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CS2200 Cache Report

Find the Best Cache

In this project, we designed a simple cache simulator for running some design experiments to find an optimal cache for the given workload. The cache size (C), block size(B) and associativity (S) can vary. However, the maximum size for cache is 32 KB, maximum block size is 64 bytes. Therefore, the maximum number for C is 15, and maximum number for B is 6.

The best cache has the lowest possible Average Access Time. The function for AAT is

AAT = Hit Time + Miss Rate * Miss Penalty

Given the function, we know that in order to get the lowest AAT, we need keep miss rate to be small. In order to make misses rate to be as small as possible, the size of cache and size of block should be as large as possible. So that the cache can store data as much as possible. So we keep number of C to be 15, and number of B to be 6. The way how cache associated will determine its performance.

Given the four traces file, we run the following bash file for each trace file in the Terminal.

Because C-B-S can not lower than 0, so the maximum value for S will be 9.

```
for (( b=0; b<=9; b++ )) do
        ./cachesim -c 15 -s $b -b 6 -i ./traces/astar.trace
done;
```

astar.trace: The lowest AAT is 7.306819 when C = 15, B= 6, S = 9

S	AAT
0	8.235293
1	7.470140
2	7.379605
3	7.373822
4	7.369834
5	7.363852
6	7.363652
7	7.362655
8	7.311605
9	7.306819

bzip2.trace: The lowest AAT is 2.154450 when C = 15, B = 6, S = 3

S	AAT
0	3.789486
1	2.207708
2	2.156653
3	2.154450
4	2.154450
5	2.154450
6	2.154450
7	2.154450
8	2.154450
9	2.154450

mcf.trace: The lowest AAT is 3.083711 when C= 15, B =6, S = 3

S	AAT
0	3.936774
1	3.493008
2	3.085877
3	3.083711
4	3.083711
5	3.083711
6	3.083711
7	3.083711
8	3.083711
9	3.083711

perlbench.trace: The lowest AAT is 4.872846 when C = 15, B = 6, S = 7

S	ATT
0	8.124062
1	5.385615
2	5.111495
3	4.943988
4	4.899647
5	4.880926
6	4.878955
7	4.872846
8	4.878364
9	4.876591

Based on the above tables, we can find best caches for 4 traces with lowest AAT.

astar.trace: The lowest AAT is 7.306819 when C = 15, B= 6, S = 9

bzip2.trace: The lowest AAT is 2.154450 when C = 15, B = 6, S = 3

mcf.trace: The lowest AAT is 3.083711 when C= 15, B =6, S = 3

perlbench.trace: The lowest AAT is 4.872846 when C = 15, B = 6, S = 7