ICS Homework 3

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2023 年 10 月 27 日

T1

from -16384 to 16383

T2

X	Does the program halt?	Value stored in R0
000000010	Yes	2
000000001	Yes	3
000000000	Yes	6
111111111	No	-
111111110	No	-

T3

The result of adding the values of R1 and R2 is not positive.

T4

1. No. Operate instructions are mainly about arithmetic operations and won't be affected by reduced registers.

2. Yes. The reduced number of registers could lead to a more efficient use of the available registers.

3. No.

T5

Data in memory cells:

1	0	1
0	1	1
0	1	0
1	1	0

$$D_{out}[2:0] = 1\ 1\ 0$$

T6

T7

1. 2×10^8

2. 2.5×10^7

3. 2×10^8

T8

Address	Instruction
x3000	1001 111 001 111111
x3001	1001 001 101 111111
x3002	0101 101 111 000 010
x3003	0101 100 110 000 001
x3004	1001 001 101 111111
x3005	1001 010 100 111111
x3006	0101 000 001 000 010
x3007	1001 011 000 111111

T9

1. Add the value of R1 and 00010 (sign-extended to 16 bits) then store the result in R2.

2. Simply increment the PC under any condition. This instruction could be used for NOP.

3. Execute the instruction of incremented PC plus 4 if the result is non-zero, otherwise execute the instruction of incremented PC.

4. Bit-wise complement the value of R7 and store the result in R2.

5. Input a character from the keyboard.

T10

When we use the BR instruction, the offset is a 9-bit number, so the range of offset is from -256 to 255. If the instruction we want to jump is too far away, the offset will be out of range. But the JMP instruction jumps to the address stored in the register. Since the address is a 16-bit number, it can jump to any address.