If we can make (W)rite operation when clock goes low-to-high and (R)ead operation when clock goes high-to-low;

a)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
LD 0(R5), R1	FR	EX	MW													**R1 <- M[R5]**
LD 0(R6), R2		FR	EX	MW												**R2 <- M[R6]**
LD 0(R7), R3			FR	EX	MW											**R3 <- M[R7]**
NOP				FR	EX	MW										
ADD R3, R2, R3					FR	EX	MW									**R3 <- R3 + R2**
NOP						FR	EX	MW								
SUB R3, R1, R3							FR	EX	MW							**R3 <- R3 - R1**
BNZ EX								FR	EX	MW						
NOP									FR	EX	MW					
NEG R3										FR	EX	MW				**NEGATE R3**
NOP											FR	EX	MW			
ADD R3, R2, R2												FR	EX	MW		**R2 <- R3 + R2**

Total amount of penalty = 4

b) Since all opretions including branch operation are dependent with each other, it is not possible to change the order of most of the operations.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
LD 0(R6), R2	FR	EX	MW														**R2 <- M[R6]**
LD 0(R7), R3		FR	EX	MW													**R3 <- M[R7]**
LD 0(R5), R1			FR	EX	MW												**R1 <- M[R5]**
ADD R3, R2, R3				FR	EX	MW											**R3 <- R3 + R2**
NOP					FR	EX	MW										
SUB R3, R1, R3						FR	EX	MW									**R3 <- R3 - R1**
BNZ EX							FR	EX	MW								
NOP								FR	EX	MW							
NEG R3									FR	EX	MW						**NEGATE R3**
NOP										FR	EX	MW					
ADD R3, R2, R2											FR	EX	MW				**R2 <- R3 + R2**

Total amount of penalty = 3

Otherwise;

a)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
LD 0(R5), R1	FR	EX	MW															**R1 <- M[R5]**
LD 0(R6), R2		FR	EX	MW														**R2 <- M[R6]**
LD 0(R7), R3			FR	EX	MW													**R3 <- M[R7]**
NOP				FR	EX	MW												
NOP					FR	EX	MW											
ADD R3, R2, R3						FR	EX	MW										**R3 <- R3 + R2**
NOP							FR	EX	MW									
NOP								FR	EX	MW								
SUB R3, R1, R3									FR	EX	MW							**R3 <- R3 - R1**
BNZ EX										FR	EX	MW						
NOP											FR	EX	MW					
NEG R3												FR	EX	MW				**NEGATE R3**
NOP													FR	EX	MW			
NOP														FR	EX	MW		
ADD R3, R2, R2															FR	EX	MW	**R2 <- R3 + R2**

Total amount of penalty: 7

b)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
LD 0(R6), R2	FR	EX	MW														**R2 <- M[R6]**
LD 0(R7), R3		FR	EX	MW													**R3 <- M[R7]**
LD 0(R5), R1			FR	EX	MW												**R1 <- M[R5]**
NOP				FR	EX	MW											
ADD R3, R2, R3					FR	EX	MW										**R3 <- R3 + R2**
NOP						FR	EX	MW									
NOP							FR	EX	MW								
SUB R3, R1, R3								FR	EX	MW							**R3 <- R3 - R1**
BNZ EX									FR	EX	MW						
NOP										FR	EX	MW					
NEG R3											FR	EX	MW				**NEGATE R3**
NOP												FR	EX	MW			
NOP													FR	EX	MW		
ADD R3, R2, R2														FR	EX	MW	**R2 <- R3 + R2**

Total amount of penalty: 6