2.24

The jump and branch use PC-relative addressing. In the case of jump, the J type instruction format produces 26 bits address, this address is shift to left by 2, and then concatenated with the first four bits provided by PC+4. Given that PC is set to 0x2000 0000, the first four bits of PC+4 will be 0010. Thus, it is impossible to reach 0x4000 0000, which has 0100 as the first four bits. In the case of branch, the address value is 16 bits, shifted to the left and become 18 bits, and then sign extended to 32 bits. This value is then added with PC+4 to get the destination address. However, this sign extended value is in the range [-2^17, 2^17-1], and thus cannot make up for the difference between 0x 2000 0000 and 0x 4000 0000, which is 2^29.

2.26.1

The program will exit when t1 reaches 0. T1 reduces by 1 in each execution of the loop. S2 increases by 2 in each execution of the loop. Thus if t1 starts with 10, the loop will be executed 10 times, and s2 will be 2*10=20.

2.26.3

Each complete loop executes 5 instructions. In the last loop in which the program exits, only the first two executions get executed. If t1 is initialized with N, N complete loop will be executed. So the total number of instructions will be 5*N+2=5N+2.

2.46.1

CPU time= instruction count * CPI *clock cycle time

For old instruction set, CPU time= (500*10^6*1 + 300*10^6*10+ 100*10^6*3) * clock cycle time

For new instruction set, CPU time= (0.75* 500*10^6*1 + 300*10^6*10+ 100*10^6*3) * 1.1 * clock cycle time

So old CPU time= 3.8*10^9 *clock cycle time

new CPU time= 4.0425 *10^9 *clock cycle time

since old CPU time > new CPU time, this is not a good design choice.