Solution 3

1.

(a) Direct-mapped: 3-bit **Block = A_{6-4}**, 2-bit **Word = A_{3-2}**; miss rate = 6/10.

Tag	Word 3	Word 2	Word 1	Word 0	
1	[8C]	[88]	[84]	[80]	Block 0
					Block 1
0	[2C]	[28]	[24]	[20]	Block 2
					Block 3
1	[CC]	[C8]	[C4]	[C0]	Block 4
					Block 5
					Block 6
					Block 7

(b) 4-way set-associative: 1-bit **Set = A_4**, 2-bit **Word = A_{3-2}**; miss rate = 6/10.

Tag	Word 3	Word 2	Word 1	Word 0	
110	[CC]	[C8]	[C4]	[C0]	Set 0
010	[4C]	[48]	[44]	[40]	Set 0
001	[2C]	[28]	[24]	[20]	Set 0
100	[8C]	[88]	[84]	[80]	Set 0
					Set 1
					Set 1
					Set 1
					Set 1

(c) Fully associative: 2-bit **Word = A_{3-2}**; miss rate = 5/10.

Tag	Word 3	Word 2	Word 1	Word 0
1000	[8C]	[88]	[84]	[80]
0100	[4C]	[48]	[44]	[40]
0010	[2C]	[28]	[24]	[20]
0000	[0C]	[08]	[04]	[00]
1100	[CC]	[C8]	[C4]	[C0]

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2.

(a) Direct-mapped: 2-bit **Block = A_{6-5}**, 3-bit **Word = A_{4-2}**; miss rate = 5/10.

Tag	Word 7	Word 6	Word 5	Word 4	Word 3	Word 2	Word 1	Word 0	
00001	[09C]	[098]	[094]	[090]	[08C]	[088]	[084]	[080]	Block 0
00100	[23C]	[238]	[234]	[230]	[22C]	[228]	[224]	[220]	Block 1
00100	[25C]	[258]	[254]	[250]	[24C]	[248]	[244]	[240]	Block 2
									Block 3

(b) 4-way set-associative: 1-bit **Set = A_5**, 3-bit **Word = A_{4-2}**; miss rate = 5/10.

Tag	Word 7	Word 6	Word 5	Word 4	Word 3	Word 2	Word 1	Word 0	
001000	[21C]	[218]	[214]	[210]	[20C]	[208]	[204]	[200]	Set 0
000010	[09C]	[098]	[094]	[090]	[08C]	[088]	[084]	[080]	Set 0
001000	[23C]	[238]	[234]	[230]	[22C]	[228]	[224]	[220]	Set 1
									Set 1

(c) Fully associative: 3-bit **Word = A_{4-2}**; miss rate = 4/10.

Tag	Word 7	Word 6	Word 5	Word 4	Word 3	Word 2	Word 1	Word 0
0000100	[09C]	[098]	[094]	[090]	[08C]	[088]	[084]	[080]
0010010	[25C]	[258]	[254]	[250]	[24C]	[248]	[244]	[240]
0010000	[21C]	[218]	[214]	[210]	[20C]	[208]	[204]	[200]
0010001	[23C]	[238]	[234]	[230]	[22C]	[228]	[224]	[220]

3.

$T_{ave} = h_1C_1 + (1-h_1)h_2C_2 + (1-h_1)(1-h_2)M = 7.2\tau - 4.8h_2$.

If **$h_2 = 1$** (i.e., 100% hit rate), then **$T_{ave} = 2.4\tau$** (minimum).

If **$T_{ave} = 4\tau$**, then **$h_2 = 2/3$** (i.e., 67% hit rate).

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