CLC Reservation Table Analyzer

In this exercise, we examine how data dependences affect execution in the

Basic 5-Stage Pipeline. Problems in this exercise refer to the following sequence of instructions:

1. Add R1,R2,R3
2. Sub R2,R1,R4
3. Add R1,R1,R2

William Stallings Link for Simulating the Programs: [CPU Cycles Program Run Simulation](http://www.ecs.umass.edu/ece/koren/architecture/windlx/main.html)

Also, assume the following cycle times for each of the options related to forwarding:

| Without Forwarding | With Forwarding |
| --- | --- |
| 250 ps | 300 ps |

1. Indicate Dependencies, and their Type (RAW, WAR, RAR, WAW)

| Dependency Type | Register in Conflict | Instr. Nos. Involved |
| --- | --- | --- |
| No Forwarding: RAW  Data Forwarding: None | No Forwarding: R1, R2  Data Forwarding: None | No Forwarding: 0,1; 02; 1,2  Data Forwarding: None |

1. Assume “no forwarding” in this pipelined processor and apply (Inst. 1, 2, and 3), from above. Indicate hazards and add NOP (Stall) instructions to eliminate them.

| Cycle No. Where  Hazard Eliminated | Instruction No. &  Pipeline Name Delayed | Reason for Change |
| --- | --- | --- |
| 4-5 | Instruction 1, pipeline 4-5 |  |
| 4-5 | Instruction 2, pipeline 4-5 |  |
| 7-8 | Instruction 2, pipeline 7-8 |  |

1. What is the total execution time of this instruction sequence in the “no forwarding” pipelined processor?

| Total Execution Time for “No Forwarding” Pipeline Processor |
| --- |
| 2,750 ps |

1. Now, assume a “forwarding” pipelined processor and apply (Inst. 1, 2, and 3), from above. Indicate hazards found, and add NOP (Stall) instructions to eliminate them.

| Cycle No. Where  Hazard Eliminated | Instruction No. &  Pipeline Name Delayed | Reason for Change |
| --- | --- | --- |
| N/A | N/A | N/A |
| N/A | N/A | N/A |
| N/A | N/A | N/A |

1. What is the Total execution of this instruction sequence in the “forwarding” pipelined processor?

| Total Execution Time for “Forwarding” Pipeline Processor |
| --- |
| 2,100 ps |

1. What is the Speedup due to Using a Forwarding Pipelined Processor?

| Processing Speedup due to Forwarding |
| --- |
| 1.31 |

Deliverables:

1. Complete answers for all parts.
2. Run the simulator and capture the total run to a file.
3. A cover page, which identifies the purpose of the assignment, and the programmers.

**What to submit:**

1. Package the deliverables into one document and submit to LoudCloud.