

"caches"

Review
caching

K: \rightarrow cache.

K+1: .

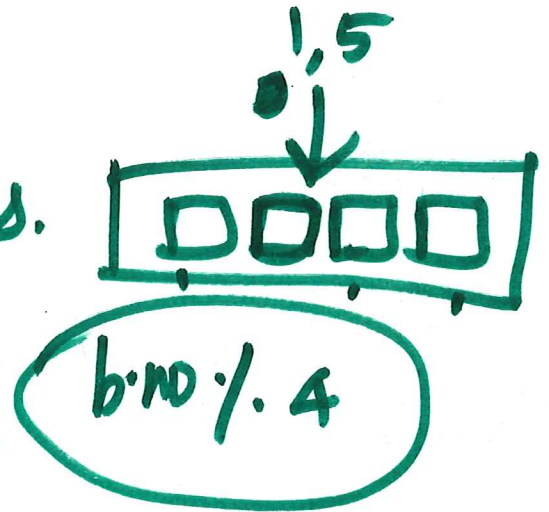
Cache hit

Cache miss

1. cold miss
2. conflict miss.

3. capacity miss

workingset $>$ cache set.



Replacement policies

LRU.

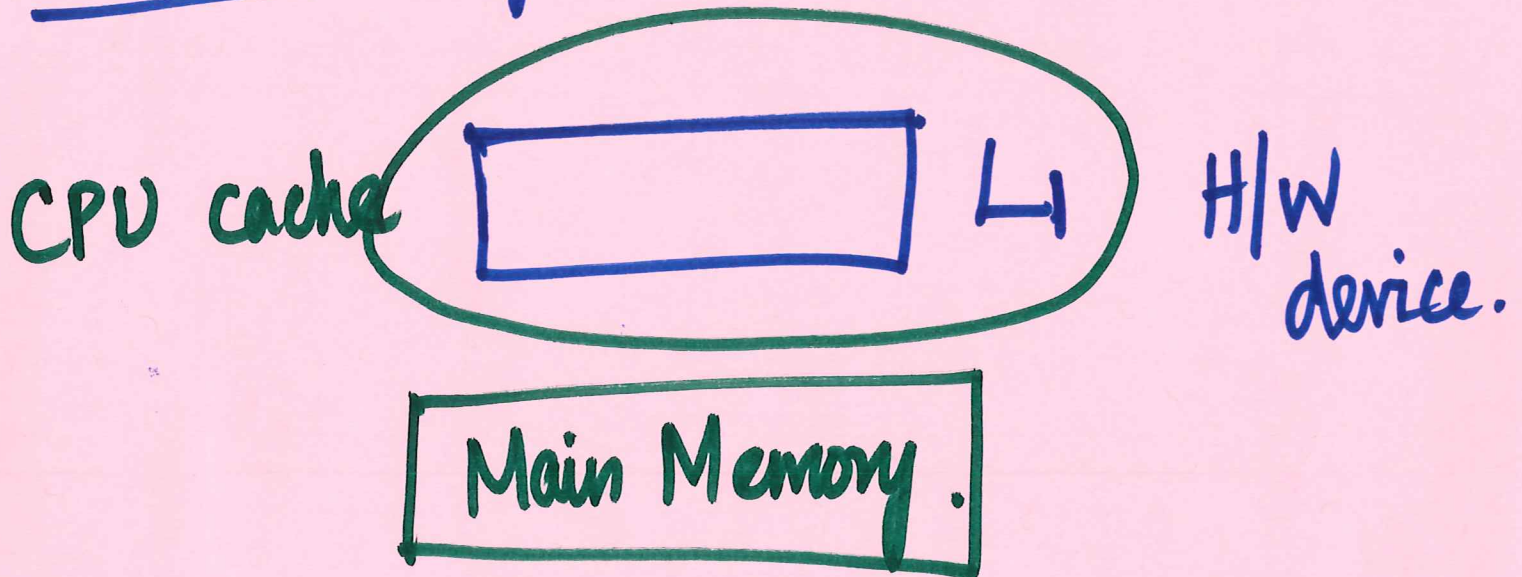
Block = group of words

Word = " " bytes

⇒ Block = group of bytes

Lecture 25

Cache Organization



32-bit system

Addr = 32-bits

$$\begin{aligned} \text{Total addr} &= 2^{32} \\ &= 2^2 \times 2^{30} \end{aligned}$$

