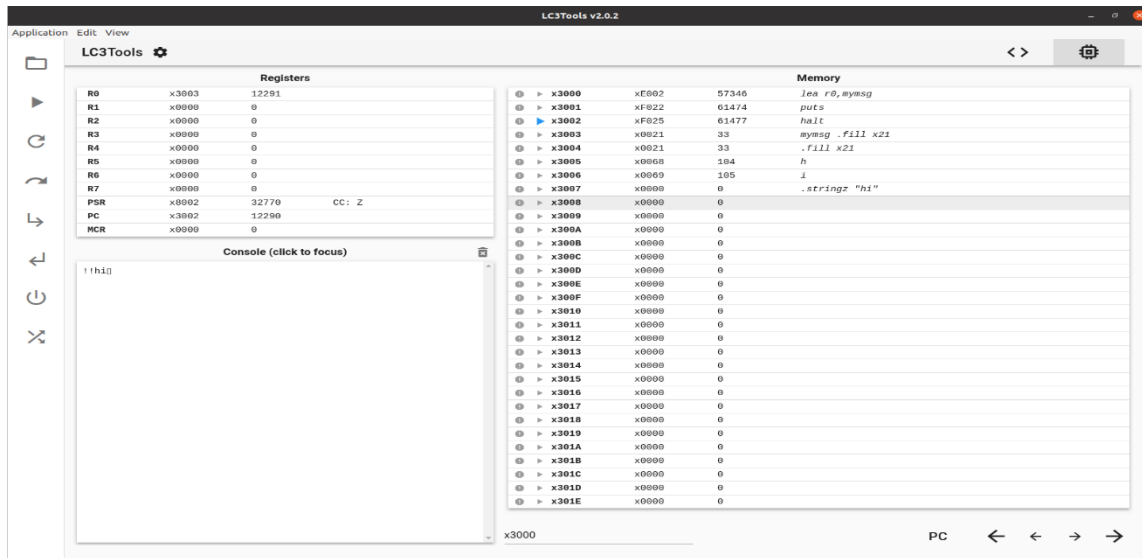
this program looped 4 times

5.

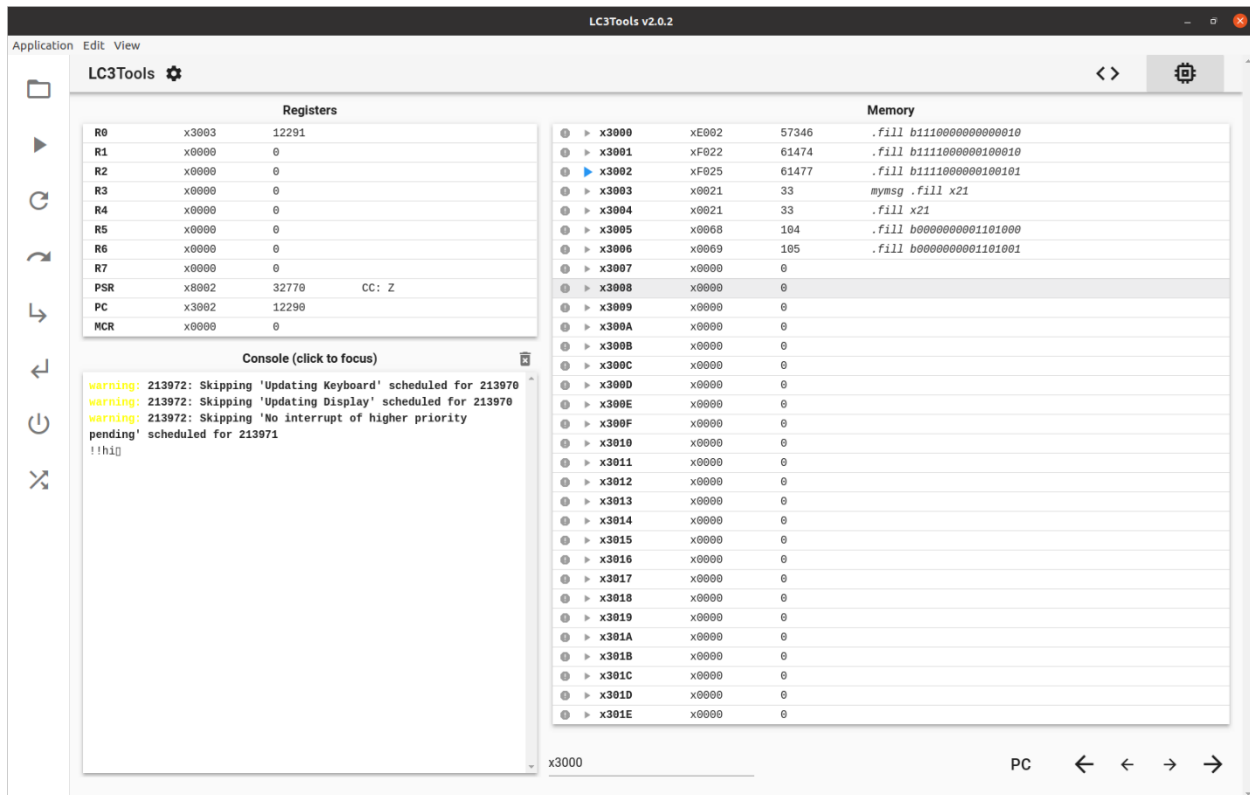
- lc3 translates each string into a binary version.
- it was designed in a way such that as long as there is a valid binary value
- even though it is not an instruction, we can simply ignore it or save it for later use

