

Homework 3: Answers

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Problem: Some registers and memory cells in a microcontroller are initialized as shown. The following code is executed:

```
1 mov r2, #20
2 ldr r3, [r0, #4]
3 add r1, r3
4 ldr r3, [r0, #-4]!
5 add r2, r3
6 str r2, [r0], #8
```

What are the contents of the registers and memory after this code is executed?

r0	0x0000 10F4
r1	0x0000 000E
r2	0x0000 0000
r3	0x0000 0000

0x0000 10FC	0x0000 369C
0x0000 10F8	0x0000 2468
0x0000 10F4	0x0000 D00D
0x0000 10F0	0x0000 1111

Solution: Trace the code line-by-line.

1. Register **r2** now holds the value $(20)_{10} = 0x14$.
2. Register **r3** holds the contents of memory address $r0 + \#4 = 0x10F8$, so **r3** contains $0x2468$.
3. The values in registers **r1** and **r3** are added together and stored in **r1**. $0xE + 0x2468 = 0x2476$.
4. The value in memory address $r0 + \#-4 = 0x10F0$ (which is $0x1111$), is stored in register **r3**. The address in **r0** is updated. Therefore, **r0** holds $0x10F0$, and **r3** contains $0x1111$.
5. The values in registers **r2** and **r3** are added together and stored in **r2**. $0x14 + 0x1111 = 0x1125$.
6. The contents of **r2** are stored at the memory address held in **r0**. After this line executes, the address held in **r0** is updated by $\#8$. So memory cell $0x10F0$ now holds the value $0x1125$, and **r0** now contains $0x10F8$.

r0	0x0000 10F8	0x0000 10FC	0x0000 369C
r1	0x0000 2476	0x0000 10F8	0x0000 2468
r1	0x0000 1125	0x0000 10F4	0x0000 D00D
r1	0x0000 1111	0x0000 10F0	0x0000 1125