Colin Fitzsimons

a.

daddi r1, r0, 24
;RAW STALL
loop:

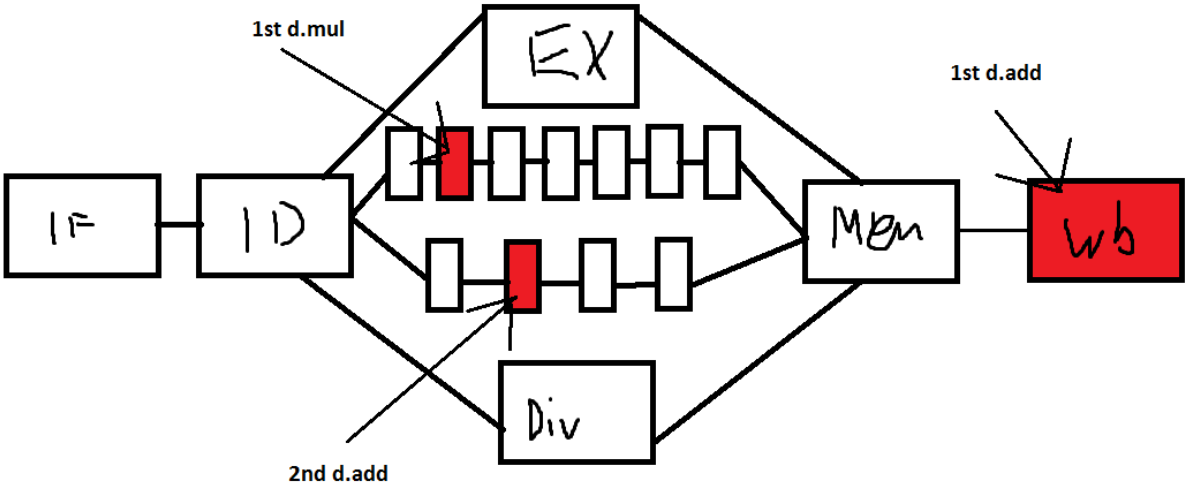
ld r2, nums (r1)
;RAW STALL
dsrl r2, r2, 1

daddi r1, r1, -8
;RAW STALL
bnez r1, loop
;BRANCH TAKEN STALL

So the number of stalls in an execution = (No. of iterations of loop* 3) -1 + 1 = 9

b.

There is one RAW stall in the program between the first and second instruction. Because of this the program must wait until the first addition has been completed before proceeding with the multiplication and the addition. Diagram below shows the first add.d just before it leaves the pipeline and how it has affected the other instructions.



Once all instructions have fully cleared the pipeline we should have passed 14 cycles.