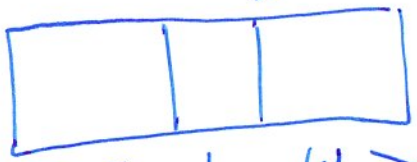
Direct-mapped cache

Each cell/block of MM can only go into one cache location.



line: tells which cache line that cell goes into

word: each line contains several words (to use spatial-locality principle); we require w bits to specify the words location in a line

n-bit address for one memory cell

tag: eg 5-bit tag would mean MM is 2^5 times bigger than cache; ie there are 2^5 blocks that get directly mapped into each line; it takes 5 bits to specify who is in this line now.

Direct-mapped cache; one word/cell 24 bits

MM: 8-Byte words
24-bit address

Cache: 256 lines
32 Bytes in each line

$\log_2 256 = 8$

$2^5_{\frac{B}{L}} \div 2^3_{\frac{B}{W}} = 2^{(2)}_{\frac{W}{L}}$

question: is memory 2^{14} times bigger than cache?

MM size: 2^{24} word/mem $\rightarrow \div$

Cache size: $2^8 \frac{\text{Lines}}{\text{cache}} \times 2^2 \frac{\text{words}}{\text{line}} = 2^{10} \frac{\text{words}}{\text{cache}}$

$= 2^{14} \frac{\text{cache}}{\text{mem}}$ ✓

Set D Tutorial

SW3 - 361S

April 12th Wednesday

3:30 - 5:20

MM: 1 GB total $\rightarrow 2^{30}\frac{B}{m}$

32-bit words

1 word/cell

Cache: 256 Bytes/line

2 kB total cache $\rightarrow 2^{11}\frac{B}{C}$

$2^{30}\frac{B}{m} \div 2^{2}\frac{B}{w} = 2^{28}\frac{w}{m}$

19	3	6
T	L	W

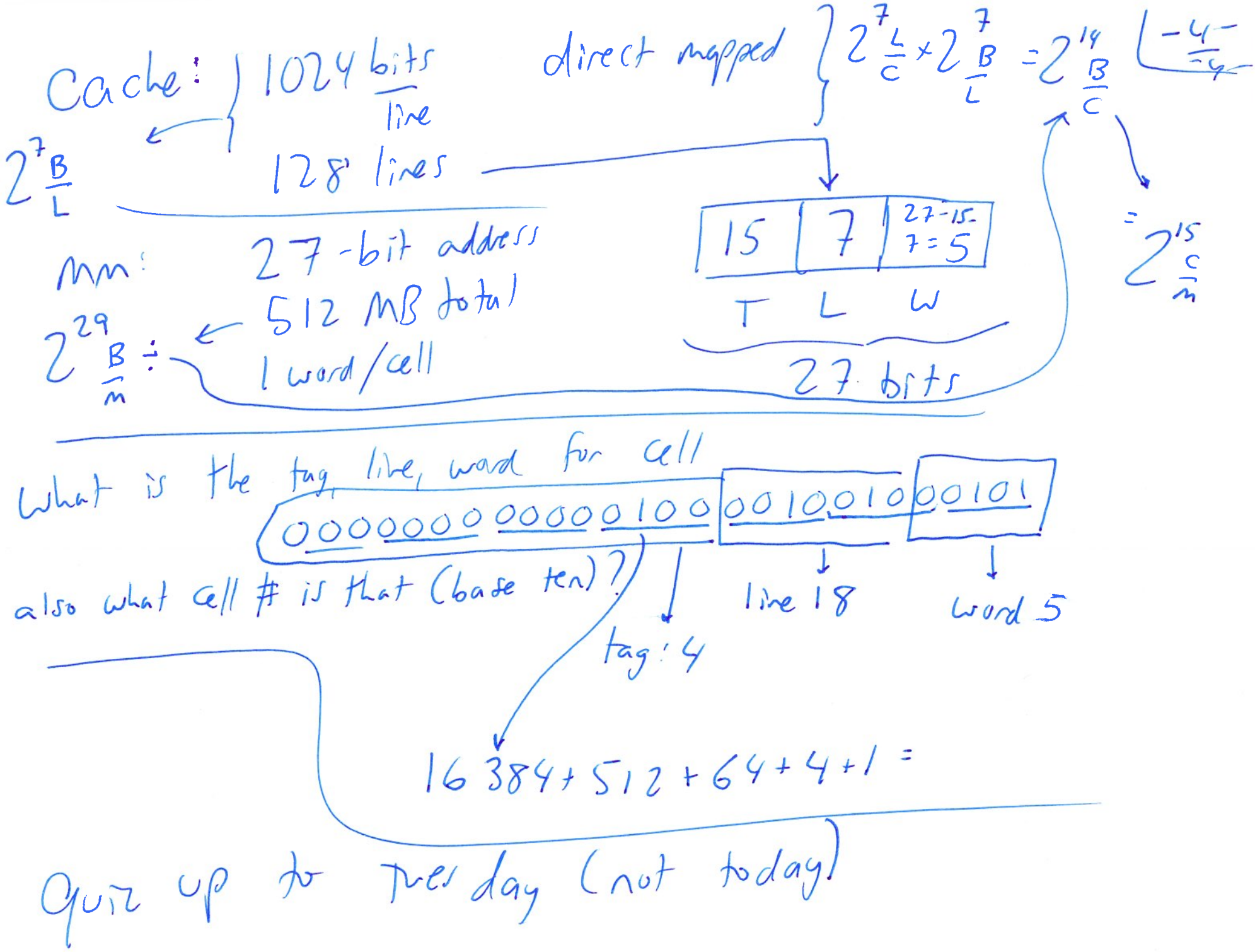
28-bit address

$2^{5}\frac{bit}{w} \div 2^{3}\frac{bit}{B} = 2^{2}\frac{B}{w}$

$2^{11}\frac{B}{C} \div 2^{8}\frac{B}{L} = 2^{3}\frac{L}{C}$

$2^{30}\frac{B}{m} \div 2^{11}\frac{B}{C} = 2^{19}\frac{C}{m}$

$2^{8}\frac{B}{L} \div 2^{2}\frac{B}{w} = 2^{6}\frac{w}{L}$ ✓


Cache: 1024 bits/line
128 lines
2^7_B
direct mapped
$2^7_L \times 2^7_B = 2^{14}_B$
$= 2^{15}_C$
27-bit address
512 MB total
1 word/cell
$2^{29}_B \div$
15 | 7 | 27-15-7=5
T L W
27 bits
What is the tag, line, word for cell
0000000 00000100 0010010 00101
line 18
word 5
tag: 4
also what cell # is that (base ten)?
16384+512+64+4+1 =
Quiz up to Tuesday (not today)