

1.

Open question. The general answer is there is no need. The fundamental benefit of exclusive state is to have the only clean copy in one core's private cache to avoid the write upgrade broadcasting in bus snooping (or communicating with the directory in directory-based).

Updating from shared to exclusive upon eviction causes overheads and may performs worse compared to the write upgrade broadcasting.

2.

Cache Coherence describes the behavior of reads and writes to the same memory location. It is concerned with the ordering of writes to a single memory location.

Memory consistency describes the behavior of reads and writes in relation to other locations. It handles the ordering of reads and writes to all memory locations.

initially A=B=0

process 1	process 2
store A : 1	load B (gets 1)
store B : 1	load A (gets 0)

This trace is coherent:

for A the order is: proc2 loads A (gets 0), proc1 stores A : 1

for B the order is: proc1 stores B : 1, proc2 loads B (gets 1)

But it is not consistent. Since if proc2 load B returns 1, then proc1 store A : 1 already happened and proc2 load A should also return 1.

3.

a)

0	17	34	19	4	21	6	7
8	9	10	11	12	13	14	15

Hit rate: 2/12

b)

16;17	34;35	4;5	6;7	8;9	10;11	12;13	14;15
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Hit rate: 1/12

c)

00	16;17	48;49
01	18;19	34;35
10	20;21	4;5
11	6;7	14;15

Hit rate: 5/12