

**NC State University**  
**Department of Electrical and Computer Engineering**  
**ECE 463/563: Fall 2021 (Rotenberg)**  
**Project #1: Cache Design, Memory Hierarchy Design**

**by**

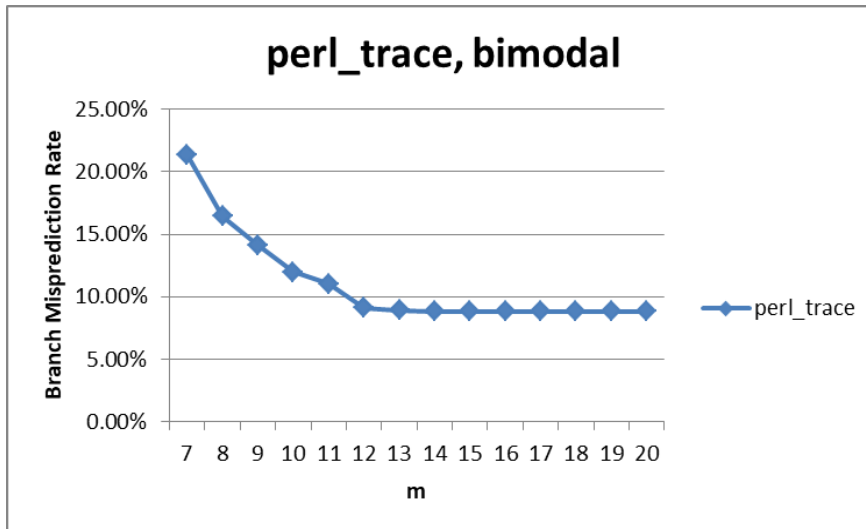
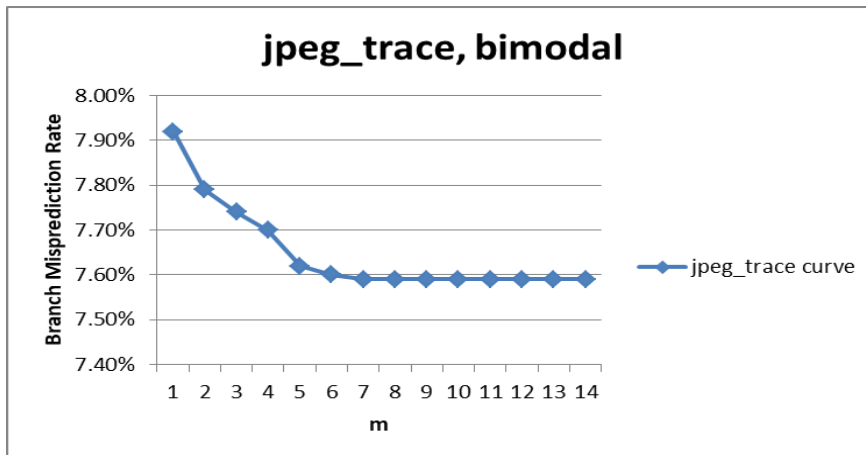
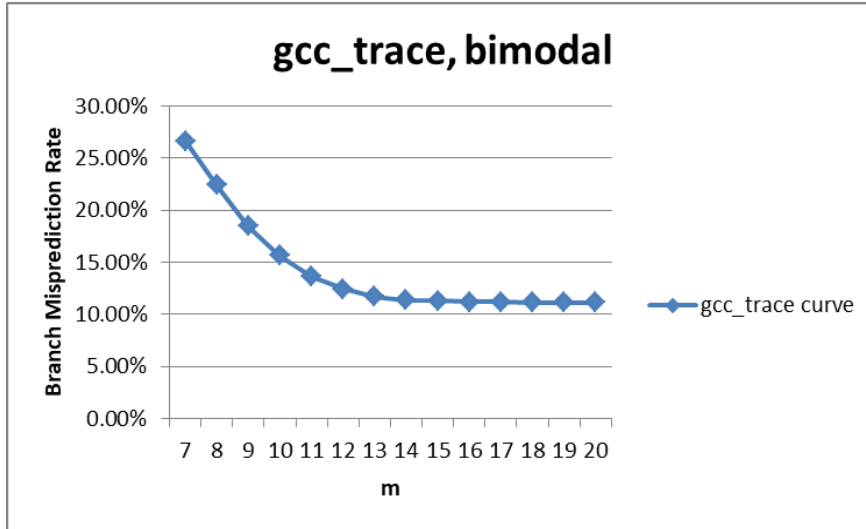
**Nandana Balachandran**

NCSU Honor Pledge: "I have neither given nor received unauthorized aid on this project."

