

University of Central Florida

Department of Computer Science

CDA 5106: Fall 2022

Machine Problem 1: Cache Design, Memory Hierarchy Design

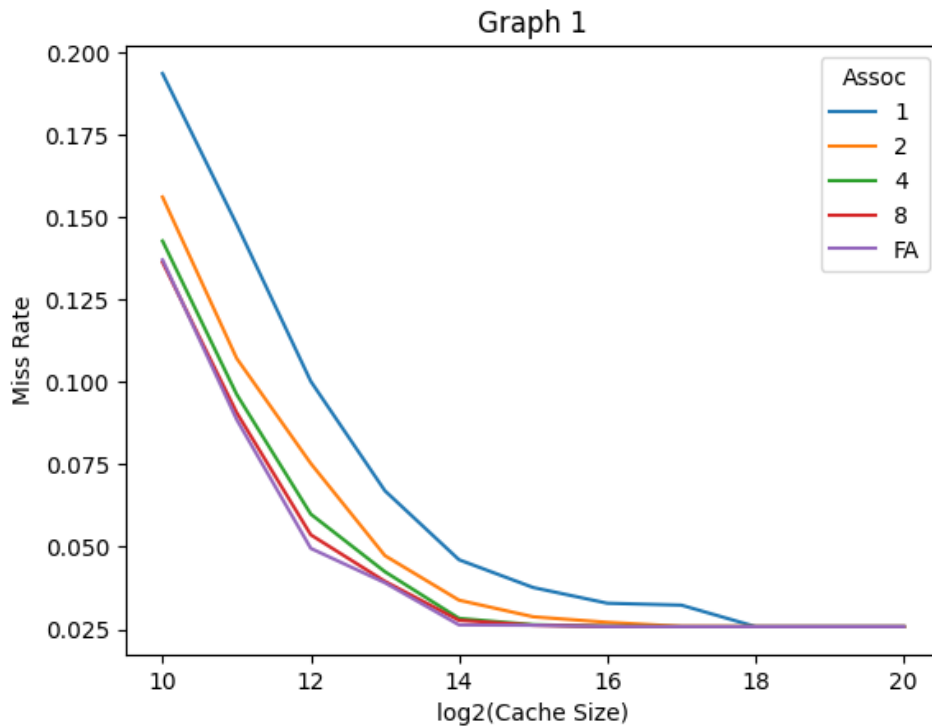
by

<< Qucheng Peng >>

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

Student's electronic signature: _____ Qucheng Peng _____
(sign by typing your name)

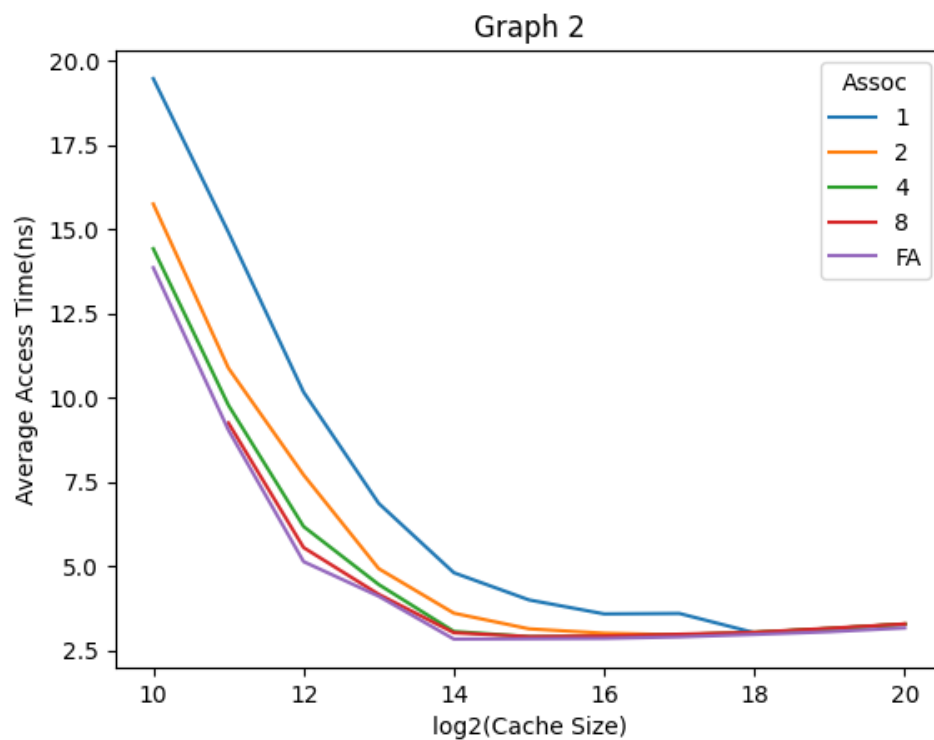
Graph 1



1. For a given associativity, when the cache size increases exponentially, the miss rate decreases exponentially. For a given cache size, the larger the associativity is, the smaller the miss rate is, but when the cache size is large enough, the miss rate has nothing to do with associativity.
2. The compulsory miss rate is 0.025820.
3. The conflict miss rate table is

