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ha

CQ1: FactRec: the function s bad locality; there is error in this function; it has temporal locality.

FactIter: the function has good locality, and it has temporal locality.

CQ2: a) N=2, B=4, R= 32/(2×4) =4.,

b= $\log_2(B) = \log_2(4) = 2$. s= $\log_2(R) = \log_2(4) = 2$.

t: m-s-b: 16-2-2=12.

Address	Index	Block Offset	Hit or Miss	Type of Miss
1000 8	10	00	Miss	Cold
1011 11	10	11	Hit	
1001 9	10	01	Hit.	
0111 7	01	11	Miss	Cold
1111 15	11	11	Miss	Cold
0000 0	00	00	Miss	Cold
0110 22	01	10	Miss	Conflict.
0010 2	00	10	Hit	
0110 6	01	10	Miss	Conflict
0011 3	00	11	Hit.	

b) 4 sets, each set has two lines, each line contain 4 bytes of data.

00				
01				
10				
11				

00				
01				
10	8	9	10	11
11				

insert 8 (1000) => miss

00				
01				
10	8	9	10	11
11				

11 hits.

00				
01				
10	8	9	10	11
11				

9 hits.

00				
01	4	5	6	7
10	8	9	10	11
11				

insert 7 (0111) => miss

00				
01	4 12	5 13	6 14	7 15
10	8	9	10	11
11				

insert 15 (10111) => miss

00	0	1	2	3
01	4 12	5 13	6 14	7 15
10	8	9	10	11
11				

insert 0 (0000)

00	0	1	2	3
01	20 12	21 13	22 14	23 15
10	8	9	10	11
11				

insert 22. (10110) => conflict.

00	0	1	2	3
01	20 12	21 13	22 14	23 15
10	8	9	10	11
11				

2 hits.

00	0	1	2	3
01	20 4	21 5	22 6	23 7
10	8	9	10	11
11				

insert 6 (0110) => conflict.

00	0	1	2	3
01	20 12	21 13	22 14	23 15
10	8	9	10	11
11				

3 hit.

Q3. a) P1 AMAT = 1.26 + 3.6% × 100 = 4.86 ns

P2 AMAT = 2.17 + 3.1% × 100 = 5.27 ns.

b) P1 CPI_{stall} = 2 + 50% × 3.6% × 100 / 1.26 = 3.43.

P2 CPI_{stall} = 2 + 50% × 3.1% × 100 / 2.17. = 2.71.

P2 is faster for this program.

c) P1 AMAT = 1.26 + 3.6% × (21.24 + 42% × 100) = 3.54 ns.

inclusion of L2 result in an improvement

d) P_1 CPI_{stall}

= 2 + 50% × (3.6% × 21.24 × 1/1.26 + 3.6% × 42% × 100 × 1/1.26)

= 2.90

e). now P2 is still faster.

Assume the new miss rate = x

$2.71 = 2 + 50\% \times (x \times 21.24 \times 1/1.26 + x \times 42\% \times 100 \times 1/1.26)$

$1.42 = x \times (21.24 \times 1/1.26 + 42\% \times 100 \times 1/1.26)$

$x = 0.0283$.

Q4.

(a) iteration $i = \frac{N}{2}$

(i): cache miss = $i/4 = N/8 = 4107$

(ii): cache miss rate = $(i/4)/i = 25\%$.

(iii): cold miss ; conflict miss.

(b) (i) cache miss = $(N/4)/2 + (N/4)/2 = N/4 = 8215$.

(ii) cache miss rate = $(N/4)/2N = 12.5\%$.

(iii) cold miss

Q5. (a) Normalized run faster since it runs on row-major order, LLC-load support this point.

(b). The miss rate increase at $N > 128$, because at $N = 128$, the size of the matrix is $128^2 \times 8$, and it would exceed L2 cache for any greater value. And it is not a sharp "jump" since L3 cache could is not exceed until $N = 512$, during that time N is too large for L3.

(c).