

**University of Central Florida**

**Department of Computer Science**

**CDA 5106: Spring 2022**

**Machine Problem 1: Cache Design, Memory Hierarchy Design**

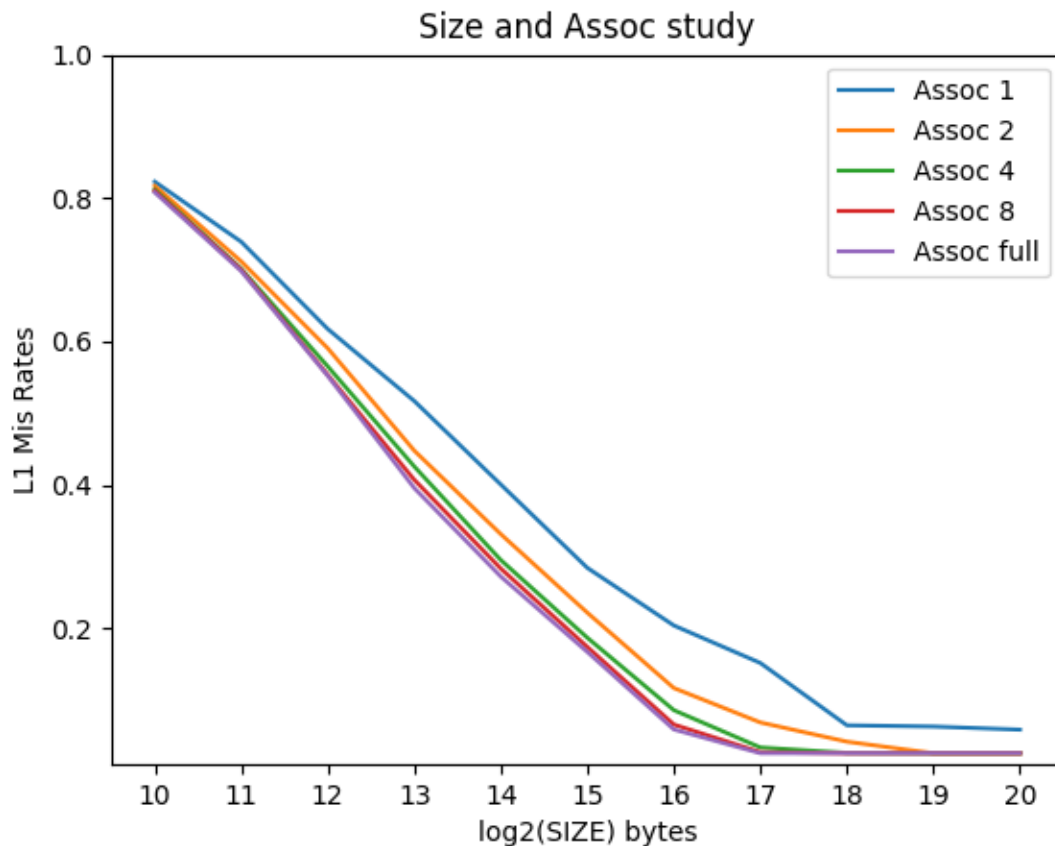
**by**

**Ashutosh A Avadhani**

Honor Pledge: "I have neither given nor received unauthorized aid on this test or assignment."

Student's electronic signature: Ashutosh A Avadhani

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Discuss trends in the graph. For a given associativity, how does increasing cache size affect miss rate? For a given cache size, what is the effect of increasing associativity?

