

CS/COE0447

Computer Organization & Assembly Language

**Chapter 5 Part 3
In-Class Exercises**

For Reference

- The following slides contain a subset of Chapter 5 Part 3 – the essentials, without the animations, discussion, and so on.
- You will get a copy of Figure 5.28 on Exam3 and the Final
- Rather than trying to memorize the other slides, try to reconstruct them while looking at Figure 5.28 and thinking about how the instructions are executed

Multi-Cycle Execution: R-type

- Instruction fetch
 - $IR \leftarrow \text{Memory}[PC]$; `sub $t0,$t1,$t2`
 - $PC \leftarrow PC + 4$;
- Decode instruction/register read
 - $A \leftarrow \text{Reg}[IR[25:21]]$; `rs`
 - $B \leftarrow \text{Reg}[IR[20:16]]$; `rt`
 - $\text{ALUOut} \leftarrow PC + (\text{sign-extend}(IR[15:0]) \ll 2)$;
- Execution
 - $\text{ALUOut} \leftarrow A \text{ op } B$; `op = add, sub, and, or, ...`
- Completion
 - $\text{Reg}[IR[15:11]] \leftarrow \text{ALUOut}$; `$t0 \leftarrow ALU result`