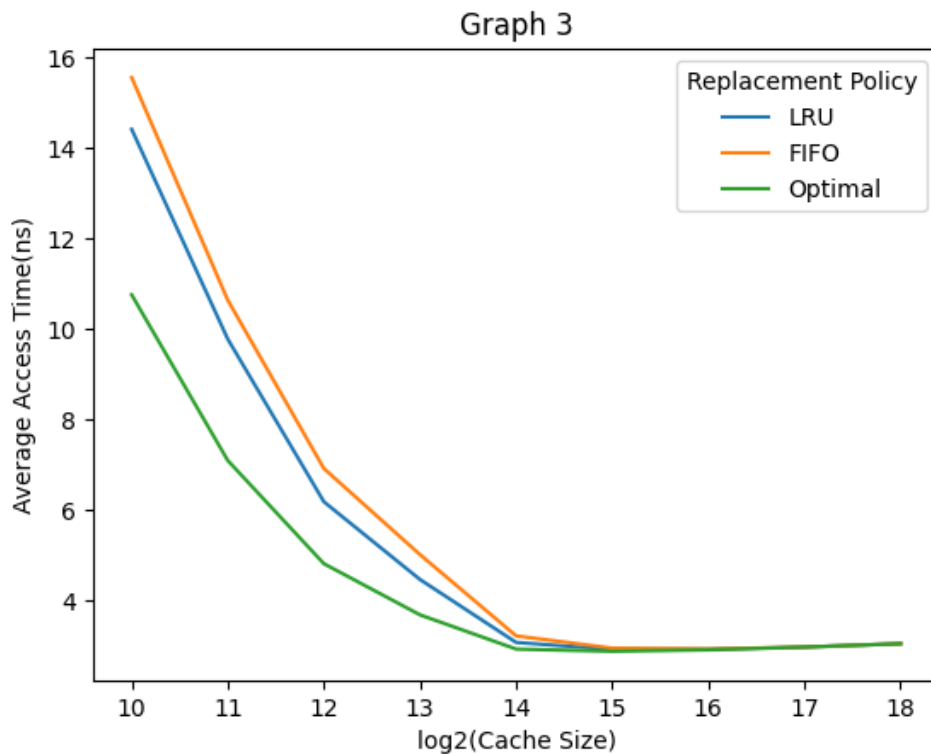
Cache size(KB)	Direct-Mapped	2-way Assoc	4-way Assoc	8-way Assoc
1	0.05650	0.01907	0.00574	-0.00069
2	0.05914	0.01854	0.00762	0.00209
4	0.05063	0.02574	0.01038	0.00411
8	0.02788	0.00822	0.00335	0.00420
16	0.01975	0.00750	0.00198	0.00140
32	0.01144	0.00257	0.00016	0.00001
64	0.00709	0.00130	0.00012	0.00006
128	0.00651	0.00008	0.00000	0.00000
256	0.00002	0.00002	0.00000	0.00000
512	0.00002	0.00000	0.00000	0.00000
1024	0.00002	0.00000	0.00000	0.00000

Graph 2



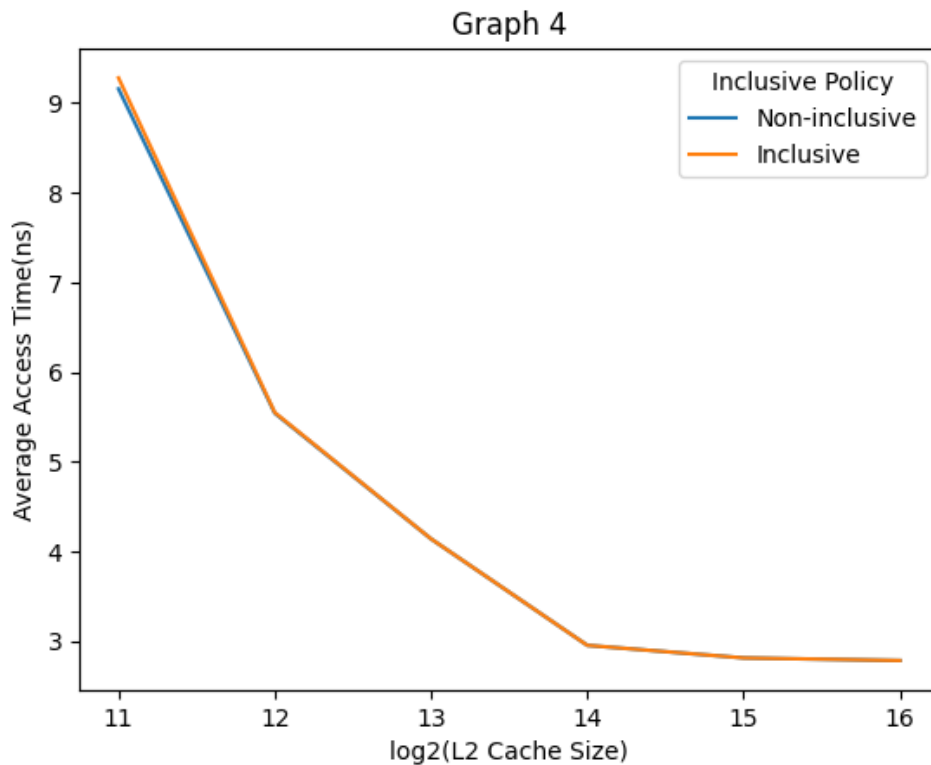
1. For the setting mentioned in the question, Fully-Associativity yields the best AAT.

Graph 3



1. For a given replacement policy, as the cache size grows exponentially, the AAT decreases exponentially. For a given cache size, generally Optimal is much better than LRU and FIFO, and LRU is obviously better than FIFO. But when the cache size is large enough, the AAT has nothing to do with the replacement policy. Optimal yields the best AAT.

Graph 4



1. For a given inclusion policy, as the cache size grows exponentially, the AAT decreases exponentially. For a given cache size, non-inclusive policy is better than inclusion policy at the beginning, but when the cache size is large enough, the difference between these two methods is very small. Generally, non-inclusive policy yields the best AAT.