

CA 2023 Lab3

Yu-Xiang Luo

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env

Docker for testing and macos iverilog with gtk-wave for debugging

difficulty

At first, the diff is just not working well even all the letters are same as correct output, and so I tried diff -b for neglecting trailing space and it works, I then find my bug, ALU_out is not same, but then the correct answer is an unsigned number, which then I email TA for correctness, then I change the ALU_out in ALU module to unsigned to fix this bug. (In lab2, ALU_out is signed one)

Branch.v

In this file, we have to flush when branch_i is true, which means there's a branch request, and flush if predict_i is True, which means it predicts it would branch, then we flush IF_ID and fetch another instruction.

Flush.v

In this file, we flush the pipeline register and reset the pc to branch one. There's two cases needed to handle, one is IFID flush and one is IDEX flush. The former flush is because it needs branch practically, and the latter one means the predict one does not match the branch_result in branch_check.v

ID_EX.v

Similar to lab2, but add a flush to ID_EX to handle predict not match

branch_check.v

Check if the prediction is right. If not, we need to flush IDEX and branch to correct one

branch__predictor.v

It's a 2-bit predictor that enables strong predict and weak predict, logic is easy so viewing code might be easier than telling in report

branch__result.v

In this file, it returns the actual value of whether branch, and turns this value to branch_predictor and branch_check to check if the prediction is right. If not, then predictor states change (strong \rightarrow weak, or weak neg \rightarrow weak pos, and so on), and flush IDEX and IFID for prediction wrong