

University of Central Florida

Department of Computer Science

CDA 5106: Spring 2020

Machine Problem 1: Cache Design, Memory Hierarchy Design

by

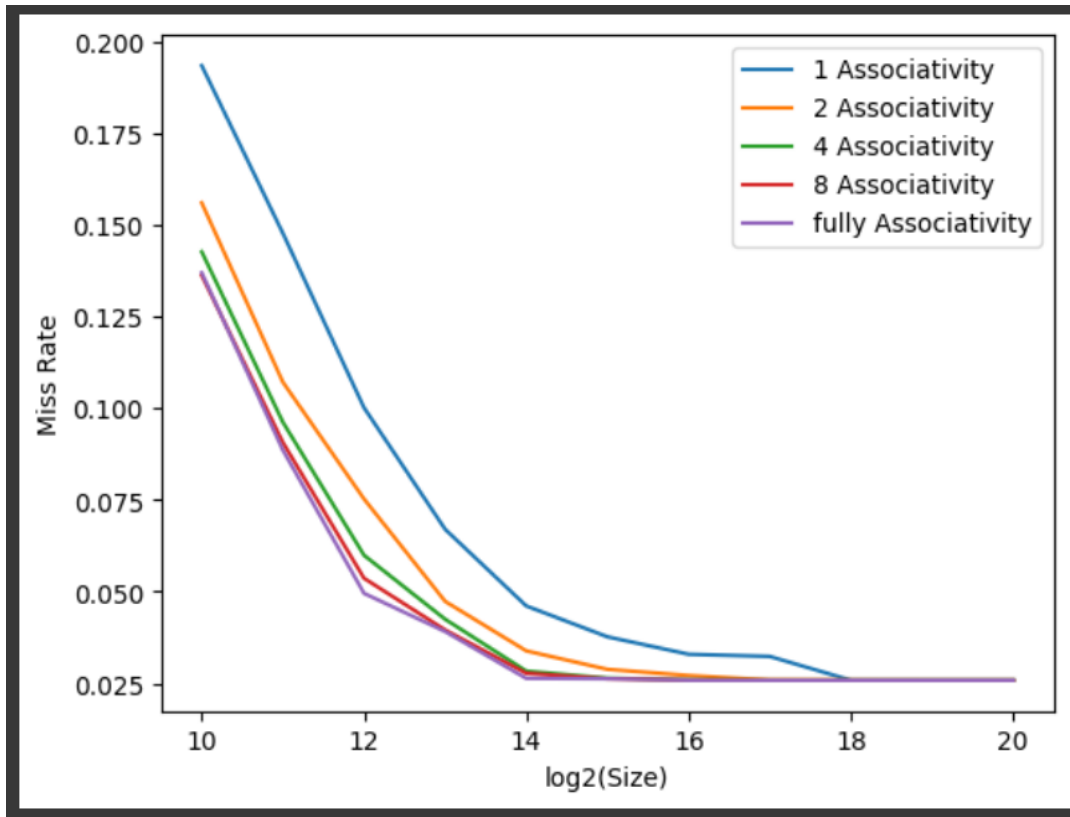
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Honor Pledge: "I have neither given nor received unauthorized aid on this test or assignment."

Student's electronic signature: Aditya Vardhan Mustyala

8.1. L1 cache exploration: SIZE and ASSOC

GRAPH #1 (total number of simulations: 55)



1. From the graph we can observe that Miss Rate decreases exponentially for each associativity as size increases, as we will have more space to allocate blocks. For a given cache size as we increase associativity Miss Rate decreases, Fully associative cache with larger size will have minimum miss rate.
2. Compulsory miss rate is defined as the misses that occur during the initial stage when cache is empty. It is unavoidable as there is no data in cache. Compulsory miss rate is invariant of associativity and is typically 1.1% of total miss rate.

