

# Performance of several branch predictor types and different RAS configurations

Advanced computer Architecture  
University of Jordan  
Dr. Gheith Abandah

Done by  
Dua'a Al-Najdawi

# Simulator and Workload

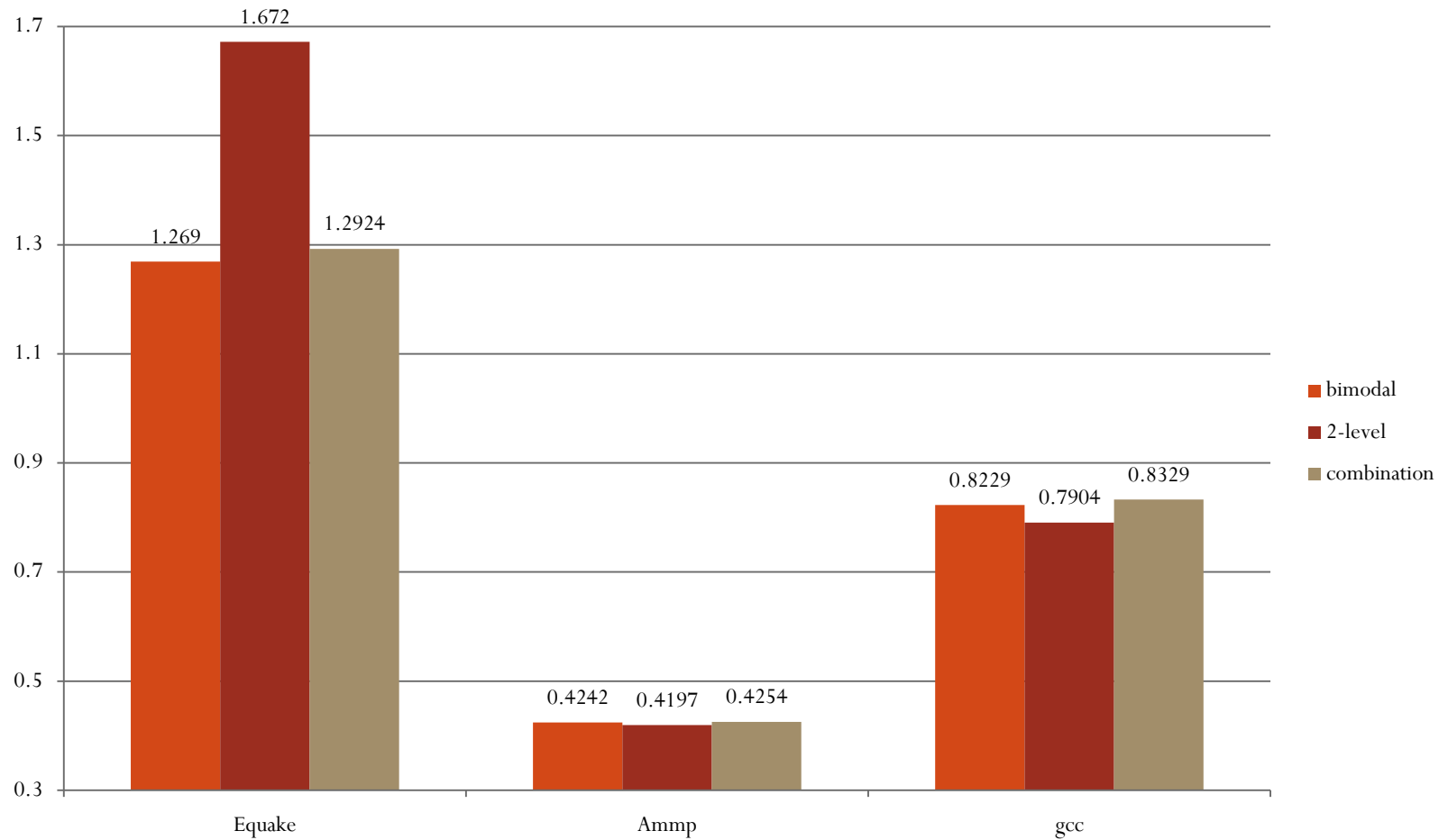
- I will use a sim-order in SimpleScalar Simulator, which is a popular toolset used frequently in testing and analysis of mainstream microarchitectural modeling research.
- SPEC2000 benchmark ,3 of them two floating point: **equake** , **ammp** and one integer: **gcc**.

