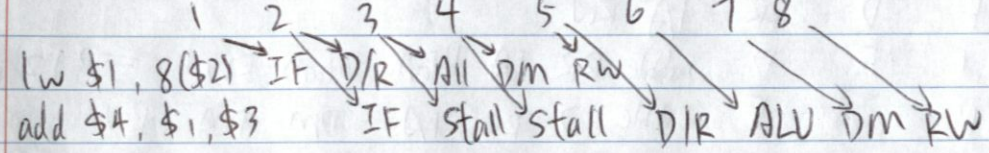
Yingjie Lian
U10587784

CS3810 Assignment 08

Question 1:

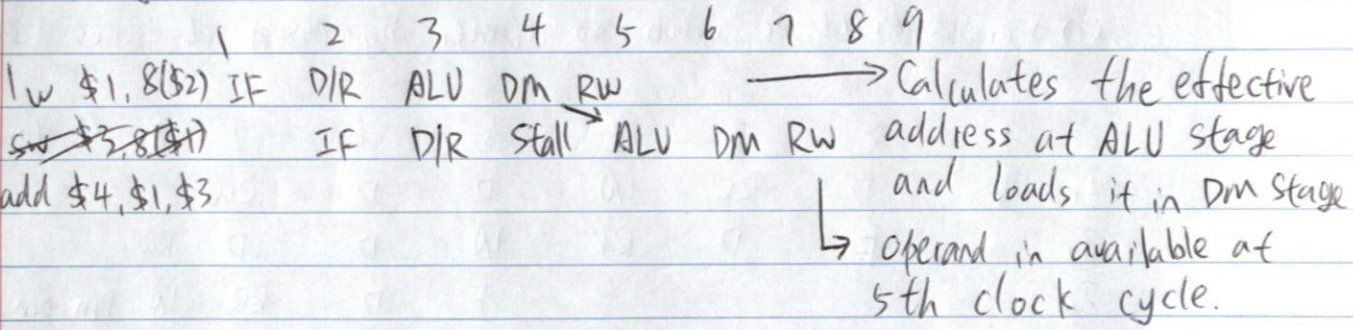
1. lw $1, 8($2)
   add $4, $1, $3

without forwarding



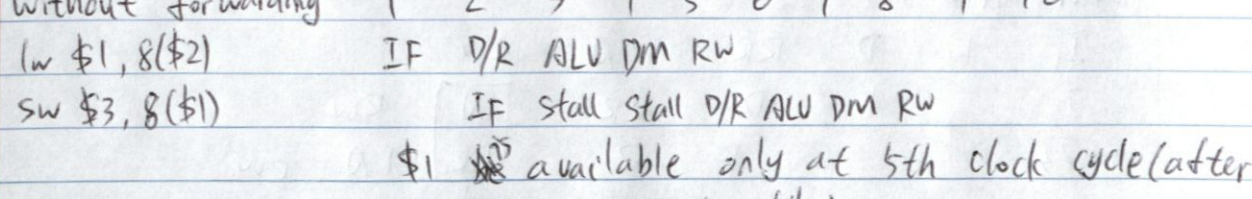
Operands ($1, $3) all available only at the end of first half of RW stage.

with forwarding

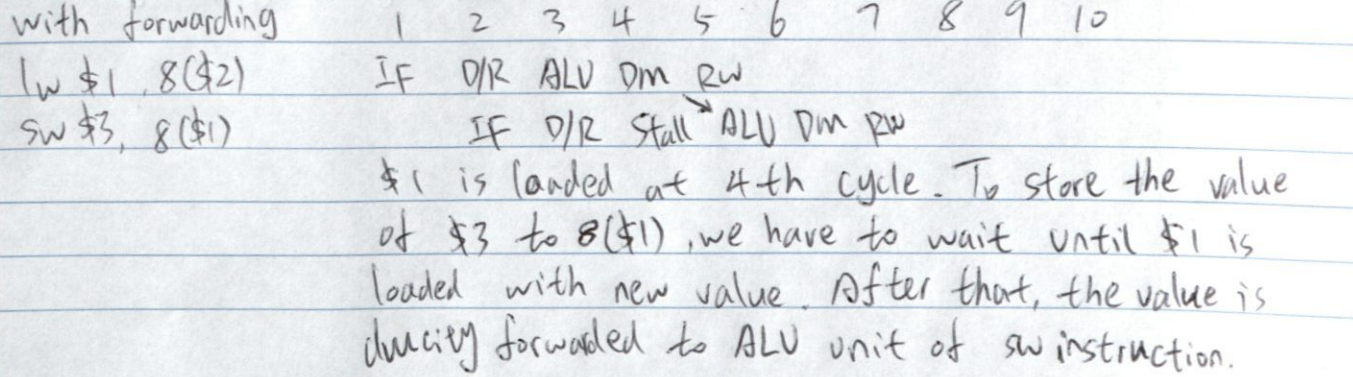


2. lw $1, 8($2)
   sw $3, 8($1)

without forwarding



with forwarding



Question 2:

	1	2	3	4	5	6	7	8	9	10	11	12
I_1	F	D	RR	IA	RW							
I_2		F	D	RR	IA	RW						
I_3	Stall	F	D	Bubble	RR	IA	Datam	Datam	RW			
I_4	Stall		F	Bubble	D	RR	IA	Dm	Dm	RW		
I_5					F	D	RR	IA	Dm	Dm	RW	

$\Rightarrow$ 12 cycles

The ~~overfore~~ overall process takes 12 cycles to complete

i) For a processor with register by passing, it takes 5 success time instructions

ii) For a processor with no register by passing, it takes 12 inst.

	1	2	3	4	5	6	7	8	9	10	11	12
I_1	F	D	RR	IA	D	D	RW					
I_2		F	D	RR	IA	D	D	RW				
I_3					F	D	RR	IA	Dm	Dm	RW	
I_4						F	D	RR	IA	Dm	Dm	RW
I_5							F	D	RR	IA	Dm	Dm

For prob i:

I_1	F	D	RR	IA	RW		
I_2		F	D	RR	IA	RW	
I_3			F	D	RR	IA	RW

↓ No Register by passing

Question 3:

① As branch conseqvence is determined in ~~the~~ 4th stage, so we can get:

~~AVGA~~ AVG CPI = 20% · 4 + 80% · 1
= 1.6

② If a branch is taken, then instruction in the phases previously the ~~3rd~~ 4th stage are squashed. Then we can get:

AVG CPI = 20% · 75% · 4 + 80% · 1 + 20% · 25% · 1
= 1.45

③ Since it is fetched, so 1 clock cycle is compulsory for branches

AVG CPI = 20% · 1 + 80% · 1
= 1

④ As hardware analyst makes precise prediction for 90% of division, 1 cl cycle is compulsory when correct calculation is made and 4 clock cycl are essential for incorrect calculation.

AVG CPI = 20% · 90% · 1 + 20% · 10% · 4 + 80% · 1
= 1.06