

Problem 2 in: <http://www.cs.utah.edu/~gregor/cs6310/pres15-6810-12.pdf>  
(Slide No. 20)

Time when							Time when										
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time				The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time		
LD	R1	←	[R2]	3	n/a	abcd			LD	R1	←	[R2]	3	n/a	abcd	4	5
LD	R3	←	[R4]	6	n/a	abde			LD	R3	←	[R4]	6	n/a	abde	7	8
ST	R5	→	[R6]	4	7	abba			ST	R5	→	[R6]	4	7	abba	5	commit
LD	R7	←	[R8]	2	n/a	abce			LD	R7	←	[R8]	2	n/a	abce	3	6
ST	R9	→	[R10]	8	3	abba			ST	R9	→	[R10]	8	3	abba	9	commit
LD	R11	←	[R12]	1	n/a	abba			LD	R11	←	[R12]	1	n/a	abba	2	10

**1**

Time when							
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time
LD	R1	←	[R2]	n/a			
LD	R3	←	[R4]	n/a			
ST	R5	→	[R6]				
LD	R7	←	[R8]	n/a			
ST	R9	→	[R10]				
LD	R11	←	[R12]	1	n/a		

**2**

Time when							
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time
LD	R1	←	[R2]	n/a			
LD	R3	←	[R4]	n/a			
ST	R5	→	[R6]				
LD	R7	←	[R8]	2	n/a		
ST	R9	→	[R10]				
LD	R11	←	[R12]	1	n/a	abba	2

**3**

Time when							
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time
LD	R1	←	[R2]	3	n/a		
LD	R3	←	[R4]	n/a			
ST	R5	→	[R6]				
LD	R7	←	[R8]	2	n/a	abce	3
ST	R9	→	[R10]		3		
LD	R11	←	[R12]	1	n/a	abba	2

can't issue this due to previous unknown store

**4**

Time when							
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time
LD	R1	←	[R2]	3	n/a	abcd	4
LD	R3	←	[R4]	n/a			
ST	R5	→	[R6]	4			
LD	R7	←	[R8]	2	n/a	abce	3
ST	R9	→	[R10]		3		
LD	R11	←	[R12]	1	n/a	abba	2

can't issue this due to previous store

**5**

Time when								
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time	
LD	R1	←	[R2]	3	n/a	abcd	4	5
LD	R3	←	[R4]	n/a				Issue!
ST	R5	→	[R6]	4		abba	5	
LD	R7	←	[R8]	2	n/a	abce	3	can't issue this due to previous store (we just calculated the address of the previous store), so we can't proceed yet!
ST	R9	→	[R10]		3			
LD	R11	←	[R12]	1	n/a	abba	2	can't issue this due to previous store

**6**

Time when								
			The register for the address calculation is made available	The register that must be stored into memory is made available	The calculated effective address	Address Calculation Time	Data Access Time	
LD	R1	←	[R2]	3	n/a	abcd	4	5
LD	R3	←	[R4]	6	n/a			Issue!
ST	R5	→	[R6]	4		abba	5	
LD	R7	←	[R8]	2	n/a	abce	3	6
ST	R9	→	[R10]		3			
LD	R11	←	[R12]	1	n/a	abba	2	can't issue this due to previous store (no mem bypassing allowed)

