Pipeline Assignment – CSCI 6314

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Refer to this video for help <https://www.youtube.com/watch?v=8NPzLBSBzPI> (only for your enjoyment)

You have learned three types of Hazards and the data hazard is further divided into WAR, RAW, and RAR. Further we talked about stalls (noOp), forwarding, placing an unrelated instruction between dependent instructions, and flushing the pipeline to solve these hazards. Complete the following table:

***Note by Ulvi Bajarani: I assumed that in 2. , I do hazards’ handling sequentially. For example, If I called bubble 2 times between instructions 1 and 2, the clock cycles of pipelining stages of next instructions have been shifted forward, so I need not to handle previous hazards again (however, I’ve written what registers are with data hazards). Also, I have not written hazards in the first stage, because all hazards might be in the next stages.***

***In MIPS, there is no Structural Hazard, but we it might be happen in other architecture. Due to reason that there is no branch, all hazards provided here are Data Hazards.***

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Code | Hazard | Registers affected | How to handle the Hazard | In case of forwarding place arrows where it can be forwarded |
| Add $t0,$t1,$t2 | - | - | - |  |
| Sub $t3,$t0,$t1 | RAW | $t0 | Forwarding | IE/MEMAdd → IESub |
| Or $t4,$t0,$t2 | RAW | $t0 | Forwarding | MEM/WBAdd → IEOr |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Code | Hazard | Registers affected | How to handle Hazard | In case of forwarding place arrows |
| Lw $t2, 60($t1) | - | - | - |  |
| Lw $t1,40($t2) | RAW | $t2 | Bubble 2 times |  |
| Add $t1,$t1,$t2 | RAW | $t1, $t2 | Bubble, then forwarding | MEM/WB LW $t1... → IEAdd |
| Sw $t1,20($t2) | RAW | $t1 | Bubble, then forwarding | IE/MEMAdd → IESw |
|  |  |  |  |  |

Please not load word and store word instructions use memory calculated by adding contents of the register indicated with the number given. Just to let you know that CPU is involved in calculating the memory location.

Please do some review of your textbook and research before filling these out. May not be as easy as you think.