Student's electronic signature: \_\_\_\_\_Nandana\_\_\_\_\_

Course number: \_\_\_\_\_563\_\_\_\_\_

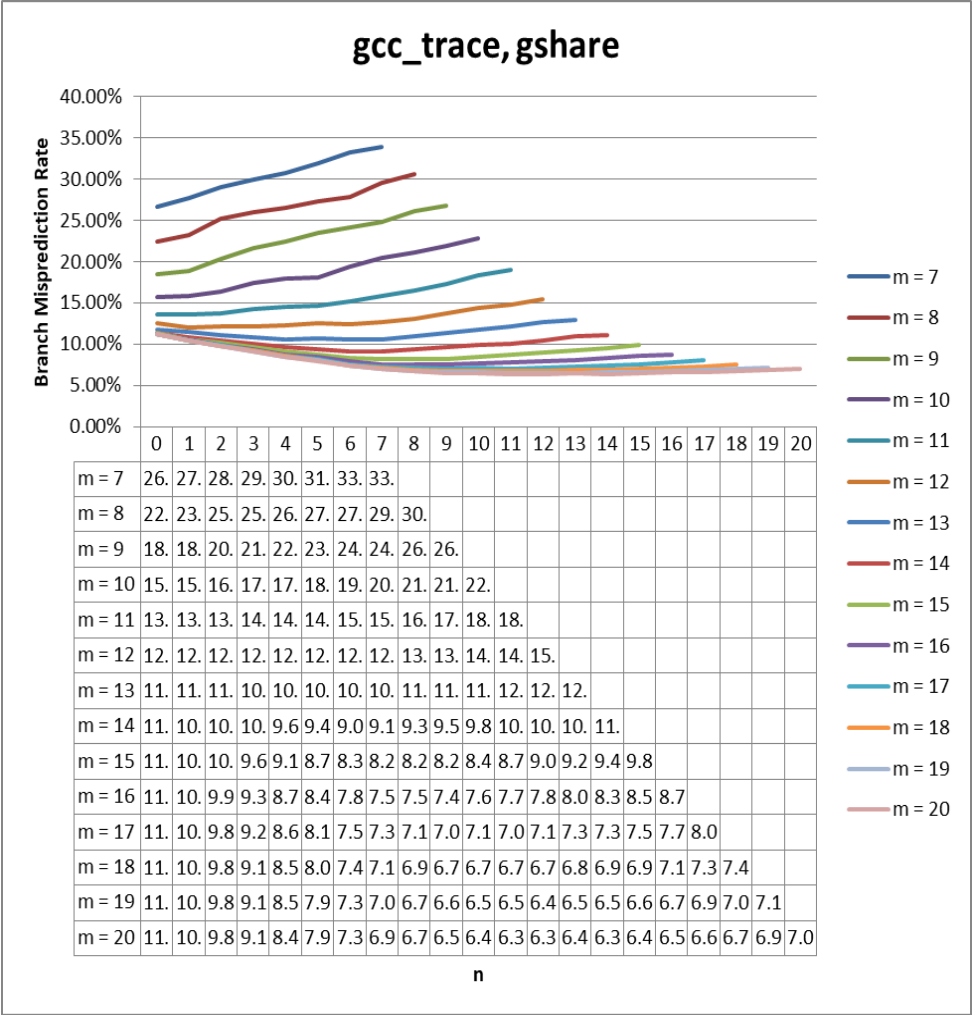
## PART 1: BIMODAL PREDICTOR



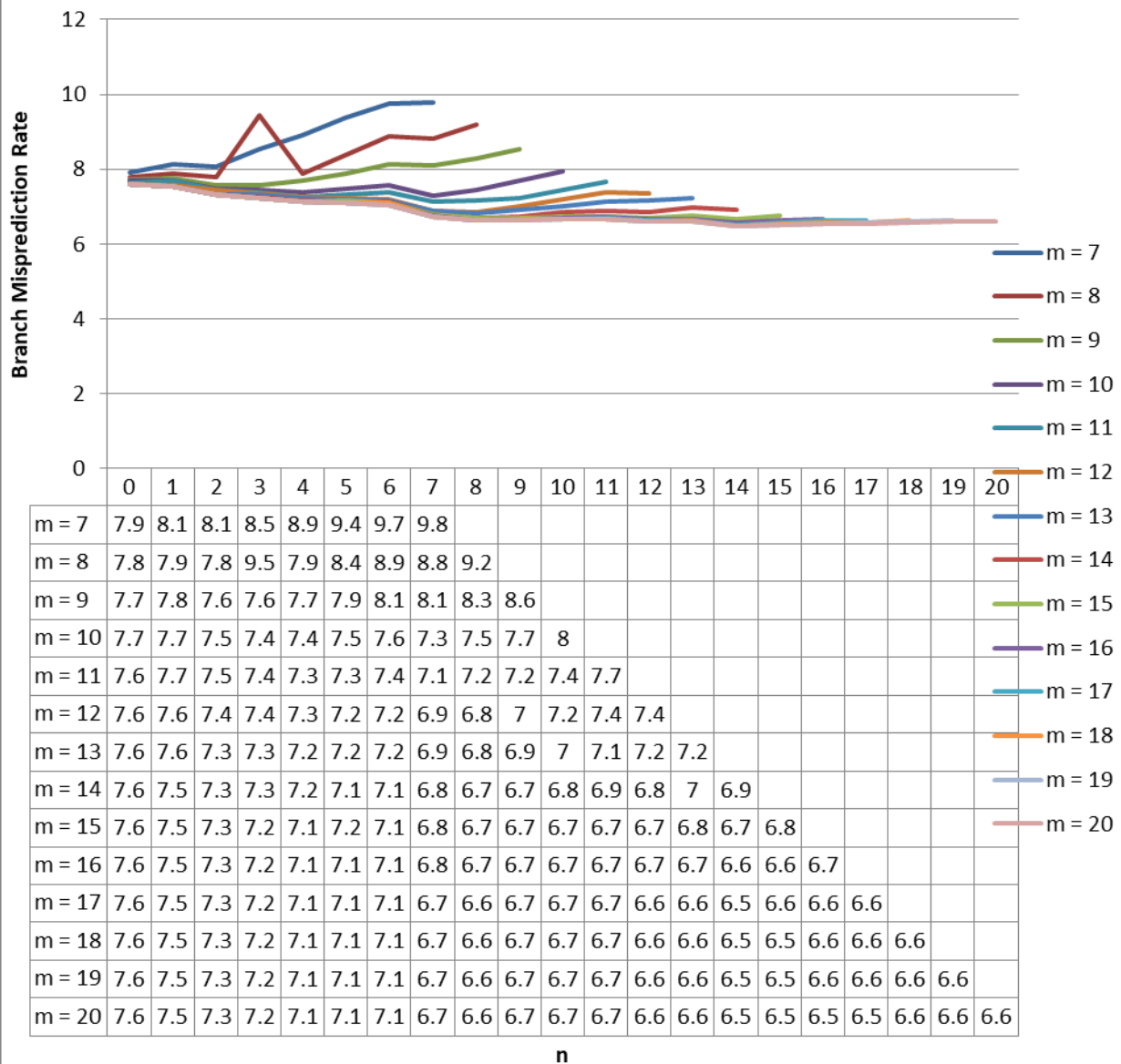
## **CONCLUSIONS AND TRENDS**

- For all the three trace files, the similarity between them is that they all show an exponential decrease with the increase in the value of  $m$ .
- For all the three models, when it reaches a particular value of  $m$ , the decrease in branch misprediction rate decreases. (gcc trace,  $m = 14$ ; jpeg trace,  $m = 7$ ; perl trace,  $m = 13$ ).
- Since different branches may make the same entry in the table, there is higher chance for misprediction. So, as the prediction table size increases, misprediction rate decreases.
- Another reason for the decreasing misprediction rate is because of the learning that it does from previously accessing the entry.
- When it reaches a particular value of  $m$ , the value stops decreasing as the learning stops and it reaches a constant value.
- Gcc trace file has the highest misprediction values.

