HW6.6. Pipelining hazards

Feel free to check out the guide that we have prepared to help you in this problem.

For this question, assume that we are working with the a 5-stage pipelined CPU, composed of Instruction Fetch, Instruction Decode/Register Read, ALU/Execution, Memory/Branch, and Writeback.

Note that in this question, **we assume that branches are resolved in the memory stage.** In other words, the branch target address becomes available at the input of the PC register during the memory stage.

We run the following code:

```
1. lw s1 0(s0)
2. add s2 s1 s1
3. slli s3 s1 1
4. bne s2 s3 exit #Note that this branch can never be taken
5. addi t1 t0 x0
6. exit:
```

For each pair of instructions, determine:

a: How many stalls that are needed in a **completely unoptimized** pipeline: Reg file does not "write-then-read" on the same cycle (i.e. no 'double pumping'), no forwarding, no branch prediction or pipeline flushing, etc.

b: The type of hazard that causes the stall

c: The pipeline optimization needed to best reduce the number of stall cycles required.

d: The number of stall cycles needed after all optimizations in part c are implemented.

Instructions	Unoptimized Stalls Needed	Hazard Type	Optimization Needed	Optimized Stalls Needed
1->2	inte			i
2->3	inte			i
3->4	inte			i
4->5	inte			i

Now, assume that the register file supports "write-then-read" functionality on the same clock cycle and that branch target addresses become available at the input of the PC register during the execution stage. Which of the following statements will be true?

- [ ] (a) Some of the hazards from the previous question will disappear.
- [ ] (b) Required number of unoptimized stalls for structural/data hazard decreases by 1 cycle.
- [ ] (c) All the answers from the previous question remain the same.
- [ ] (d) Required number of unoptimized stalls for control hazard decreases by 1 cycle.
- [ ] (e) Required number of optimized stalls for control hazard decreases by 1 cycle.
- [ ] (f) Required number of optimized stalls for structural/data hazard decreases by 1 cycle.

Select all possible options that apply.

Save & Grade *20 attempts left* | Save only | *Additional attempts available with new variants*

Homework 6

Assessment overview

Total points: 0/100

Score: 0%

Question

Value: 15

History:

Awarded points: 0/15

Report an error in this question

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Attached files

No attached files

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