2022 計算機組織
Computer Organization

Lab 8 Report

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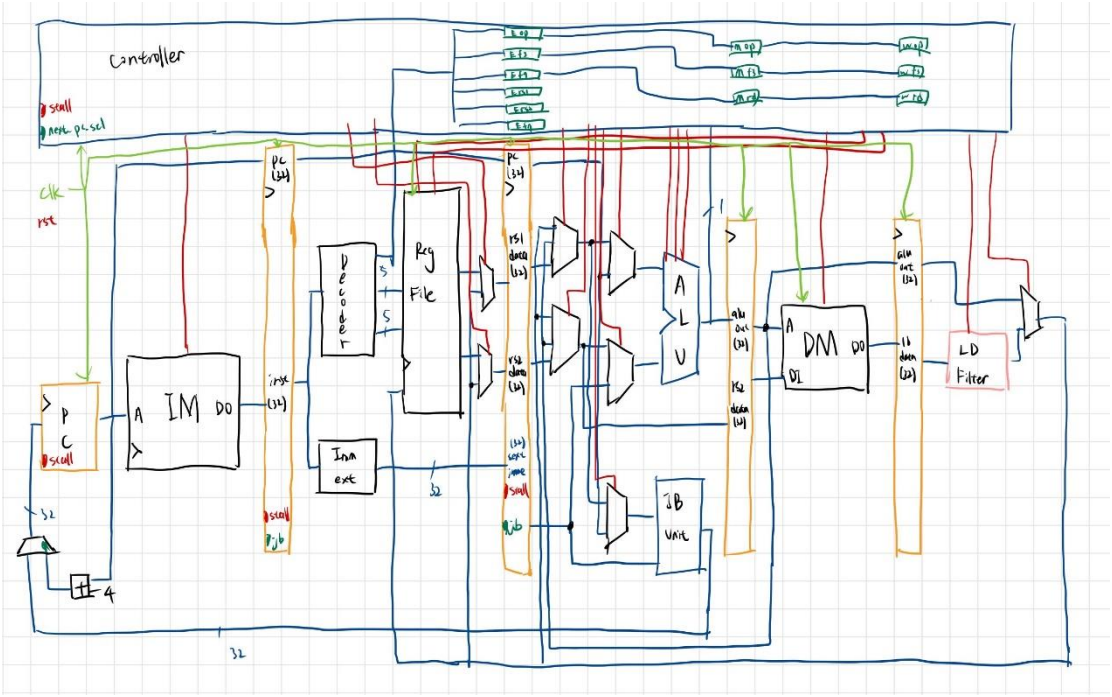
1. Architecture Diagram



2. Explain why Pipeline can accelerate the CPU

Because the cpu can handle more work for the same amount of time, and hence result in a short processing time.

3. Describe all the hazards you encountered and how you fixed them in your Pipeline CPU

I encountered mostly data hazard and control hazard, which are usually caused by some stupid mistakes I made in the modules, such as porting the wire to the wrong port just because I didn't double check the name of the ports that I copied and pasted a lot. Also, setting the wrong requirement for the if-else loop for certain results. It took me tremendous amount of time just to follow the data path step by step, and then find the modules that output wrong data, figure out the mistakes by examining the input and the output, and then eventually fix it. I think the most difficult part is all the process before successfully run over all the pcs and then finish the program, because without knowing the errors of the execution of those instructions, it is hard to know where exactly the code is wrong.

4. Screenshot the successful result of prog0

```
DM['h9000] = fffffff0, pass
DM['h9004] = fffffff8, pass
DM['h9008] = 00000008, pass
DM['h900c] = 00000001, pass
DM['h9010] = 00000001, pass
DM['h9014] = 78787878, pass
DM['h9018] = 000091a2, pass
DM['h901c] = 00000003, pass
DM['h9020] = fefcfefd, pass
DM['h9024] = 10305070, pass
```

```
DM['h9024] = 10305070, pass
DM['h9028] = cccccccc, pass
DM['h902c] = ffffffcc, pass
DM['h9030] = ffffcccc, pass
DM['h9034] = 000000cc, pass
DM['h9038] = 0000cccc, pass
DM['h903c] = 00000d9d, pass
DM['h9040] = 00000004, pass
DM['h9044] = 00000003, pass
DM['h9048] = 000001a6, pass
DM['h904c] = 00000ec6, pass
DM['h9050] = 2468b7a8, pass
DM['h9054] = 5dbf9f00, pass
DM['h9058] = 00012b38, pass
DM['h905c] = fa2817b7, pass
DM['h9060] = ff000000, pass
DM['h9064] = 12345678, pass
DM['h9068] = 0000f000, pass
DM['h906c] = 00000f00, pass
DM['h9070] = 000000f0, pass
DM['h9074] = 0000000f, pass
DM['h9078] = 56780000, pass
DM['h907c] = 78000000, pass
DM['h9080] = 00005678, pass
DM['h9084] = 00000078, pass
DM['h9088] = 12345678, pass
DM['h908c] = ce780000, pass
DM['h9090] = fffff000, pass
DM['h9094] = fffff000, pass
DM['h9098] = fffff000, pass
DM['h909c] = fffff000, pass
DM['h90a0] = fffff000, pass
DM['h90a4] = fffff000, pass
DM['h90a8] = 13579d7c, pass
DM['h90ac] = 13578000, pass
DM['h90b0] = fffff004, pass
```

```
**************************
**                      **
**  Waku Waku !!        **
**                      **
**  Simulation PASS !!  **
**                      **
**************************
Simulation complete via $finish(1) at time 6955 NS + 1
```

