

Late submissions will be accepted without penalty until the morning of 30 May 2026.

Collaboration Rules

Each student is expected to complete his or her own assignment. It is okay to work with other students and to ask questions in order to get ideas on how to solve the problems or how to overcome some obstacle (be it a question of MIPS, RISC-V, or assembler syntax, interpreting error messages, how a part of the problem might be solved, etc.) It is also acceptable to seek out resources for help on MIPS, RISC-V, etc. It is okay to make use of AI LLM tools such as ChatGPT, Claude, and Copilot to generate sample code. (Do not assume LLM output is correct. Treat LLM output the same way one might treat legal advice given by a lawyer character in a movie: it may sound impressive, but it can range from sage advice to utter nonsense.)

After availing oneself to these resources **each student is expected to be able to complete the assignment alone**. Test questions will be based on homework questions and **the assumed time needed to complete the question will be for a student who had solved the homework assignment on which it was based**.

Student Expectations

To solve this assignment you are expected to avail yourself of references provided in class and on the Web site, and to learn how to handle references that are at first hard to understand, and to keep looking (and asking) when the answer isn't in the first place you look. Some of the problems require thought, and you are expected to persevere until you find a solution. It is each student's duty to him or herself to resolve frustrations and roadblocks, helped along by the satisfaction of making progress. There are plenty of old problems and solutions to look at. One way to resolve issues is to ask Dr. Koppelman or others for help.

Resources

Many past final exams and homework assignments have problems on branch prediction.

Problem 1: Solve 2025 Final Exam Problem 3a, which asks for the prediction accuracy of bimodal and local predictors on two branches.

Problem 2: Consider the predictor from Problem 3b of the 2025 Final Exam. Assume that the size of the target field is 16 bits and that $h = 8$.

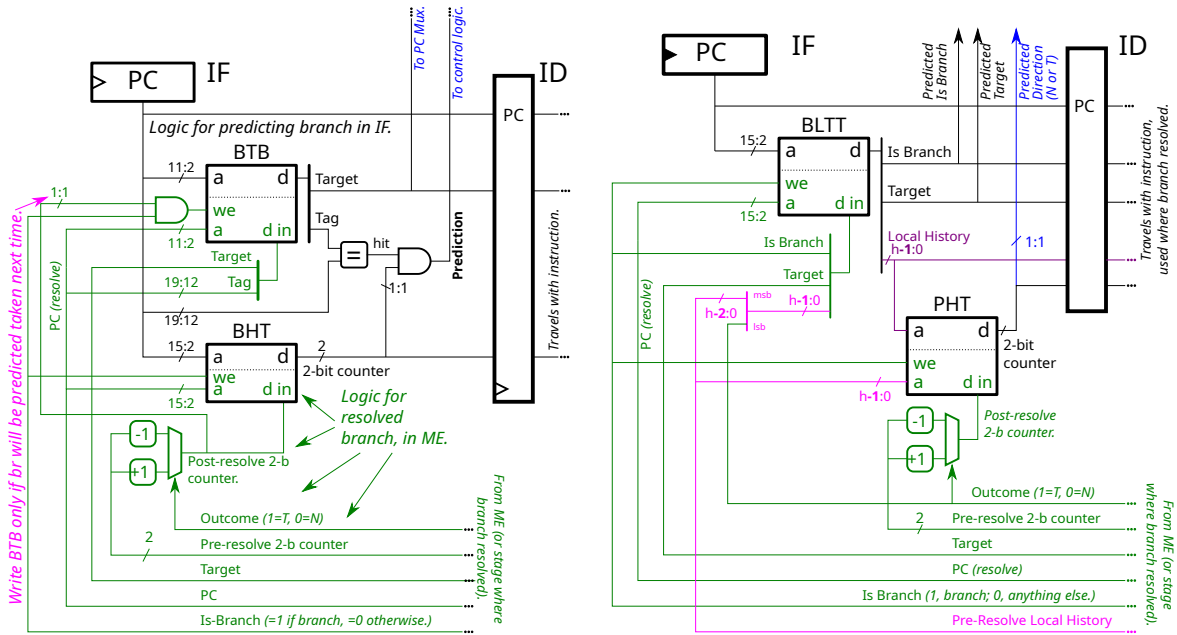
Determine the size of the BHT in bits. Determine the size of the PHT in bits.

Problem 3: Solve Problem 3b of the 2025 Final Exam. This will be really easy after looking at the recently added tagged BTB/BHT bimodal predictor material in the course predictor notes, <https://www.ece.lsu.edu/ee4720/2026/lsl112.pdf>.

Solve Problem 3b of the 2025 Final Exam.

The really interesting problem is on the next page.

