

# **16.482 / 16.561: Computer Architecture and Design**

Spring 2014

## Lecture 6: Key Questions March 6, 2014

1. What do we mean by “speculation?”
2. Why must we separate instruction completion from instruction commit in a processor that allows speculative execution?
3. What is a reorder buffer (ROB), and what is its purpose?
4. Describe the fields in each ROB entry.

5. Describe the differences in Tomasulo's Algorithm when speculation is added.

**Example:** Follow the execution of the code below through all cycles, showing the appropriate state for each piece of hardware in Tomasulo’s Algorithm with speculation. Fill in the tables provided. Assume 2 cycle latency (1 EX, 1 MEM) for loads/stores, 6 cycles for multiply, 2 cycles for integer addition, and 1 cycle for the branch.

Cycle	1	2	3																	
L.D F0,0(R1)	IF	IS	EX																	
MUL.D F4,F0,F2		IF	IS																	
S.D F4,0(R1)			IF																	
DADDIU R1,R1,#-8																				
BNE R1,R2,Loop																				
L.D F0,0(R1)																				
MUL.D F4,F0,F2																				
S.D F4,0(R1)																				
DADDIU R1,R1,#-8																				
BNE R1,R2,Loop																				

6. How does the reorder buffer help us avoid memory hazards?

7. How do we handle exceptions in a speculative machine?