Robby Bergers

Cache Memory

Instruction sequence to multiply matrices (Row Major):

L-100,L-10c,L-101,L-10e,L-102,L-110,L-103,L-112,S-114,L-100,L-10d,L-101,L-10f,L-102,L-111,L-103,L-113,S-115,L-104,L-10c,L-105,L-10e,L-106,L-110,L-107,L-112,S-116,L-104,L-10d,L-105,L-10f,L-106,L-111,L-107,L-113,S-117,L-108,L-10c,L-109,L-110,L-10b,L-112,S-118,L-108,L-10d,L-109,L-10f,L-109,L-111,L-106,L-113,S-119

Cache Comparison

1. Direct Mapped Cache[4]

HIT 63% MISS 37% || ADD. RESOURCES 1448 NAND

Instruction Breakdown

TAG	INDEX	OFFSET
7 bit	2 bit	2 bit

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	0010001	BLOCK 44 WORD 0 - 3	0
1	1	0010000	BLOCK 41 WORD 0 - 3	0
2	1	0010001	BLOCK 46 WORD 0 - 3	0
3	1	0010000	BLOCK 43 WORD 0 - 3	0

2. Fully Associative Cache[4]

HIT 81% MISS 19% || ADD. RESOURCES 5736 NAND

Instruction Breakdown

TAG	OFFSET
9 bit	2 bit

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	70	BLOCK 46 WORD 0 - 3	1
1	1	65	BLOCK 41 WORD 0 - 3	0
2	1	67	BLOCK 43 WORD 0 - 3	0
3	1	68	BLOCK 44 WORD 0 - 3	0

3. 2-Way Set Associative Cache[2]

HIT 73% MISS 27% || ADD. RESOURCES 1808 NAND

Instruction Breakdown

TAG	INDEX	OFFSET
8 bit	1 bit	2 bit

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	34	B. 44 W. 0 - 3	0
1	1	32	B. 41 W. 0 - 3	0

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	35	B. 46 W. 0 - 3	1
1	1	34	B. 45 W. 0 - 3	0

4. 4-Way Set Associative Cache[1]

HIT 81% MISS 19% || ADD. RESOURCES 2252 NAND

Instruction Breakdown

TAG	INDEX	OFFSET
9 bit	0 bit	2 bit

Cache Table

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	70	B. 46 W. 0 - 3	1

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	65	B. 41 W. 0 - 3	0

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	67	B. 43 W. 0 - 3	0

Index	Valid	Tag	Data (Hex)	Dirty Bit
0	1	68	B. 44 W. 0 - 3	0

The two cache types that had the highest success rate were the 4-Way Set Associative Cache and the Fully Associative Cache, both had an 81% hit rate, but since the Fully Associative Cache used more than twice as many resources, the 4-Way Set Associative Cache is the better option.

Instruction sequence to multiply matrices (Column Major):

L-100,L-10C,L-101,L-10D,L-102,L-11E,L-103,L-10F,S-10F,L-100,L-110,L-101,L-111,L-102,L-112,L-103,L-113,S-115,L-104,L-10C,L-105,L-10D,L-106,L-10E,L-107,L-10F,S-116,L-104,L-110,L-105,L-111,L-106,L-112,L-107,L-113,S-117,L-108,L-10C,L-109,L-10D,L-10A,L-10E,L-10B,L-10F,S-118,L-108,L-110,L-109,L-111,L-10A,L-112,L-10B,L-113,S-119

In column major, all caches use similar resources, but the 2-Way Set Associative Cache hit rate decreases from 73% to 72%.