Pipelining (III)

Hazards

- Pipelining can improve the throughput then speed up the instruction execution. However, there are some situations that prevent the next instruction from starting in the next cycle. We call these situations “hazards.”
- Hazards can generally be grouped into three types: structural hazards, data hazards, and control hazards.

Structural Hazards

- Structural hazards occur when a required resource is busy. For example, in dirty laundry example, if the load B starts using the washer once the load A is done with washing, the dryer is still drying the load A and is unavailable to the load B when it is done with washing.
- To address the structural hazards, more stages are usually helpful. More stages need more control hardware, but it also lowers the bound on cycle time of each stage. Modern CPU divides the four stages we discussed above into even smaller steps, so the time spent on each stage will be more balanced.
- Another way to address the structural hazards is waiting. Wait till the required resource becomes available. Actually, all hazards can be resolved by waiting. We call the waiting “stall.”