b₃ b₂ b₁ b₀

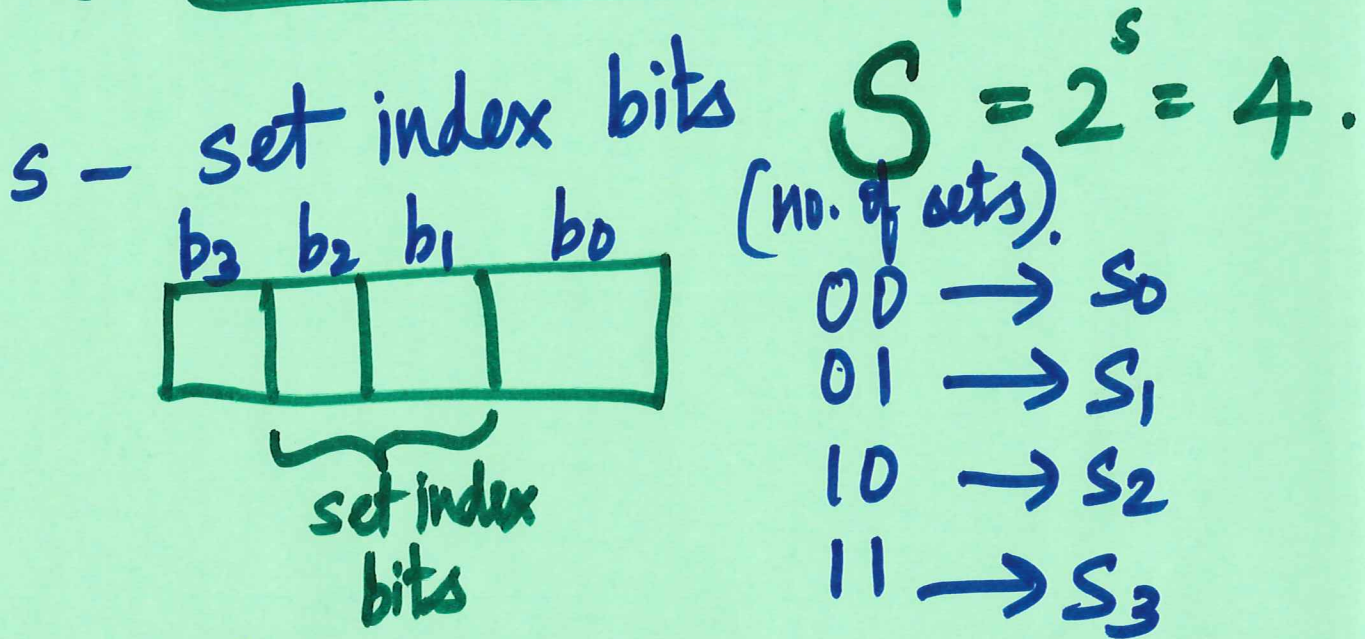
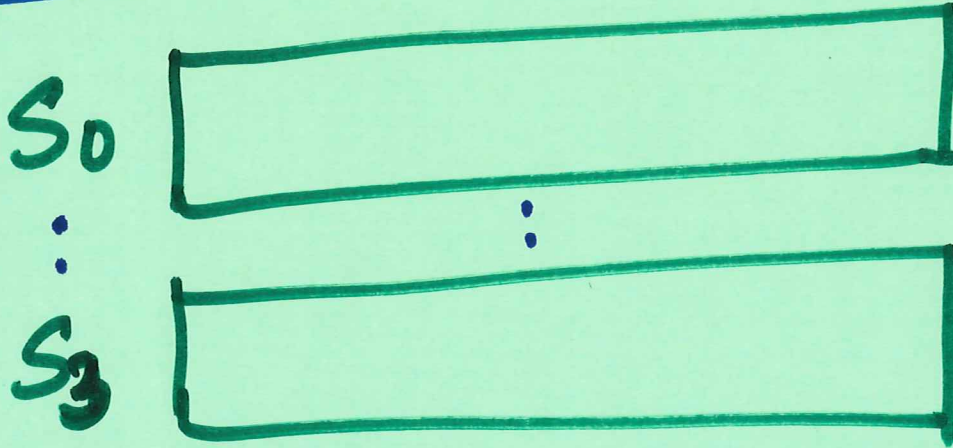
if addr bits = 4