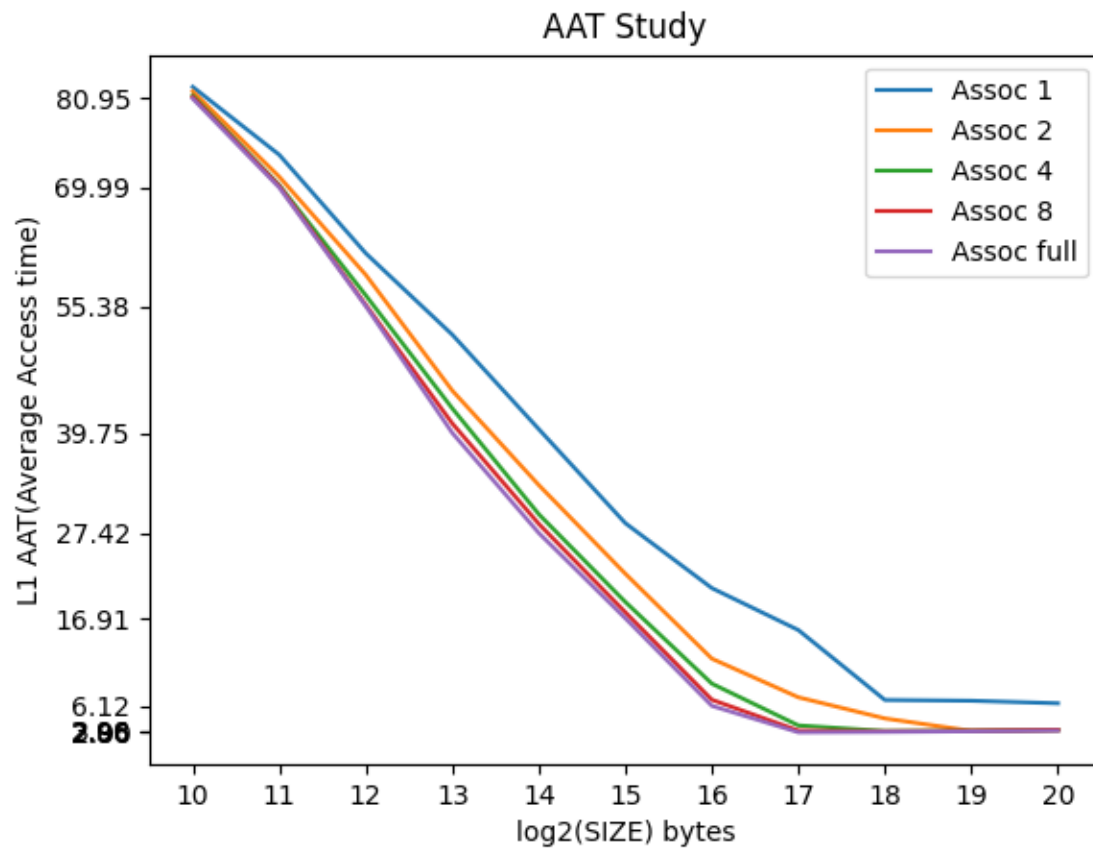
- ➔ As the cache size increases by fixating the associativity the miss rate decreases fast but after a certain cache size value it stays constant. For a given cache size, as the associativity increases the miss rate is also decreasing. From the given graph we can also say that there is not a huge difference between 8-way set and fully associative set.

Estimate the compulsory miss rate from the graph

- ➔ Compulsory miss rate is the rate at which the blocks are read for the first time in the cache from the main memory. So, from the graph we can say that the compulsory miss rate will be maximum when the cache size is significantly higher, and the associativity comes out to be fully associative. The miss rate is approximately  $\sim 0.25$

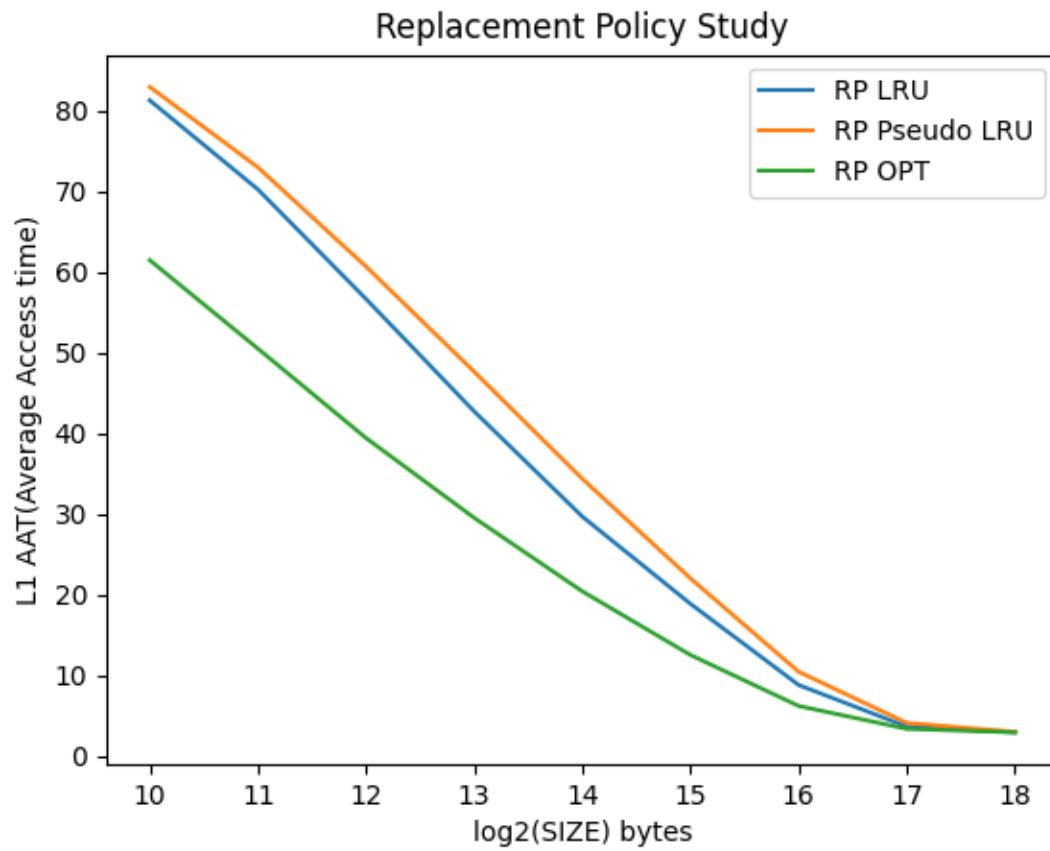
For each associativity, estimate the conflict miss rate from the graph.

