

**Quiz 2**  
**CSE/ECE 511 Computer Architecture**

---

**Q1**

Branches - Pipeline A only

Memory - Pipeline B only

a) No bypassing

In st. No .	Pipe line	Instructions	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	A	MUL R1 R2 R3	F	D	A0	A1	W														
2	B	ADD R4 R5 R6	F	D	B0	B1	W														
3	A	ADD R7 R4 R8		F	D	D	D	D	A0	A1	W										
4	B	SUB R9 R10 R11		F	D	B0	B1	W	W	W	W										
5	B	LD R12 0(R1)			F	D	D	D	B0	B1	B1	W									
6	B	LD R13 0(R2)			F	F	F	F	D	B0	B0	B1	W								
7	A	SUB R3 R4 R5							F	D	A0	A1	W								
8	B	ADD R13 R3 R6							F	D	D	D	D	D	A0	A1	W				
9	B	LD R7 0(R1)								F	D	B0	B1	W	W	W	W				
10	A	MUL R14 R15 R7								F	F	D	D	D	D	D	D	D	A0	A1	W

Cycle count : 19

Instruction 1 = 0.5

Instruction 2 to Instruction 10 = 9 \* 1.5 = 13.5 marks

1 mark for cycle count

b)Full Bypassing

Inst No.	Pipeline	Instructions	0	1	2	3	4	5	6	7	8	9	10	11
1	A	MUL R1 R2 R3	F	D	A0	A1	W							
2	B	ADD R4 R5 R6	F	D	B0	B1	W							
3	A	ADD R7 R4 R8		F	D	A0	A1	W						
4	B	SUB R9 R10 R11		F	D	B0	B1	W						
5	B	LD R12 0(R1)			F	D	B0	B1	W					
6	B	LD R13 0(R2)			F	D	D	B0	B1	W				
7	A	SUB R3 R4 R5				F	D	A0	A1	W				
8	B	ADD R13 R3 R6				F	F	D	B0	B1	W			
9	B	LD R7 0(R1)						F	D	B0	B1	W		
10	A	MUL R14 R15 R7						F	D	D	D	A0	A1	W

**Cycle count = 12**

Instruction 1 = 0.5

Instruction 2 to Instruction 10 = 9 \* 1.5 = 13.5 marks

1 mark for cycle count