⇒ Total addr = 2^4

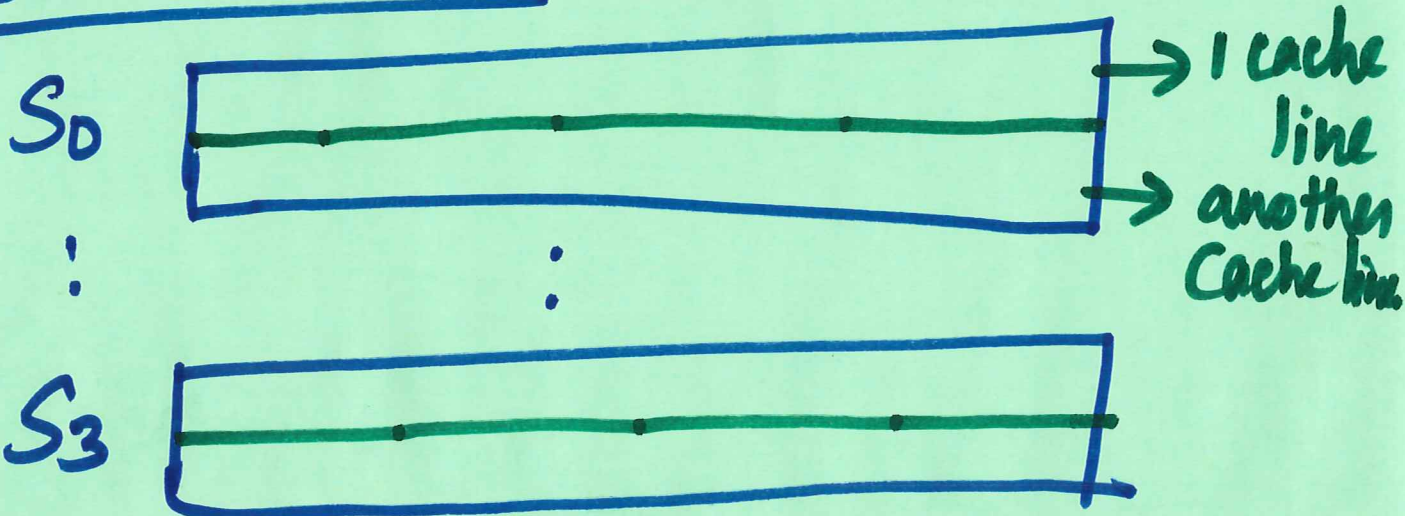
16

Cache

1. Sets



2. Cache Lines

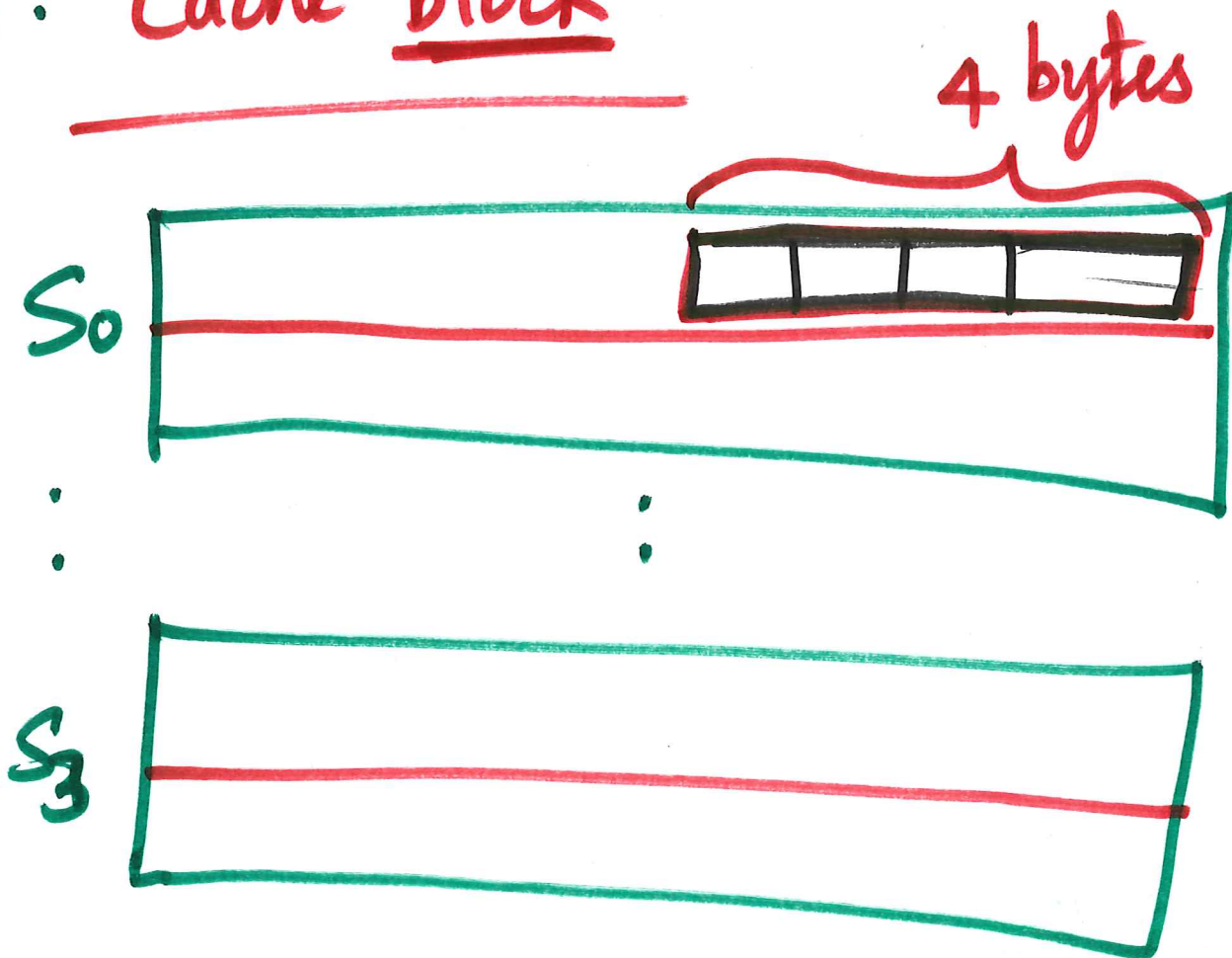


No. of Cache lines (E) / set.

eg. $E = 2$

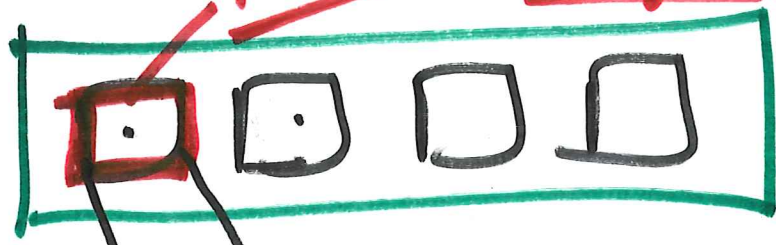
E - no. of cache lines / set.

