Lecture 7 Branch Prediction Exercises

Q1:
Assume a branch outcome of

T T N N T T N N T T N N …

T = taken, N = not-taken

What is the prediction accuracy of a 1-bit history-based branch prediction scheme where the initial prediction state is not taken (N)?

Hint: List branch outcomes, states and predictions the same way as learned in the lecture.

Solution:
Branch outcome: T T N N T T N N T T N N …
State: N T T N N T T N N T T N …
Prediction: N **T** T **N** N **T** T N N T T N …

Q2:
A snapshot of the taken/not-taken behavior of a branch is:

T T N N T T N N T T N N T T N N...

Determine the **steady state** prediction accuracy of a 2-bit, saturating counter prediction scheme where the initial prediction state is strongly not taken (N).

Solution:
(steady state predictions are underlined, correct predictions during the steady state in green, correct predictions before reaching a steady state in orange)

Initial prediction state is N:
Branch outcome: T T N N T T N N T T N N T T N N T T N N ...
State: N n t n N n t n N n t n N n t n N nt n …
Prediction: NN T N N N T N N N T N N NTN N N T N …

Q3:
Given the branch and assumptions in Q2, what is the steady state prediction accuracy if the initial prediction state is strongly taken (T)?

Solution:
Initial prediction state is T:

Branch outcome: T T N N T T N N T T N N T T N N T T N N ...
State: T T T t n t T t n t T t n t T t n t T t …
Prediction: T T T T N T T T N T T T N T T T N T T T …

Note that the second iteration (the second column) has not entered a steady state yet, because the State row has not yet shown a stable pattern if we count starting from the second iteration.

Answer: also 25% in steady state