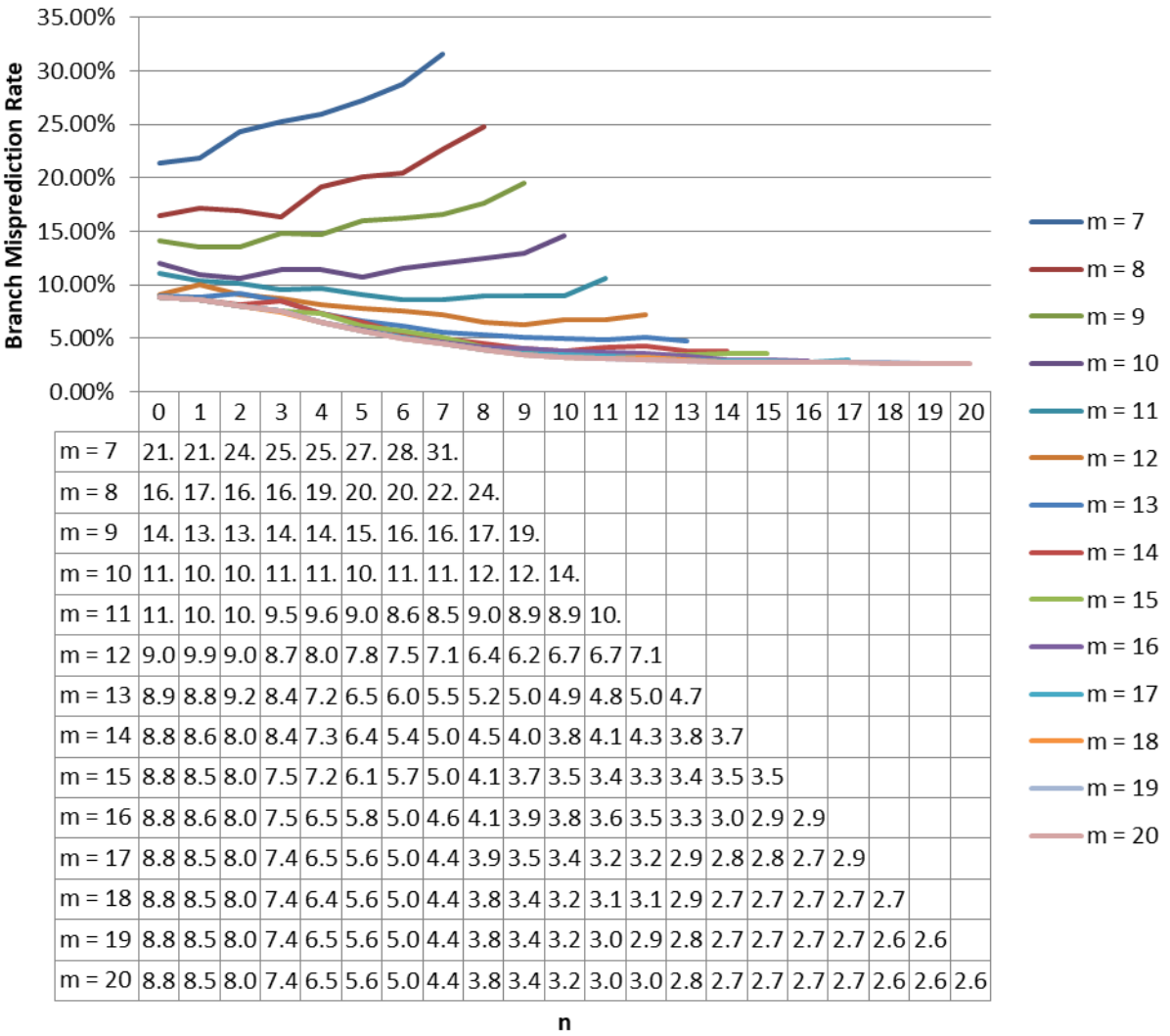
PART 2: GSHARE PREDICTOR



## jpeg\_trace, gshare



## perl\_trace, gshare



## CONCLUSION AND TRENDS

- As the number of program counter bits that is used to index the branch predictor and the number of bits in the global history table increases, misprediction rate should ideally decrease. However, it initially shows an increase in the branch prediction rate till m value reaches a particular optimum value and then starts showing a decreasing trend. For jpeg, the best trade-off is 6.5% which is reached when m=17 and n=14. For perl, m=19 and n=18 and the best value is 2.6%. For gcc trace when n=12 and m=20, it gives the lowest value of 6.3%.
- For smaller values of m, the prediction table entries will interfere with each other and hence there will be higher tendency to have misprediction values. Hence as the value for m increases, the misprediction rate decreases. From m=17, it reaches a constant value for all n values.