3. Cache block

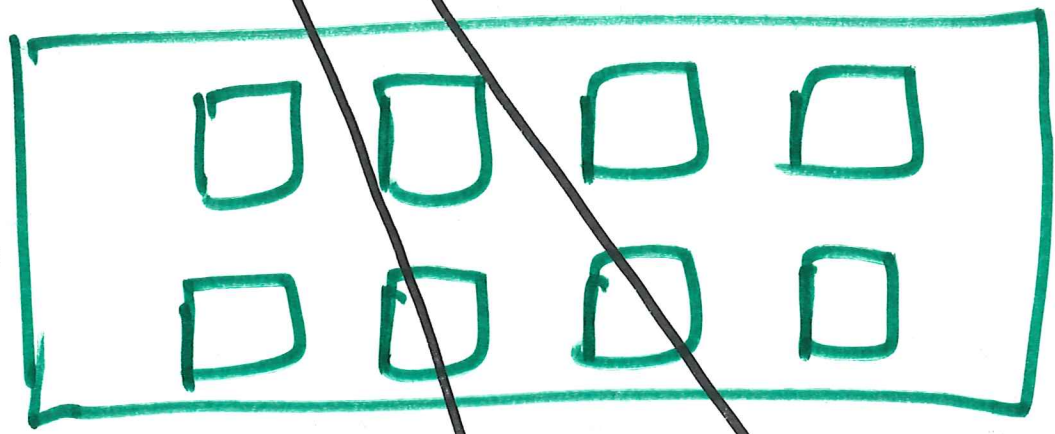


1 block = 4 bytes

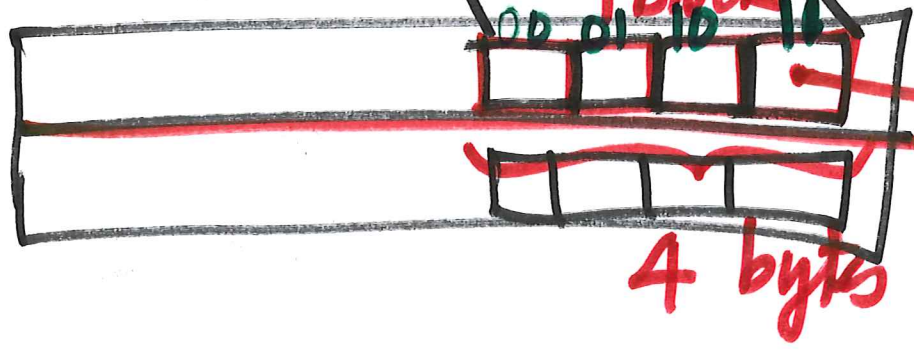
K:



K+1:



