

BRANCH PREDICTOR ANALYSIS

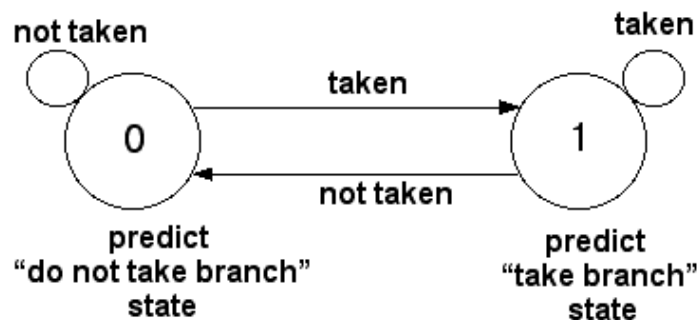
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The different type of branch predictors are as follows:-

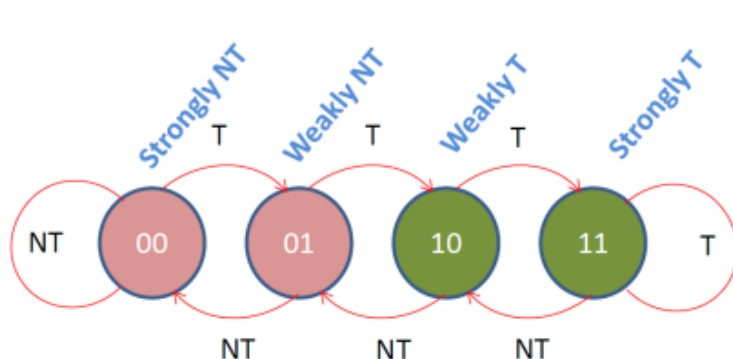
1. **Always-Taken**: In this type of branch predictor, whenever the pc encounters a branch instruction, it takes it and changes the program counter to the target address which we extract from the branch target buffer.
2. **Always Not-Taken**: In this type of branch predictor, whenever the pc encounters a branch instruction, it does not take it and changes the program counter to the immediate next instruction, that is pc+4.
3. **1-bit Branch Predictor**: In this type of branch predictor, whenever the pc encounters a branch instruction, it looks up its current state in the state table, and in case it is T, it takes the branch and in case it is N, it does not take the branch. Now, the current state of this instruction is updated in the state table according to the state diagram shown below:

** 1 stands for T and 0 stands for N



4. **2-bit Branch Predictor**: In this type of branch predictor, whenever the pc encounters a branch instruction, it looks up its current state in the state table, and in case it is ST or WT, it takes the branch and in case it is SNT or WNT, it does not take the branch. Now, the current state of this instruction is updated in the state table according to the state diagram shown below:

** 00 stands for SNT, 01 stands for WNT, 10 stands for WT and 11 stands for ST



Results Obtained:

TYPE OF PREDICTOR → FILE NAME ↓	<i>Always Taken</i>	<i>Always Not Taken</i>	<i>One bit</i>	<i>Two bit</i>
Bubble_test_Lab	43.3526	56.6474	97.1571	98.384
Fac_test_Lab	72.4425	27.5575	90.8259	92.067
sqrt_test_Lab	71.0993	28.9007	96.7603	97.3449
qsort_test_Lab	74.5177	25.4823	94.5191	95.2484
Recursion_test_Lab	76.56	23.44	96.3638	96.5174
wikisort_test_Lab	69.9638	30.0362	96.9859	97.7713
recursion_test_Lab	88.1045	11.8955	82.5039	84.1722

Here,

$$Accuracy (\%) = \frac{\text{Total number of correct predictions on Branch Instructions}}{\text{Total number of Branch Instructions}} * 100$$

So, as it is evident from the results, the accuracy of one bit and two bit branch predictors is much better than always taken or always not taken predictors. Moreover, in general, accuracy of two bit predictor is better than accuracy of one bit predictor for large traces.