

Problem 1

tag 26 | CI 4 | Byte 2

a)	Byte	CI	tag	Hit/Miss
24	0	0110	0	Miss
856	0	0110	1101	Miss
700	0	1111	1010	Miss
856	0	0110	1101	Hit
24	0	0110	0000	Miss
336	0	0100	0101	Miss
260	0	0001	0001	Miss
696	0	1110	1110	Miss
256	0	0000	0000	Miss
420	0	1001	1001	Miss
340	0	0101	0101	Miss
860	0	0111	0111	Miss

b)	Byte	CI	tag	Hit/Miss
24	000	011	0000	Miss
856	000	011	1101	Miss
700	100	111	1010	Miss
856	000	011	1101	Hit
24	000	011	0000	Miss
336	000	010	0101	Miss
260	100	000	0100	Miss
696	000	111	1010	Hit
256	000	000	0100	Hit

420	100	100	0110	Miss
340	100	010	0101	Hit
860	100	011	1101	Miss

Problem 2

$$AMAT = 1 + 0.1(5 + 0.2(100 + 0.05(100000)))$$

$$= 103.5 \text{ cycles}$$

- a) disk, because it has the largest impact on AMAT
- b) L2, because it has the lowest impact on AMAT
- c) L1, the miss rate of L1 has largest impact
- d) Memory, the miss rate has the smallest impact

Problem 3

a) direct map, 16x4 byte block

Byte Address	Block Address	Miss / Hit
4	1	Miss
16	4	Miss
32	8	Miss
20	5	Miss
80	20	Miss
68	17	Miss
76	19	Miss
224	56	Miss
36	9	Miss

44	11	Miss
16	4	Miss
172	43	Miss
20	5	Hit
24	6	Miss
36	9	Hit
68	17	Hit

Final Cache Content		
Block	Address	Data
0		
1		71
2		
3		79
4		19
5		23
6		27
7		
8		227
9		39
10		
11		175
12		
13		
14		

15

16

b) Direct mapped, 16 bytes block, 64 bytes in total

Byte Address	Block Address	Miss / Hit
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4

0

Miss

16

1

Miss

32

2

Miss

20

1

Hit

80

5

Miss

68

4

Miss

76

4

Hit

224

4

Miss

36

2

Miss

44

2

Hit

16

1

Miss

172

10

Miss

20

1

Hit

24

1

Hit

36

2

Miss

68

4

Hit

Final Cache

Content

Block Address

Data

0

79

1	31
2	47
3	

c) 2-way associative

Byte Address	Block Address	Miss / Hit
4	1	Miss
16	4	Miss
32	8	Miss
20	5	Miss
80	20	Miss
68	17	Miss
76	19	Miss
224	56	Miss
36	9	Miss
44	11	Miss
16	4	Hit
172	43	Miss
20	5	Hit
24	6	Miss
36	9	Hit
68	17	Hit

Block	Address	Left	Right
0		35	227
1		39	71
2			
3		175	47
4		19	83
5		23	
6		27	
7			

d) fully associative

Byte	Address	Block	Address	Miss / Hit
	4		1	Miss
	16		4	Miss
	32		8	Miss
	20		5	Miss
	80		20	Miss
	68		17	Miss
	76		19	Miss
	224		56	Miss
	36		9	Miss
	44		11	Miss

16	4	Hit
172	43	Miss
20	5	Hit
24	6	Miss
36	9	Hit
68	17	Hit

Block	Address	Data
0		7
1		19
2		35
3		23
4		83
5		71
6		79
7		227
8		39
9		47
10		175
11		27
12		
13		
14		
15		

Problem 4

a) BS: 2 bits

CI: 4 bits

Tag: 26 bits

$$\text{total} = 16 \cdot (1 + 26 + 32) = 944$$

Valid
1 bit

Tag
26 bits

Data
32 bits

b) Valid
1 bit

Tag
26 bits

Data
128 bits

$$\text{total} = 4 \cdot (1 + 26 + 128) = 620 \text{ bits}$$

c) Valid
1 bit

Tag
27 bits

Data
8 bits

Data
8 bits

Data
8 bits

Data
8 bits

Valid
1 bit

$$\text{total} = 2 \cdot (8 \cdot (1 + 27 + 32)) = 960$$

d) Valid
1 bit

Tag
30 bits

Data
32 bits

$$\text{total} = 16 \cdot (1 + 30 + 32) = 1008$$