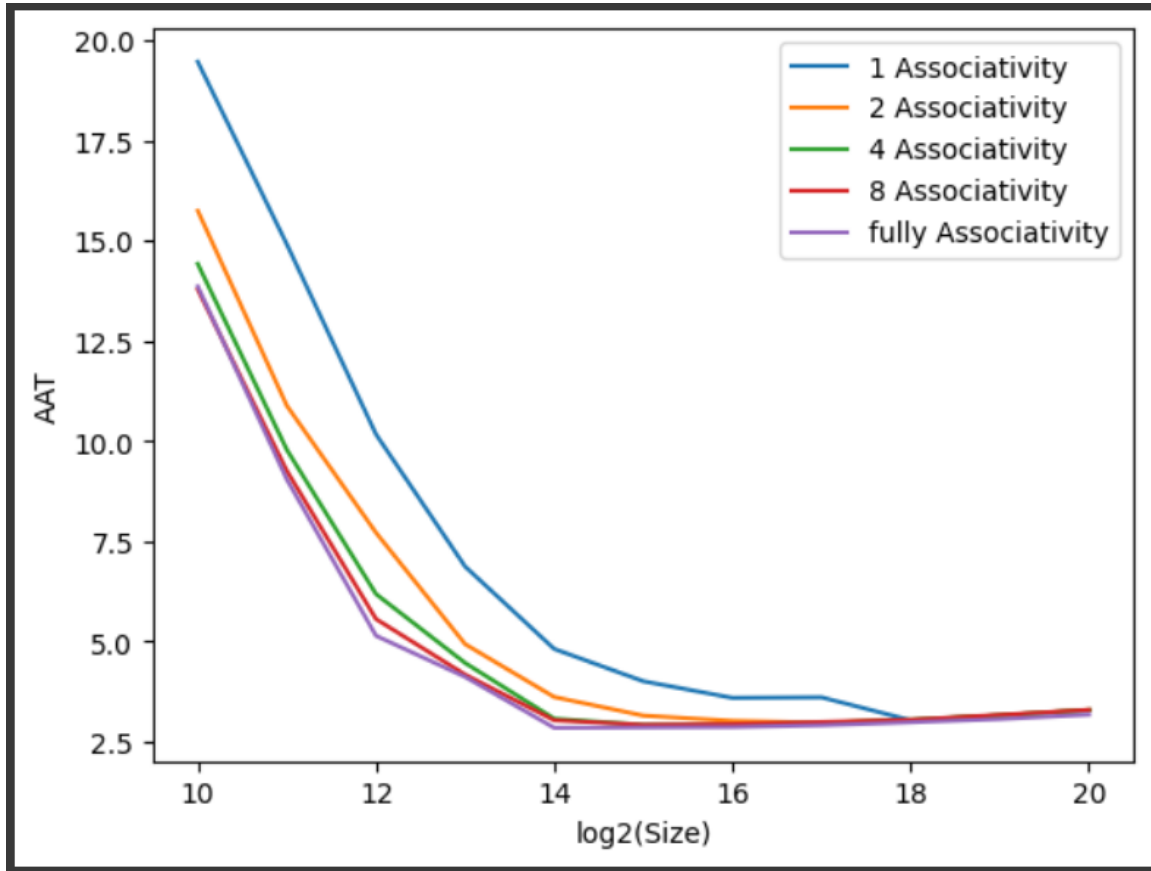
Miss Rate(1MB - Fully Associativity) is 0.02582

Hence compulsory miss rate of 1 MB cache with fully associative is

$1.1 \times (0.02582) / 100 = \mathbf{0.00028402\%}$ of total misses

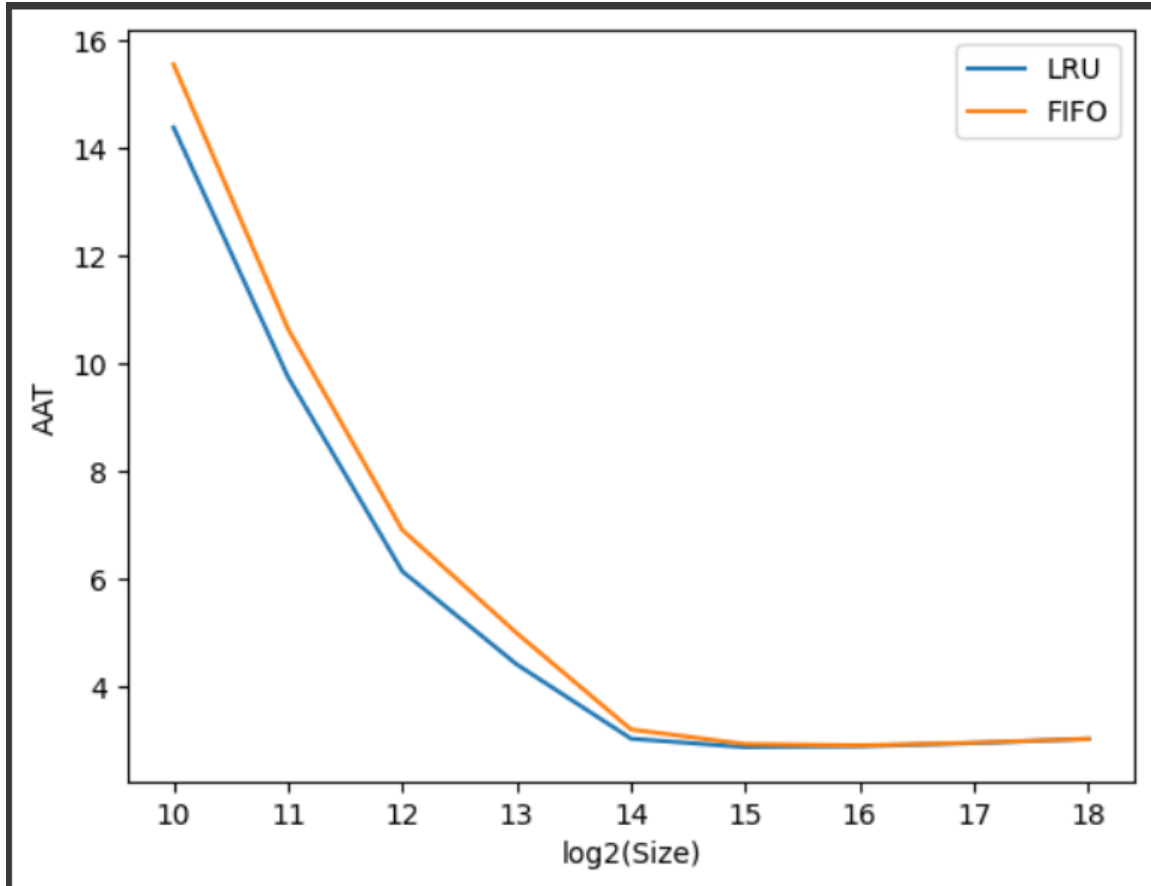
3. Conflict miss rate is defined as the misses occur in a set as it is filled fully and some victim block needs to be removed. These depend on the associativity where fully associative having least conflict miss rate as all block go to same set. From the graph we can see that miss rate decreases as associativity increases and as conflict miss rate is a portion of total miss rate, conflict miss rate also decreases with increasing associativity
ex. For 1MB fully associative cache conflict misses are 4% $\Rightarrow 4 \times (0.02582) / 100 = \mathbf{0.0010328\%}$