# Design options ,2-parts

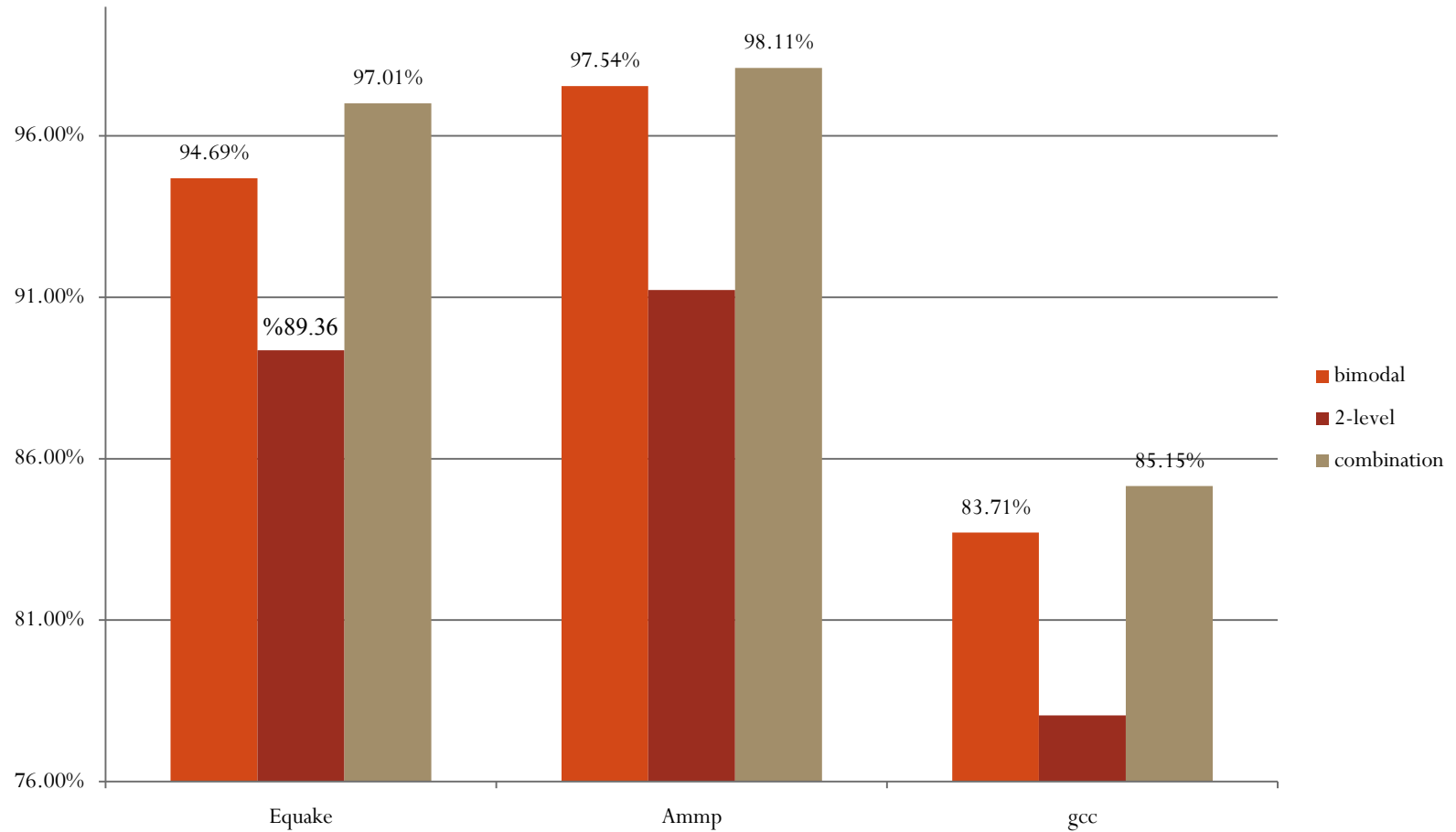
1. different types of the branch prediction: bimodal prediction, 2-level prediction, combination of the bimodal prediction and 2-level prediction. All have the same size which is 256 (2-level prediction  $l_1=1, l_2=256$ ).
2. The Return Address Stack (RAS) Changes to different sizes: 2,4,8,16,32 (Of course the size of RAS will be the power of 2). And the type of the branch prediction is the **bimodal branch prediction** and its table size is 256.

