

Problem 1: Answer Spring 2016 Final Exam Problem 3, which asks about the performance of various branch predictors.

The solution to this problem is available. **Make a decent attempt to solve this problem on your own, without looking at the solution.** Only peek at the solution for hints and use the solution to check your work. Credit will only be given if there is some evidence of an attempt to solve the problem.

Problem 2: Compute the amount of storage needed for each predictor described at the beginning of Spring 2016 Final Exam Problem 3 (the same question used in the problem above) accounting for the following additional details: Each BHT stores a six-bit tag and a 16-bit displacement (in addition to whatever other data is needed).

Be sure to show the size of *each* table (BHT, PHT) that each predictor (bimodal, local, global) uses. Show the size in bits.

Problem 3: In a bimodal predictor the size of the tag and displacement is much larger than the 2-bit counter used to actually make the prediction. Consider a design that uses two tables, a BHT and a *Branch Target Buffer (BTB)*. The BHT stores only the 2-bit counter, the BTB stores the tag and displacement. However, the tag and displacement are only written to the BTB if the branch will be predicted taken.

Draw a sketch of such a system and indicate the number of entries that should be in each table so that the amount of storage is the same as the original bimodal predictor.