ECE552 Computer Architecture
Lab 1 Rerport

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1 Percentage of Performance Drop

```
sim: ** simulation statistics **
sim_num_insn              279373007 # total number of instructions executed
sim_num_refs              109106589 # total number of loads and stores executed
sim_elapsed_time                 41 # total simulation time in seconds
sim_inst_rate          6813975.7805 # simulation speed (in insts/sec)
sim_num_RAW_hazard_q1      97388830 # total number of RAW hazards (q1)
sim_num_RAW_hazard_q2      88922682 # total number of RAW hazards (q2)
sim_num_RAW_hazard_one_cycle_stall_q1      9206516 # total number of RAW hazard with one cycle stall (q1)
sim_num_RAW_hazard_two_cycle_stall_q1     88182314 # total number of RAW hazard with two cycle stall (q1)
sim_num_RAW_hazard_one_cycle_stall_q2     68796288 # total number of RAW hazard with one cycle stall (q2)
sim_num_RAW_hazard_two_cycle_stall_q2     20126394 # total number of RAW hazard with two cycle stall (q2)
CPI_from_RAW_hazard_q1       1.6642 # CPI from RAW hazard (q1)
CPI_from_RAW_hazard_q2       1.3903 # CPI from RAW hazard (q2)
```

Figure 1: Simulation result from `gcc.eio`

The simulation result of `gcc.eio` showed the `CPI_from_RAW_hazard` for Question is 1.6642, and for Question 2 the value is 1.3903. Therefore we can derive the % drops as following:

$$p_1 = \frac{CPI\_from\_RAW\_hazard\_q1 - 1}{1} = \frac{1.6642 - 1}{1} \times 100\ \% = 66.42\ \%$$
$$p_2 = \frac{CPI\_from\_RAW\_hazard\_q2 - 1}{1} = \frac{1.3903 - 1}{1} \times 100\ \% = 39.03\ \%$$

2 Micro-benchmark for Part 1

In the micro-benchmark written for part1, below behaviours has been evaluated

- Propagated stalls
- Read after write with 1-cycle stall
- Read after write with 2-cycle stall
- Read after load with 2-cycle stall
- Store after load with 2-cycle stall
- Store after write with 2-cycle stall

Within each for-loop counters should record 4 2-cycle stalls and 1 1-cycle stall; Plus, the for-loop boundary check itself triggers 2 2-cycle stalls. Therefore by iterating the process 1,000,000 times, the statistics should provide around 6,000,000 2-cycle stall and 1,000,000 1-cycle stall. Benchmark result is shown as below, matches the expected value.

```
sim_num_RAW_hazard_one_cycle_stall_q1      1000080 # total number of RAW hazard with one cycle stall (q1
sim_num_RAW_hazard_two_cycle_stall_q1      6000851 # total number of RAW hazard with two cycle stall (q1
```

Figure 2: Simulation result from `mbq1`