# Results

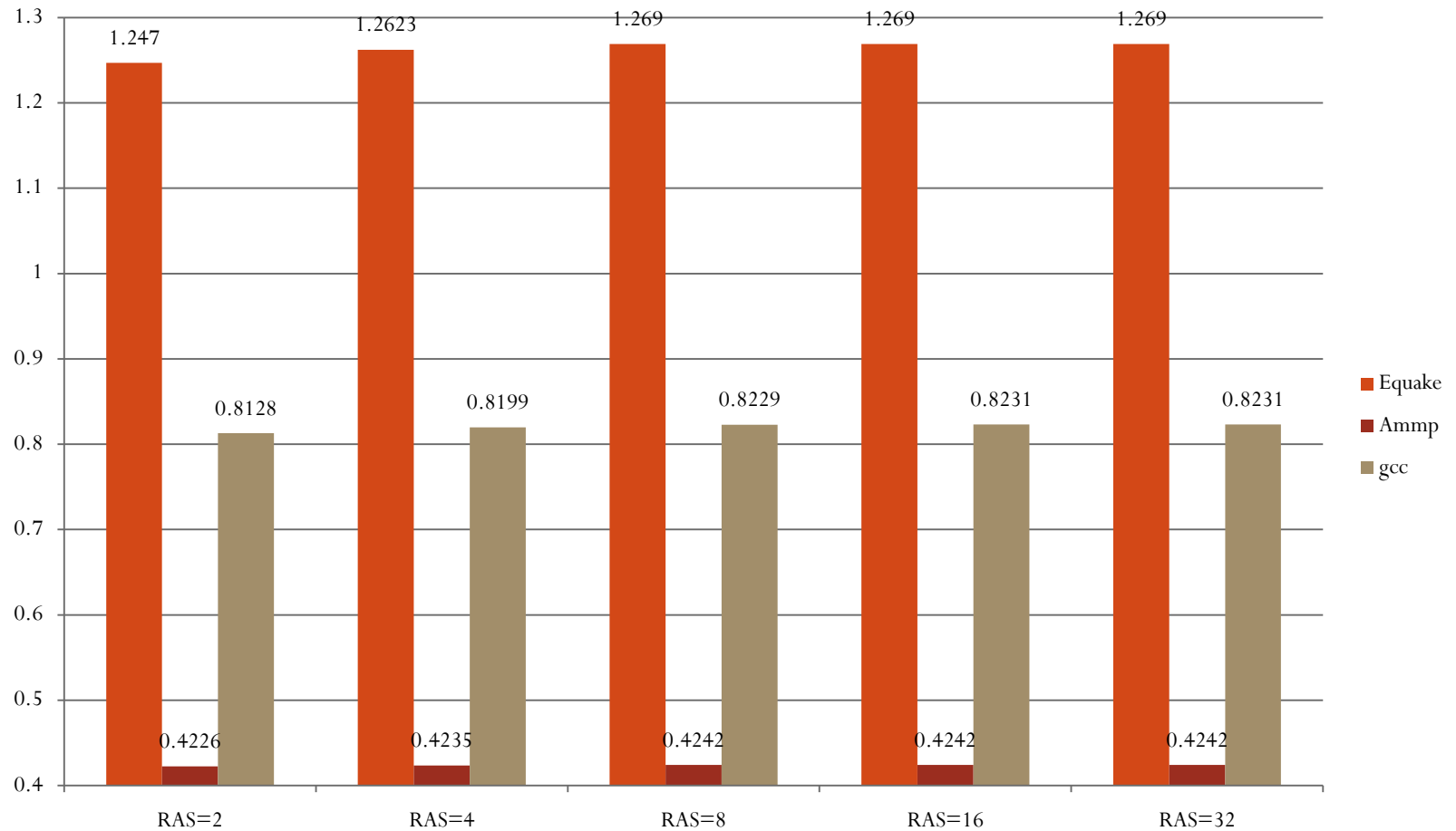
# IPC for different types of branch prediction