S₀



1 byte

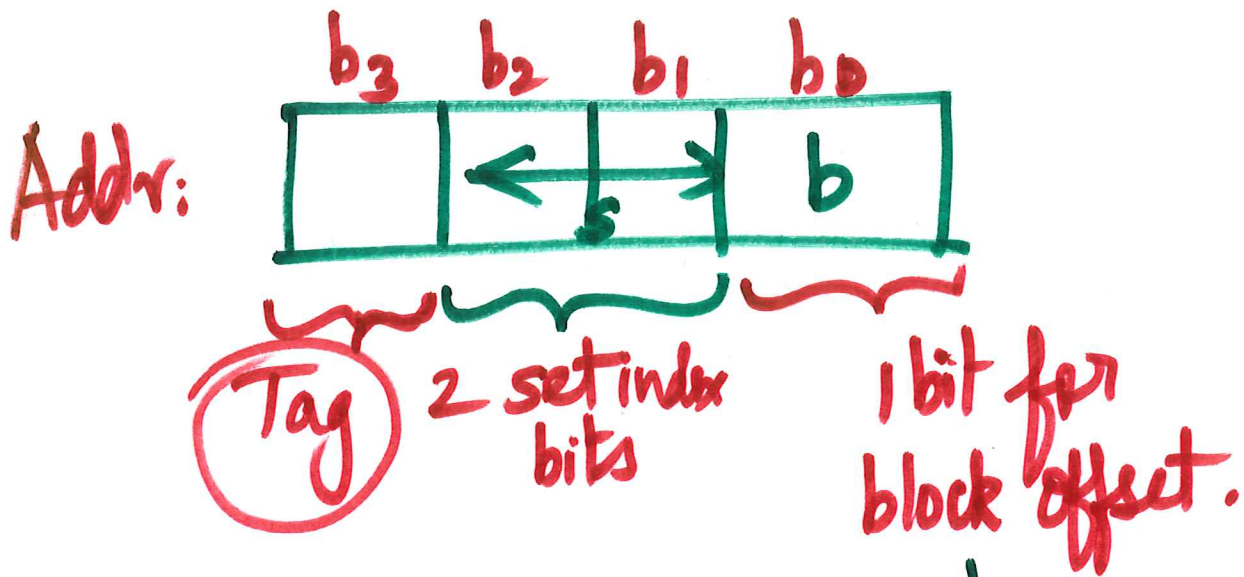
4 bytes

S₁



$b = 2$

2 bits to access
4 bytes



↓ specific
 to find the \wedge bytes
 within the block.

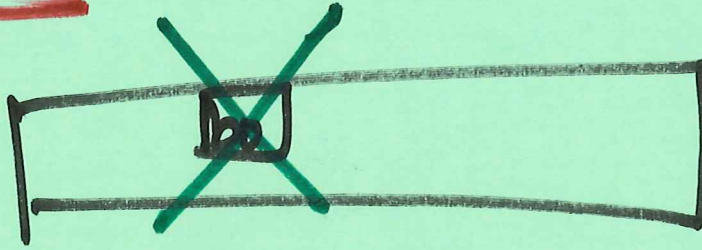
if $b = 3$

⇒ you can have 8 bytes in a block.

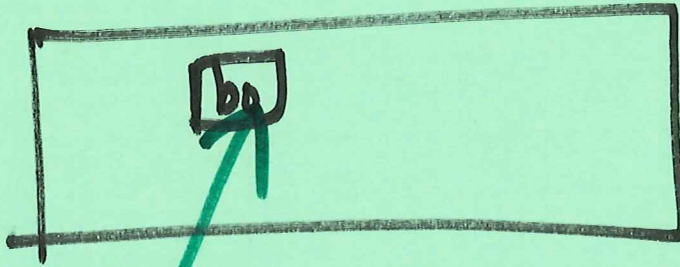
No. of bytes in a block in a cache line $(B) = 2^b$

Valid bit

K



K+1:



