

CS M151B Winter 2015 Homework 2 Solutions

1. PH 2.24.

Not possible for either. The jump instruction has a 26-bit address field that is multiplied by 4 to get a byte address, for a total of 28 bits. The lowest 28 bits of the PC are then set to these 28 bits. To jump from 0x20000000 to 0x40000000, though, you would need to change bits 29 and 30. The beq has a 16 bit immediate field and sets $PC = PC + 4 + (imm * 4)$ when the two registers are equal; this gives it a jump range of about $\pm 2^{17}$ byte addresses.

2. PH 2.26.1.

20. The code will add 2 to \$s2 ten times, at which point \$t1 will be zero, so the slt will fail (and set \$t2 to 0), and then the beq will branch to DONE.

3. PH 2.26.3.

$5*N+2$ (assuming $0 \leq N < 2^{31}$). All five instructions will be executed N times, at which point \$t1 will be zero. Then the slt and beq are each executed once more to exit the loop.

4. PH 2.46.1.

Cycles before: $500M*1 + 300M*10 + 100M*3 = 3800M$

Cycles after: $375M*1 + 300M*10 + 100M*3 = 3675M$

Time before: $(\text{cycles before}) / (\text{clock rate before}) = 3800M / \text{rate}$

Time after: $(\text{cycles after}) / (\text{clock rate after}) = 3675M / (\text{rate}/1.1) = 4042.5M / \text{rate}$

Based (only) on the performance of this program before and after the change, adding the new instructions would not be a good design choice.