• CS286: Lecture Note (Lecture #17, October 24, 2022)

The agenda for CS286 lecture #17 (October 24, 2022):

1. **Pick up:**
   - Attendance card

2. **Quiz #7 is scheduled next Wednesday (10/26)**
   - The second part of Quiz #7 has been posted to the course home.

3. **Finish: “delayed branch”**

4. **Exercise Question**

   EXERCISE #2 (October 19, 2022)

   Assume that we have a CPU with a pipeline datapath that has 20 \(k = 20\) stages. The size of the branch slot in this CPU is 19 cycles (i.e., every time a conditional branch takes a jump, the processor loses 19 cycles). Now we are applying delayed-branch to assembly programs to be executed by this CPU. For the programs executed by this CPU, branches are taken for 56% of their executions. It was also found that in 23% of time, delayed-branch could not be applied because of data dependencies between the instructions. To simplify this question, let’s assume that any of the 19 instructions could not be moved after a branch instruction as long as any one of the 19 instructions has a data dependency (i.e., for 23% of time, none of the 19 instructions can be moved to the behind of a conditional branch instruction). Assume that the number of the instructions the CPU executes is huge (you can safely consider that is infinity \(\infty\)).

   **Question:** in order for the slow-down due to conditional branch instructions to be less than 20% (after the delayed-branch is used), what should be the frequency of branch instructions in your programs (i.e., how much of the assembly instructions are conditional branch instructions)?

5. **Start a new topic: memory subsystem**

6. **Review Quiz #7 questions**
   - CS286 Office hour on 10/26 will be available (at 10:00 am)
   - For those who can not make 10:00 am on 10/26, I suggest the office hour zoom tomorrow (10/25) at 10:00 am