6.

Scr1



Binary version



8. scr1: shows contents of program 7 as expected

The screenshot shows the LC3Tools v2.0.2 interface. The Registers window displays the following values:

Register	Address	Value
R0	x0000	0
R1	x7FFF	32767
R2	xFFFF	65535
R3	x0000	0
R4	x8000	32768
R5	x0000	0
R6	x2FFC	12284
R7	x310A	12554
PSR	x0002	2
PC	x036C	876
MCR	x0000	0

The Memory window shows the following instructions:

Address	Hex	Value	Instruction
x3101	x2C1A	11290	ld r6,mem
x3102	x2A0B	10763	ld r5,count
x3103	x6380	25472	ldr r1,r6,0
x3104	xE00A	57354	lea r0,ad1
x3105	xF022	61474	puts
x3106	xE014	57364	loop1 lea r0,new1
x3107	xF022	61474	puts
x3108	x2E14	11796	ld r7,rsev
x3109	xC1C0	49600	jmp r7
x310A	x1DA1	7585	retu add r6,r6,#1
x310B	x6380	25472	ldr r1,r6,0
x310C	x1B7F	7039	add r5,r5,#-1
x310D	x03F8	1016	brp loop1
x310E	x0200	512	count .fill b0000001000000000
x310F	x002E	46	.
x3110	x006F	111	o
x3111	x0072	114	r
x3112	x0069	105	i
x3113	x0067	103	g

The Console window shows the following output:

```
priority pending! scheduled for 8030271
.orig x3000
[] .Fill b11110000000100010
[] .Fill b00100100000011001
[] .Fill b00101000000011010
[] .Fill b01010110010001000
[] .Fill b00001010000000111
[] .Fill b11100000000011010
[] .Fill b11110000000100010
[] .Fill b00010010010000001
[] .Fill b00010100101111111
```

Scr2: middle part has some values that are not 0 (garbage)

The screenshot shows the LC3Tools v2.0.2 interface. The Registers window displays the following values:

Register	Address	Value
R0	x0000	0
R1	x7FFF	32767
R2	xFFFF	65535
R3	x0000	0
R4	x8000	32768
R5	x0000	0
R6	x2FFC	12284
R7	x310A	12554
PSR	x0002	2
PC	x036C	876
MCR	x0000	0

The Memory window shows the following instructions:

Address	Hex	Value	Instruction
x3101	x2C1A	11290	ld r6,mem
x3102	x2A0B	10763	ld r5,count
x3103	x6380	25472	ldr r1,r6,0
x3104	xE00A	57354	lea r0,ad1
x3105	xF022	61474	puts
x3106	xE014	57364	loop1 lea r0,new1
x3107	xF022	61474	puts
x3108	x2E14	11796	ld r7,rsev
x3109	xC1C0	49600	jmp r7
x310A	x1DA1	7585	retu add r6,r6,#1
x310B	x6380	25472	ldr r1,r6,0
x310C	x1B7F	7039	add r5,r5,#-1
x310D	x03F8	1016	brp loop1
x310E	x0200	512	count .fill b0000001000000000
x310F	x002E	46	.
x3110	x006F	111	o
x3111	x0072	114	r
x3112	x0069	105	i
x3113	x0067	103	g

The Console window shows the following output:

```
[] .Fill b00000000000000000
[] .Fill b00000000000000000
[] .Fill b00101100000011010
[] .Fill b00101010000001011
[] .Fill b01100011100000000
[] .Fill b11100000000001010
[] .Fill b11110000000100010
[] .Fill b111000000000010100
[] .Fill b11100000000100010
[] .Fill b00101110000010100
[] .Fill b11000001110000000
```

End of the 256 lines.

- For some reason my laptop has access violation at the end however I did not have that in the lab.

