CS M151B HW2

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1   2.24

(1)
No it can not be possible to use jump instruction. Because jump uses pseudo direct addressing. It encodes the 28 lower bits of address into 26 bits and uses the 4 upper bits of pc to make up the target address. But in this case, the 4 upper bits are different in PC and the target address, so it cannot be encoded into 26 bits and be used as jump target address.

(2)
No because beq uses branch addressing, so it adds the offset of maximum 16bits times 4 and add it to the current pc address. But in this case the target address is 0x20000000 away from current pc address, so it cannot be encoded into 16 bits and used as a branch address.

2   2.26.1

20
$S2 will be 20 as for every loop $S2 is increased by 2. $S1$ is 10 and decreases by 1 every loop, so there are 10 iterations of the loop for $S1$ to be equal to 0.

3   2.26.3

5N+2
When $N \leq 0$, there are 2 instructions executed(slt and beq) as pc will branch to DONE. When $N > 0$, 5 instructions are executed every iteration of the loop. There are N iterations in total before N=0 as N is deducted by 1 every iteration. So there are 5N+2 instructions executed.

4   2.46.1

Before there are in total 500*1 + 300*10 + 100*3 = 3800 million cycles.
After the addition, there are in total 500*0.75*1 + 300*10 + 100*3 = 3675 million cycles.
Let the original cycle time be t, the execution time before is $3.8 * 10^9$t.

The new cycle is 10% longer than previous cycle, it is 1.1t. So the new execution tme is 3675million*1.1t $= 4.0425*10^9$t.
So it is not a good choice as the execution time increases than before.