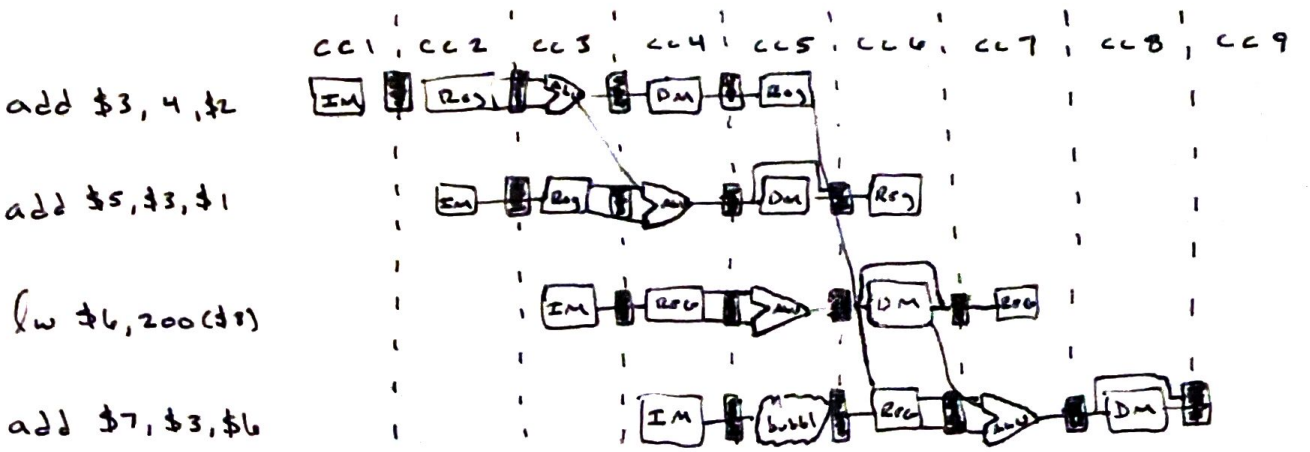
4)

a) add $3, $4, $2 and sub $5, $3, $1 [forwarding]
add $, $4, $2 and lw $6, 200($5) [forwarding]
lw $6, 200($3) and add $7, $3, $6 [stall 1, forwarding]
add $3, $4, $2 and add $7, $3, $6 [from registers]




b)

1) Only 1 bubble will be between LW and ADD with forwarding. There is no bubble between Add & LW
=> 3 cycles => 1 to complete LW + 1 bubble + 1 add
3 cycles to complete 2 instructions
= CPI = 3/2 = 1.5

2) The value in the register can be used only without forwarding, so that there are 2 cycles of bubbles between LW and other dependent ADD. Similarly, between ADD and dependent LW, we have 2 more bubbles
Total 6 cycles => 1 add + 2 bubbles + 1 ADD + 2 bubbles
To complete 2 instructions it takes 6 cycles
CPI = 6/2 = 3