National University of Computer and Emerging Sciences, Lahore Campus

	Course:	**Computer Architecture**	**Course Code:**	**EE204**
	Program :	**BS(Computer Science)**	**Semester :**	**Fall 2018**
	Due Date:	**27-11-2018**	**Total Marks:**	**10**
	Section:	**C**	**Weight**	**4**
	Exam:	**Quiz 3**	**Page(s):**	**1**

Question 1:

(10 marks)

Imagine the multi-cycle diagram for a single-issue processor. As can be seen, the current program takes around 12 cycles to finish execution.

	1	2	3	4	5	6	7	8	9	10	11	12
lw R2, 0(R1)	F	D	X	M	W							
lw R3, 4(R1)		F	D	X	M	W						
lw R4, 8(R1)			F	D	X	M	W					
lw R5, 12(R1)				F	D	X	M	W				
add R6, R2, R3					F	D	X	M	W			
add R7, R4, R6						F	D	X	M	W		
add R8, R5, R7							F	D	X	M	W	
lw R9, 0(R8)								F	D	X	M	W

Now imagine a dual-issue static scheduling pipeline. Draw the multi-cycle diagram below. You are only required to write F, D, X, M, W and * (for stalls) for each instruction. Note that this processor cannot re-order instructions and is capable of issuing two instructions per cycle. Hazards are resolved by introducing stalls like our traditional MIPS processor. (8 marks)

	1	2	3	4	5	6	7	8	9	10	11	12
lw R2, 0(R1)												

lw R3, 4(R1)												
lw R4, 8(R1)												
lw R5, 12(R1)												
add R6, R2, R3												
add R7, R4, R6												
add R8, R5, R7												
lw R9, 0(R8)												

How many total cycles are required (2 marks):

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