

L1 (i-cache and d-cache):

Blocksize = 64 Bytes =  $2^6$  Bytes  $\rightarrow$  offset needs 6 bits

Number of blocks = cache size / block size = 32KB / 64B =  $2^9$  B

Number of sets =  $2^9 / 4 = 2^7$   $\rightarrow$  index needs 7 bits

Tag bits =  $48 - 6 - 7 = 35$  bits

No dirty bit because write-through, valid bits = 1 bit

Total: # Blocks (bits per block + tag + v-bit) =  $2^9 (512 + 35 + 1) = 280576$  bits  
Per cache

L2:

Blocksize = 64B =  $2^6$  B  $\rightarrow$  offset needs 6 bits

Number of Blocks = cache size / block size = 256KB / 64B =  $2^{12}$  B

Number of sets =  $2^{12} / 8 = 2^9$   $\rightarrow$  index needs 9 bits

Tag bits =  $48 - 6 - 9 = 33$  bits

1 Dirty bit because write-back, valid bits = 1 bit

Total: # Blocks (bits per block + tag + v-bit + d-bit) =  $2^{12} (512 + 33 + 1 + 1) = 2240512$  bits

L3:

Blocksize = 64B =  $2^6$  B  $\rightarrow$  offset needs 6 bits

Number of blocks = cache size / block size = 8MB / 64B =  $2^{17}$  B

Number of sets =  $2^{17} / 16 = 2^{13}$   $\rightarrow$  index needs 13 bits

Tag bits =  $48 - 6 - 13 = 29$  bits

1 Dirty bit because write-back, valid bits = 1 bit

Total: # Blocks (bits per block + tag + v-bit + d-bit) =  $2^{17} (512 + 29 + 1 + 1) = 71172096$  bits