National University of Computer and Emerging Sciences, Lahore Campus

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Student: Name:	 Roll No
Section:	

Question 1a [15]

Consider the following MIPS assembly language loop. Assume that we run this code on the five stages pipelined data path.

Instruction Lw r1, r3,0

1:

Instruction Lw r3, r3,40

2:

Instruction Sub r2,r1,r3

3:

Instruction Lw r4,r1, 30

4:

Instruction Lw r6,r4,100

5:

Instruction St r4, r2,15

6:

Instruction OR r5,r5,r7

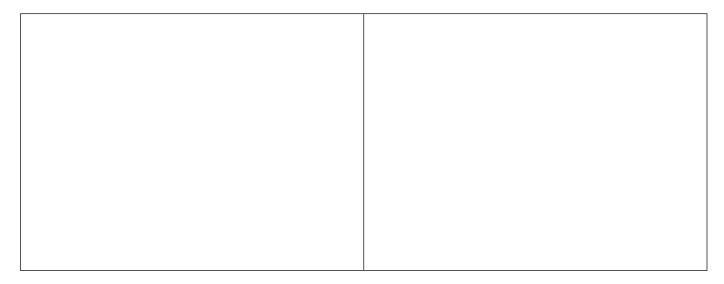
7:

a) Find all possible hazards in the above code. Fill the following table by writing lines and register in front of particular hazard. For example if a **WAR** hazard exist between instruction 1 and 2 due to register R0 then write **1 & 2** in column "Lines" and Register number **R0** in column "Register".

Without Forwarding				With Forwarding		
Hazard	Lines	Register	Hazard	Lines	Register	
WAR						
WAW						
RAW						

b) Add stalls in the above code to remove all hazards

Without Forwarding	With Forwarding	



c) Reschedule the code to remove as many stalls as possible with forwarding. How many stalls are still required?

Question 2 [5]

Assume that registers r1, r2, r3 and r4 contain the values 20, 30, 40, 50 respectively. Moreover memory contains the following values at mentioned addresses

Address	Value
40	150
44	250
48	350
52	450
56	550

Write the value of r3 and r2 after execution of each line of following code. No forwarding is implemented

Add r3, r3, - 20 Add r3, r3, r1 Load r2, r3, 8