

6	5	5	16
opcode	rs	rt	immediate

- New branched address =  
PC + 4 + immediate<<2

What machine code will be instruction E translated to?

Note: the PC value when executing E is 0x0000 0100

Label1 -> 0x0000 010C  
0x0000 0108  
0x0000 0104  
0x0000 0100  
0x0000 00FC  
0x0000 00F8  
0x0000 00F4  
0x0000 00F0

Inst. H
Inst. G
Inst. F
Inst. E = beq \$t1, \$t2, label1
Inst. D
Inst. C
Inst. B
Inst. A

Note2: the 'PC value' here is defined as the address of currently executing instruction.

In the lectures on CPU design, you will get a better understanding why we always use PC + 4.

For now, just take it (PC + 4 + immediate<<2) as is.

Note3: the branch series instructions jump based on the current PC value. The word range of jump is determined by the 'immd' field, which is a 2's C number in  $[-2^{15}, 2^{15}-1]$

Note 4: to work out the immediate value for beq \$t1, \$t2, label1, firstly note the distance between The 'beq' instruction and the branch target: 0x010C-0x0100 = 0xC = 12. So, 4 + immd << 2 = 12. Then we have 'immd' = 2. Thus, the machine code for beq \$t1, \$t2, label1 is 0x1149 0002