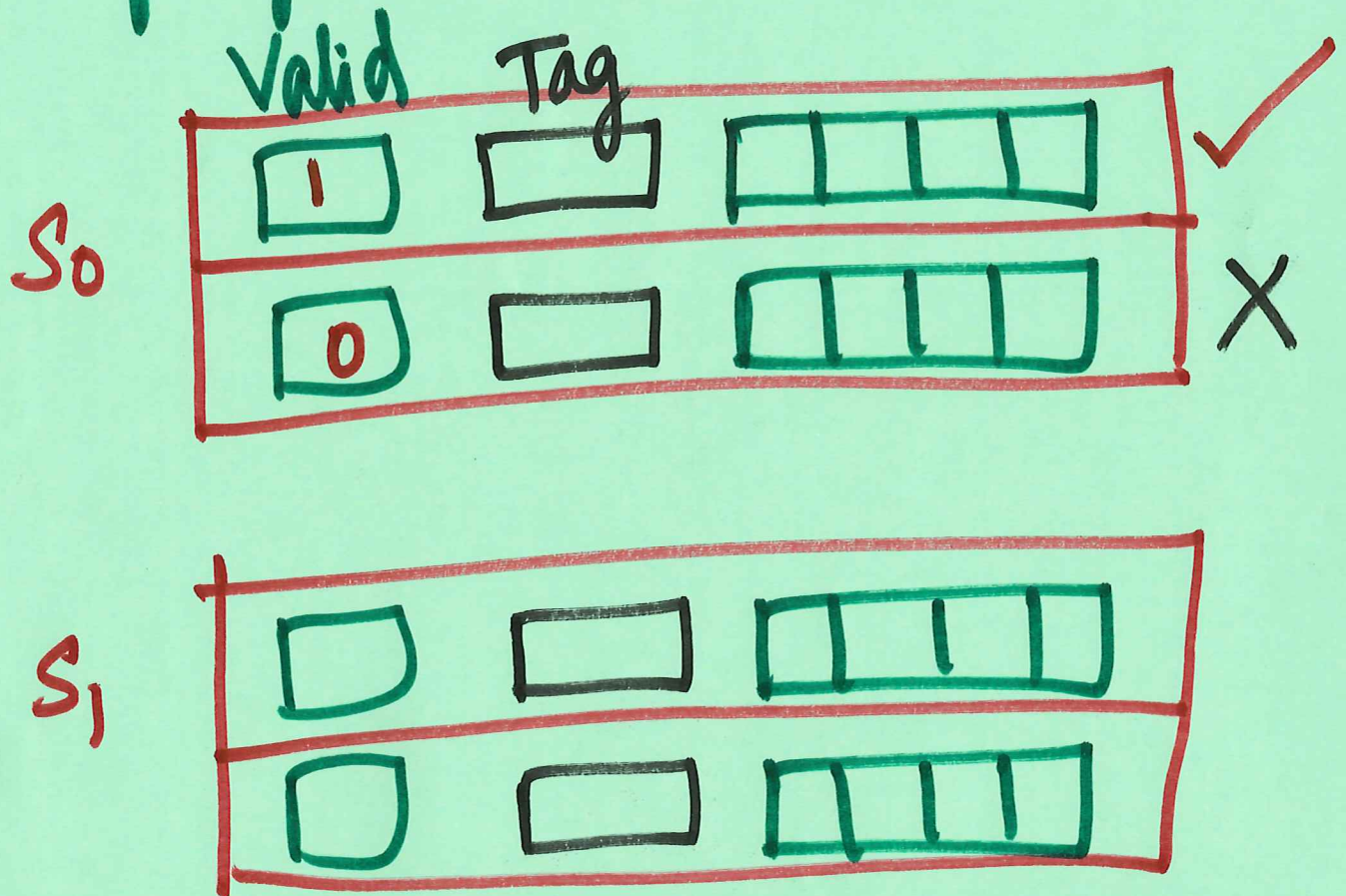
write

$$S = 2^s$$

E - no. of cache lines

$$B = 2^b$$

no. of bytes in a block



Addr (decimal)	Tag	set index	byte block offset	Block no.
0	0	0 0	0	0
1	0	0 0	1	0
2	0	0 1	0	1
3	0	0 1	1	1
4	0	1 0	0	2
5	0	1 0	1	2
6	0	1 1	0	3
7	0	1 1	1	3
8	1	0 0	0	4
9	1	0 0	1	4
10	1	0 1	0	5
11	1	0 1	1	5
12	1	1 0	0	6
13	1	1 0	1	6
14	1	1 1	0	7
15	1	1 1	1	7

$$S = 2^2 = 4$$

$$B = 2^1 = 2$$

$E = 1 \Rightarrow 1$ cache line.

