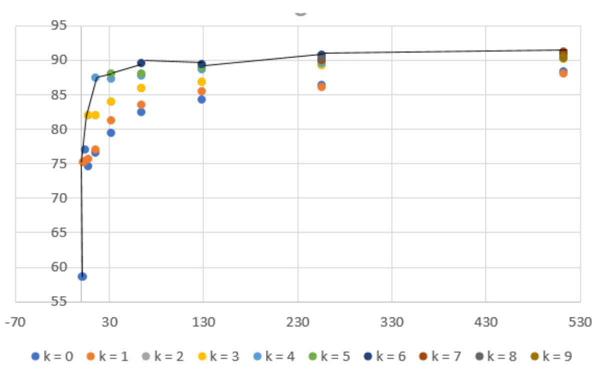
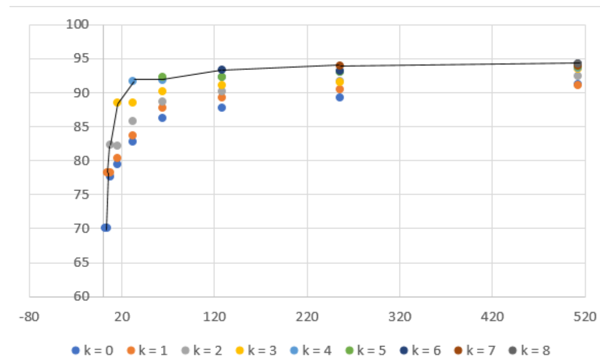
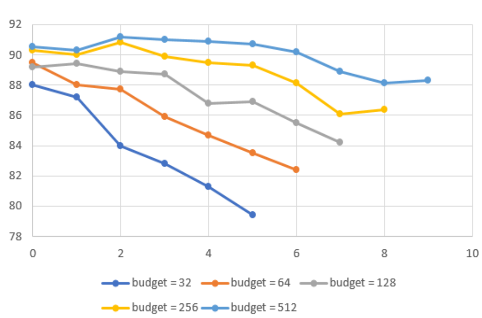
Analysis 1

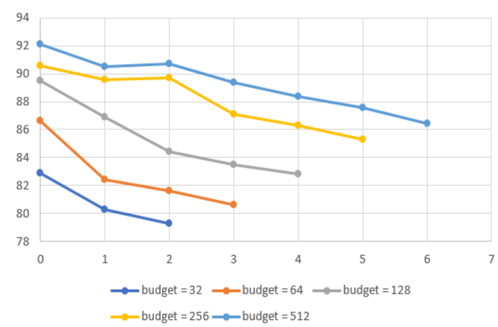




The scatter plots are of Branch Prediction Accuracies vs Budgets for a specific k. The left plot is for n = 1 and the right plot is for n = 2. The budget of a branch predictor is (2^(m+k))*n and n is constant for both the graphs. We can see that, as m+k increases, the accuracy increases, as we have more information to consult before making a prediction, leading to better accuracies. The budget increase is either due to increase in m or k or both. Increasing m means that the predictor can remember large histories of branches and make better predictions. Increasing k means that the predictor can differentiate between branch addresses as there are more address bits and there is less chance of 2 branches having the same last k bits. This leads to a lower chance of 2 different branches sharing the same prediction counter. The lines joining the points represent a Pareto curve, whose points give the optimal accuracy for a given budget. The curve is obtained by joining the points with best accuracy for budgets 1, 2, 8, 16, till 512. We also see that the accuracy increases from n = 1 to n = 2 for the corresponding budgets. This is because a predictor with n = 2 can make better predictions on varying branches than n = 1, as there are more states in n = 2 and branch variations are captured better. The best accuracy for n = 1 is 91.2% for m = 2 and k = 7. The best accuracy for n = 2 is 94.2% for m = 2 and k = 6. Thus an optimal combination of m,k gives the best accuracy, as both the global history and address of the branch are taken into consideration while making the prediction.

Analysis 2





The graphs represent the plot between the number of global history bits(m) and accuracy for a specific branch predictor budget. The left graph is for n = 1, the middle one is for n = 4 and the right one is for n = 8. We are analyzing the effect of varying the global history (m bits) on the branch prediction accuracy for 3 different n values. In all 3 graphs, we can see that for any line, whose budget is greater than 128, the accuracy decreases first, then increases and then falls again. Since the budget and n value is constant for a line, an increasing m represents a decreasing k. We get the best accuracy between m = 0 and 2 for each line. The best accuracy is when there is an optimal balance between m and k and k is not too small. As k decreases, the addresses bits keep getting smaller which leads to a high chance of 2 different branches having the same last k bits, leading them to point to the same counter. This would lead to an interference between two different branch patterns which a branch predictor might not comprehend accurately. This reduces the overall accuracy of the branch predictor.