5. Screenshot the successful result of prog1

```
DM['h9004] = 00000001, pass
DM['h9008] = 00000001, pass
DM['h900c] = 00000003, pass
DM['h9010] = 00000003, pass
DM['h9014] = 00000006, pass
DM['h9018] = 00000008, pass
DM['h901c] = 0000000a, pass
DM['h9020] = 0000000a, pass
DM['h9024] = 0000000b, pass
DM['h9028] = 0000000c, pass
DM['h902c] = 0000000f, pass
DM['h9030] = 00000010, pass
DM['h9034] = 00000012, pass
DM['h9038] = 00000012, pass
DM['h903c] = 00000017, pass
DM['h9040] = 00000017, pass
DM['h9044] = 00000017, pass
DM['h9048] = 00000018, pass
DM['h904c] = 0000001b, pass
DM['h9050] = 0000001e, pass
DM['h9054] = 00000025, pass
DM['h9058] = 00000025, pass
DM['h905c] = 00000026, pass
DM['h9060] = 00000027, pass
DM['h9064] = 00000028, pass
DM['h9068] = 00000028, pass
DM['h906c] = 00000029, pass
DM['h9070] = 0000002b, pass
DM['h9074] = 0000002d, pass
DM['h9078] = 0000002d, pass
DM['h907c] = 0000002e, pass
DM['h9080] = 0000002f, pass
DM['h9084] = 00000031, pass
DM['h9088] = ffffffce, pass
DM['h908c] = ffffffce, pass
DM['h9090] = ffffffd1, pass
DM['h9094] = ffffffd1, pass
DM['h9098] = ffffffd2, pass
DM['h909c] = ffffffe2, pass
DM['h90a0] = ffffffe9, pass
DM['h90a4] = ffffffea, pass
DM['h90a8] = ffffffeb, pass
DM['h90ac] = ffffffed, pass
DM['h90b0] = ffffffef, pass
DM['h90b4] = fffffff3, pass
DM['h90b8] = fffffff7, pass
DM['h90bc] = fffffffa, pass
DM['h90c0] = fffffffa, pass
DM['h90c4] = fffffffd, pass
DM['h90c8] = fffffffe, pass
DM['h90cc] = ffffffff, pass
DM['h90d0] = 00000000, pass
DM['h90d4] = ffffffcf, pass
```

```
DM['h90d8] = ffffffd2, pass
DM['h90dc] = ffffffd2, pass
DM['h90e0] = ffffffd4, pass
DM['h90e4] = ffffffd5, pass
DM['h90e8] = ffffffd6, pass
DM['h90ec] = ffffffdb, pass
DM['h90f0] = ffffffe3, pass
DM['h90f4] = ffffffe3, pass
DM['h90f8] = ffffffe8, pass
DM['h90fc] = ffffffe9, pass
DM['h9100] = ffffffee, pass
DM['h9104] = ffffffee, pass
DM['h9108] = ffffffee, pass
DM['h910c] = ffffffef, pass
DM['h9110] = fffffff0, pass
DM['h9114] = fffffffe, pass
DM['h9118] = 00000000, pass
DM['h911c] = 00000000, pass
DM['h9120] = 00000000, pass
DM['h9124] = 00000003, pass
DM['h9128] = 00000009, pass
DM['h912c] = 0000000f, pass
DM['h9130] = 00000013, pass
DM['h9134] = 00000016, pass
DM['h9138] = 00000017, pass
DM['h913c] = 00000017, pass
DM['h9140] = 00000023, pass
DM['h9144] = 0000002e, pass
```

```
    ****************************
    **                        **
    **  Waku Waku !!          **
    **                        **
    **  Simulation PASS !!    **
    **                        **
    ****************************
Simulation complete via $finish(1) at time 498065 NS + 1
./top_tb.sv:115     $finish;
xcelium> exit
TOOL:   xmverilog       22.03-s003: Exiting on Jan 21, 2023 at 21:48:51 CST  (total: 00:00:01)
```