GRAPH #2



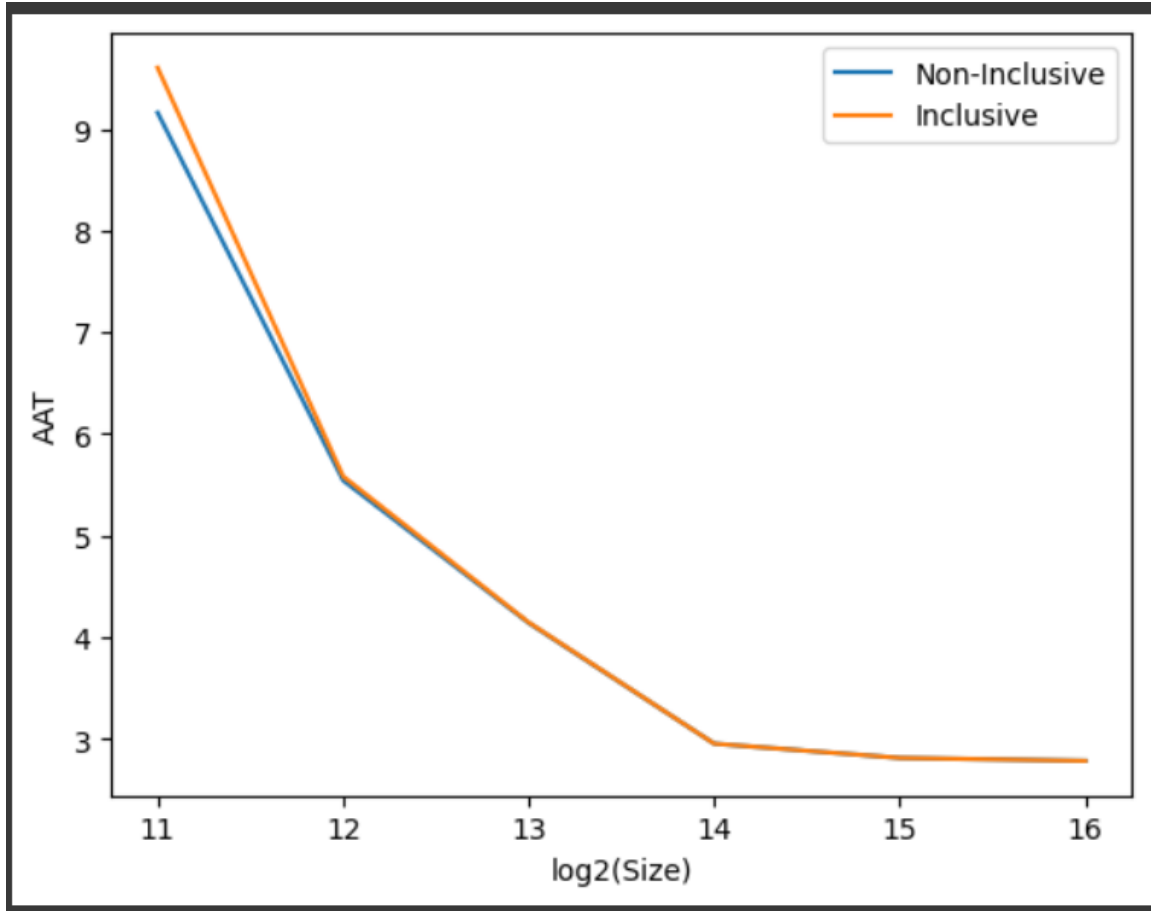
1. For memory hierarchy with only L1 and block size 32 the configuration that has least AAT(2.91125) is
cache size = 16KB with
associativity = Fully associative

8.2. Replacement policy study



1. LRU has less AAT in comparison to FIFO when the size is less, but as size increases both AATs come closer to each other. Overall LRU yields better results when compared to FIFO

8.3. Inclusion property study



1. As we can see in the graph above Non-inclusive property works better in lower sizes but as size increases miss rate become same for both inclusive and non-inclusive case. But on an average from the graph we can say that Non-inclusive property yields better results.