Problem 4: The BTB/BHT bimodal predictor from the notes (and on the lower left) avoids wasting a BTB entry on a branch by using an oversized BHT. Below on the right is the local predictor used in the 2025 Final Exam and the class slides, but with the BHT (branch history table) renamed BLTT (branch local history and target table). (The table was renamed to avoid confusion with the bimodal predictor's BHT.) Larger versions of these appear on the following pages, and their SVG sources can be found at <https://www.ece.lsu.edu/ee4720/2026/lsl112-bimodal-btb-tag.svg> and <https://www.ece.lsu.edu/ee4720/2026/hw07-local-pred.svg>, and a collection of gates can be found at <https://www.ece.lsu.edu/ee4720/2026/c.svg>.

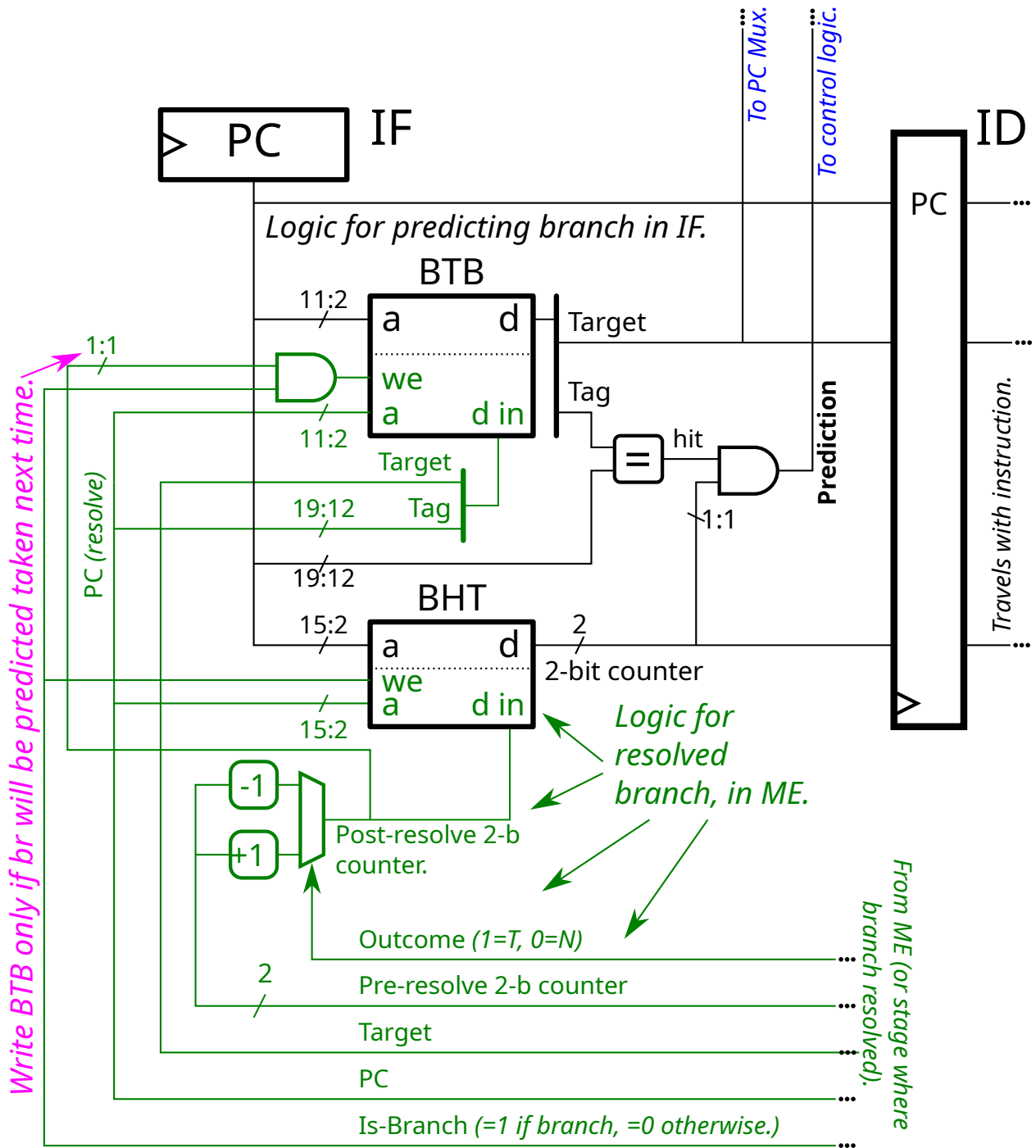


The local predictor BLTT entries are even larger than the BTB in a bimodal predictor, so we don't want to waste the BLTT entries either. Modify the local predictor so that its BLTT entries are not wasted on branches that are mostly not taken. Do so using a third table, something like the BHT in a bimodal.

- Modify the local predictor to avoid wasting BLTT entries on mostly not-taken branches.par
- The local predictor should still be able to predict sequences like N N N T T N N N T T ...
- Note that it's important to keep the local history in the BLTT consistently updated.

Tagged BTB/BHT Bimodal Predictor

SVG source at <https://www.ece.lsu.edu/ee4720/2026/lsl112-bimodal-btb-tag.svg>.



Local Predictor:

SVG source at <https://www.ece.lsu.edu/ee4720/2026/hw07-local-pred.svg>.