- ➔ Conflict miss occurs due to insufficient cache associativity. To reduce the conflict, miss rate the associativity must be increased. Therefore, the conflict miss rate for fully associative cache can be considered as 0.



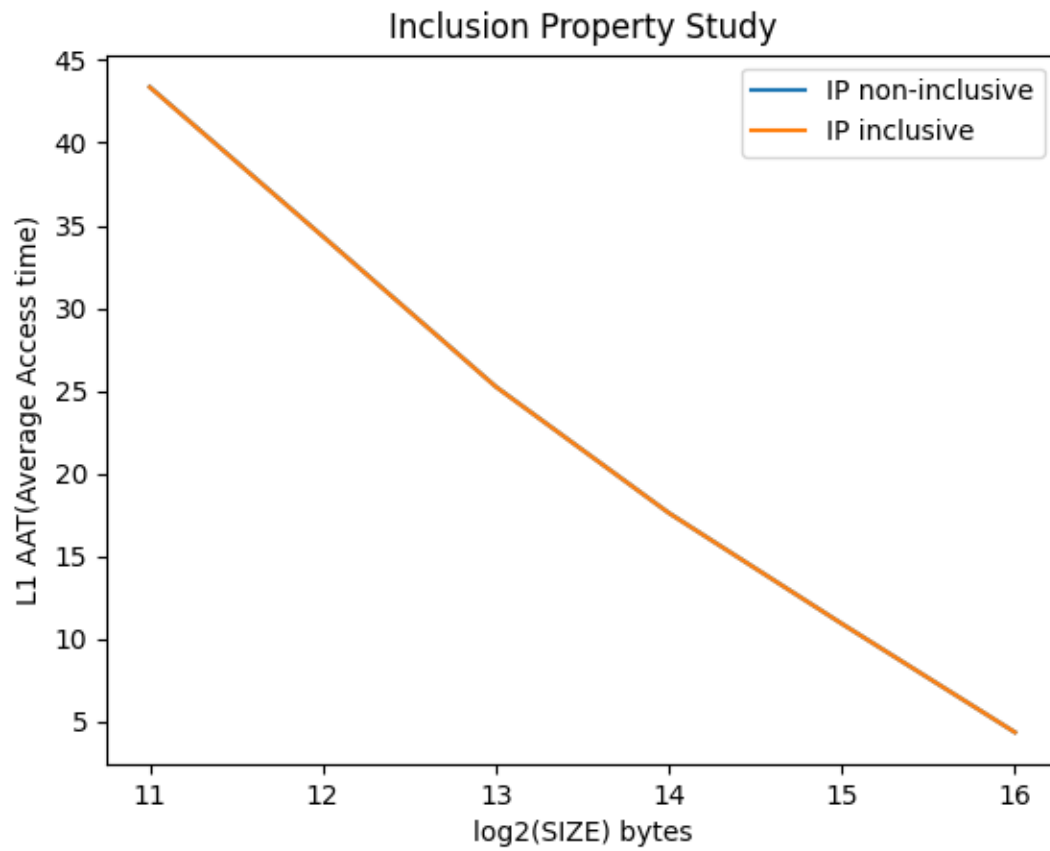
For a memory hierarchy with only an L1 cache and BLOCKSIZE = 32, which configuration yields the best (i.e., lowest) AAT?

➔ From the graph we can say that the best AAT is approx ~ 2.91 for L1 cache with full associativity.



Discuss trends in the graph. Which replacement policy yields the best (i.e., lowest) AAT?

➔ The OPT policy yields the lowest AAT followed by LRU and Pseudo LRU.



Discuss trends in the graph. Which inclusion property yields a better (i.e., lower) AAT?

- ➔ Both the properties are providing with the same result or almost the same result. Therefore, both are giving the best yield.