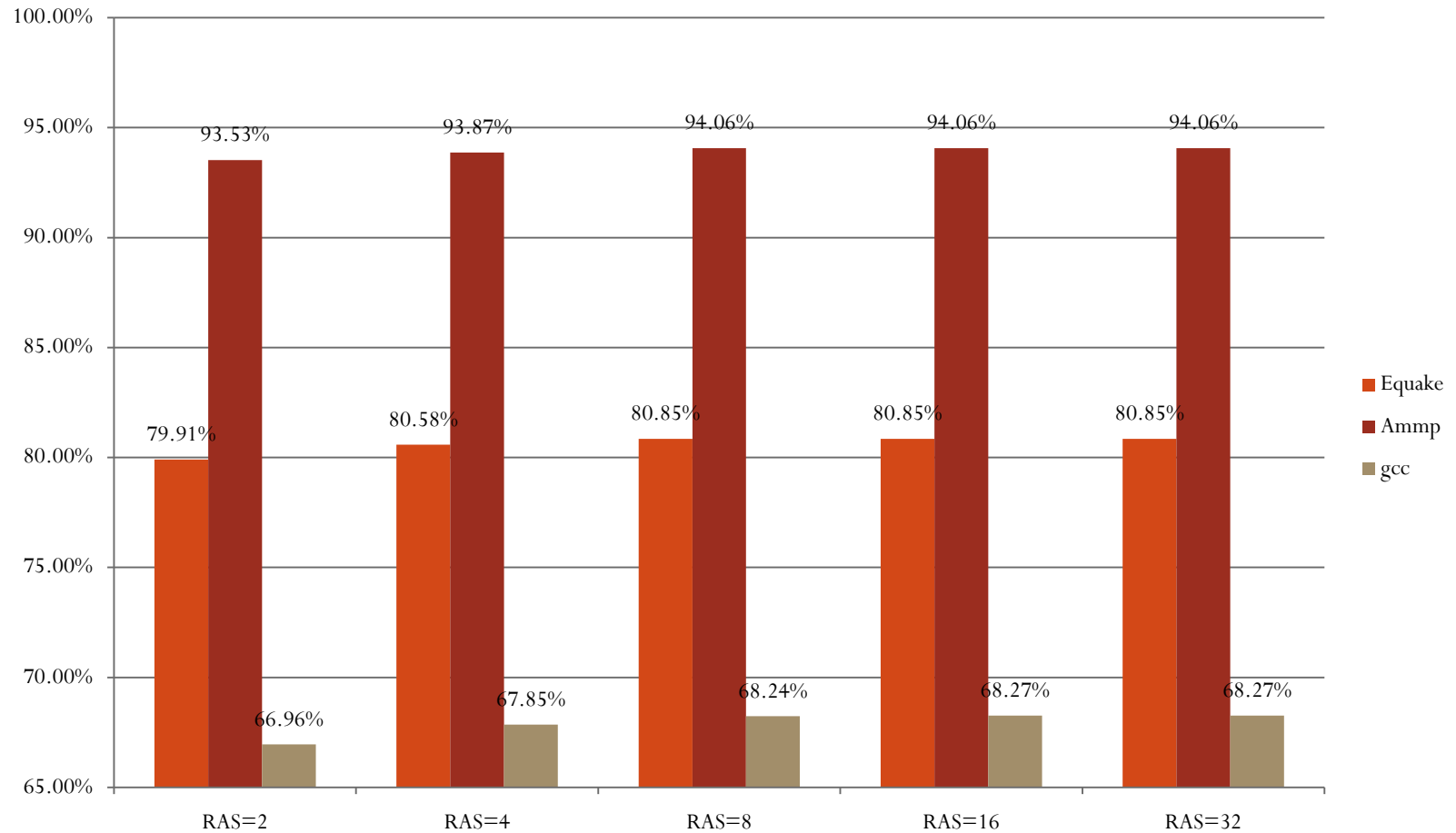
# Prediction hit rate to different types of branch prediction



# IPC for different sizes of RAS



# Prediction hit rate for different sizes of RAS





# Conclusion

- We saw the performance of the bimodal predictor is better than the performance of 2-level adapter predictor. When we combine between them the performance all will be better, prediction hit rate and IPC increase.
- When we increase the size of RAS (2, 4, 8) the IPC and the prediction rate increase so all the performance will enhance. This result up to RAS=8, but after that (RAS=16 or =32) almost the results will be the same so the best size of RAS is 8 which is used now in the superscalar processor.

# References:

- 1-**Speculative Return Address Stack Management Revisited**, HANS VANDIERENDONCK and ANDR'É SEZNEC, **Transactions on Architecture and Code Optimization (TACO)** , November 2008
- 
- 2-**Comparison of branch prediction schemes for superscalar processors**, ICEEC 2004 ,\_Youssif, A.A. Ismail, N.A. Torkey, F.A.
- 3-  
[http://bwrc.eecs.berkeley.edu/Classes/CS252/Projects/Reports/terry\\_chen.pdf](http://bwrc.eecs.berkeley.edu/Classes/CS252/Projects/Reports/terry_chen.pdf)
- 4-<http://harryscode.blogspot.com/2008/10/installing-simplescalar.html>
- 5-<http://students.cse.tamu.edu/msahn/csce614/hw1.pdf>
- 6-[http://www.simplescalar.com/docs/simple\\_tutorial\\_v2.pdf](http://www.simplescalar.com/docs/simple_tutorial_v2.pdf)
- 7-Arguments:<http://students.cse.tamu.edu/msahn/csce614/spec2000args.tgz>
- 8-  
binaries:<http://www.eecs.umich.edu/mirv/benchmarks/gcc2000.v3.tar.gz>.

**Thank you**