

Homework 5 : Pathri Vidya Praveen - CS24BTECH11047

1. Cache reads : Varying lines (8,8)

	Lines(2^N)	Ways(2^N)	Blocks(2^N)	Hits	Misses	Hit rate
Program1	1	0	2	49	17	0.7424
Program1	2	0	2	49	17	0.7424
Program1	3	0	2	49	17	0.7424
Program2	1	0	2	2	64	0.0303
Program2	2	0	2	2	64	0.0303
Program2	3	0	2	3	63	0.04545

Cache reads: Varying lines (16,16)

	Lines(2^N)	Ways(2^N)	Blocks(2^N)	Hits	Misses	Hit rate
Program1	1	0	2	193	65	0.7481
Program1	2	0	2	193	65	0.7481
Program1	3	0	2	193	65	0.7481
Program2	1	0	2	2	256	0.007752
Program2	2	0	2	2	256	0.007752
Program2	3	0	2	2	256	0.007752

Cache reads: Varying blocks (8,8)

	Lines(2^N)	Ways(2^N)	Blocks(2^N)	Hits	Misses	Hit rate
Program1	3	0	3	57	9	0.8636
Program1	3	0	4	61	5	0.9242
Program1	3	0	5	63	3	0.9545
Program2	3	0	3	57	9	0.8636
Program2	3	0	4	61	5	0.9242
Program2	3	0	5	63	3	0.9545

Cache reads : Varying blocks (16,16)

	Lines(2^N)	Ways(2^N)	Blocks(2^N)	Hits	Misses	Hit rate
Program1	3	0	3	225	33	0.8721

Program1	3	0	4	241	17	0.9341
Program1	3	0	5	249	9	0.9651
Program2	3	0	3	2	256	0.007752
Program2	3	0	4	3	255	0.01163
Program2	3	0	5	247	11	0.9574

Cache reads : Varying ways (8,8)

	Lines(2^N)	Ways(2^N)	Blocks(2^N)	Hits	Misses	Hit rate
Program1	3	0	2	49	17	0.7424
Program1	3	1	2	49	17	0.7424
Program2	3	0	2	3	63	0.04545
Program2	3	1	2	49	17	0.7424

Cache reads : Varying ways (16,16)

	Lines(2^N)	Ways(2^N)	Blocks(2^N)	Hits	Misses	Hit rate
Program1	3	0	2	193	65	0.7481
Program1	3	1	2	193	65	0.7481
Program2	3	0	2	2	256	0.007752
Program2	3	1	2	2	256	0.007752

2. Write policies: Program 1 (8,8)

Write policy	Write allocate type	Blocks(2^N)	Lines(2^N)	Ways(2^N)	Hits	Misses	Hit rate	Write backs
Write through	Write allocate	2	5	0	49	17	0.7424	64
Write through	Without allocate	2	5	0	3	63	0.04545	64
Write back	Write allocate	2	5	0	49	17	0.7424	0
Write back	Without allocate	2	5	0	3	63	0.04545	62

Write policies : Program 1 (16,16)

Write policy	Write allocate type	Blocks(2^N)	Lines(2^N)	Ways(2^N)	Hits	Misses	Hit rate	Write backs
Write through	Write allocate	2	5	0	193	65	0.7481	256
Write through	Without allocate	2	5	0	3	255	0.01163	256
Write back	Write allocate	2	5	0	193	65	0.7481	33
Write back	Without allocate	2	5	0	3	255	0.01163	254

Write policies: Program 2 (8,8)

Write policy	Write allocate type	Blocks(2^N)	Lines(2^N)	Ways(2^N)	Hits	Misses	Hit rate	Write backs
Write through	Write allocate	2	5	0	49	17	0.7424	64
Write through	Without allocate	2	5	0	3	63	0.04545	64
Write back	Write allocate	2	5	0	49	17	0.7424	0
Write back	Without allocate	2	5	0	3	65	0.04545	62

Write policies : Program 2 (16,16)

Write policy	Write allocate type	Blocks(2^N)	Lines(2^N)	Ways(2^N)	Hits	Misses	Hit rate	Write backs
Write through	Write allocate	2	5	0	3	255	0.01163	256
Write through	Without allocate	2	5	0	3	255	0.01163	256
Write back	Write allocate	2	5	0	3	255	0.01163	223
Write back	Without allocate	2	5	0	3	255	0.01163	254

3. Associativity : Program 3 (8,8)

Policy	Blocks(2^N)	Lines(2^N)	Ways(2^N)	Hits	Misses	Hit rate	Write backs
32-entry 4-word direct mapped	2	5	0	2	128	0.01538	0
32-entry 4-word 2-way set associative	2	5	1	96	34	0.7385	0
32-entry 4-word fully associative	2	5	fully	96	34	0.7385	0

Associativity : Program 3 (16,16)

Policy	Blocks (2^N)	Lines(2^N)	Ways(2^N)	Hits	Misses	Hit rate	Write backs
32-entry 4-word direct mapped	2	5	0	35	479	0.06809	0
32-entry 4-word 2-way set associative	2	5	1	384	130	0.7471	0
32-entry 4-word fully associative	2	5	fully	384	130	0.7471	0

Report :

Program 1 (8,8) :

Changing lines from 1 to 3 had no effect on hit rate. Misses are likely compulsory and the program's sequential access (high spatial locality) does not benefit further. Increasing number of blocks significantly increases the hit rate because a large cache reduces capacity misses. Increasing associativity had no effect because program 1's sequential access does not create any conflict misses. With "write allocate" first write miss brings block in making all subsequent sequential stores to that block hits. "Write without allocate" never catches the block so every store is a miss.

Program 1 (16,16) :

Changing lines had no effect. Increasing the blocks reduces capacity misses with increase in hit rate. Changing associativity had no effect because misses are mostly capacity or compulsory not conflict misses. Write allocate has higher hit rate than write without allocate.

Program 2 (8,8) :

Changing lines has almost no effect because of low spatial locality and fetching large block is useless when next access is far away. Increasing blocks significantly increases hit rate and reducing capacity misses. Increasing ways drastically increase hit rate because 1 way caused many conflict misses. Write allocate better than write without allocate.

Program 2 (16,16) :

Changing lines had no effect because of spatial locality factor like above. If blocks is 5, hit rate drastically increased because 3 or 4 blocks cause capacity misses. Here increasing associativity don't have any effect because of more capacity misses than conflict misses because associativity cannot be fixed that. Here allocation policy had no much impact because of very high number of misses.

Program 3 (8,8) :

Hit rate drastically jumped for 2-way and same for fully associative. 2 ld instructions mapped to same cache set which is fixed by 2-way associativity.

Program 3 (16,16) :

Similar to (8,8) observation.