

8.32

block offset bits = $\log_2(\text{block size}) = \log_2(64\text{B}) = 6$ bits
blocks in the cache = $32\text{K} / 64\text{B} = 32 \cdot 2^{10} / 64 = 512$
index bits = $\log_2(\text{\#blocks}/\text{\#sets}) = \log_2(512/4) = 7$ bits
tag bits = $32 - 6 - 7 = 19$ bits

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a)

#sets = #blocks / associativity

#blocks = #sets * associativity

#index bits = $\log_2(\text{\#sets}) = 8$

#sets = $2^8 = 256$

#blocks = $256 * 2 = 512$

b)

#address bits = #tag bits + #index bits + #block offset bits
= $14 + 8 + 2 = 24$

24 bit addresses implies 2^{24} bytes of memory

therefore

#memory blocks = $2^{24} \text{ bytes} / 4 \text{ bytes per block} = 2^{22}$ memory blocks

c)

d)

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8B per object
128 blocks in the cache
8 objects per block

A

Misses once every 8 *j* cycles
 $1024^2 \text{ } j \text{ cycles} / 8 \text{ misses per } j \text{ cycle} = 131072 \text{ misses}$

B

Misses every *j* cycle once every 8 *i* cycles
 $1024 \text{ } j \text{ cycles} * 1024 \text{ } i \text{ cycles} * \frac{1}{8} \text{ misses per } i \text{ cycle} = 131072 \text{ misses}$

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24 bit virtual addresses
16 bit physical addresses
1K page size

virtual pages = $2^{24} / 1K = 2^{24} / 2^{10} = 2^{14} = 16K \text{ pages}$
physical pages = $2^{16} / 1K = 2^{16} / 2^{10} = 2^6 = 64 \text{ pages}$
bits in virtual page number = $\log_2(16K) = \log_2(2^{14}) = 14 \text{ bits}$
bits in physical page number = $\log_2(64) = \log_2(2^6) = 6 \text{ bits}$
bits in page offset = $\log_2(1K) = \log_2(2^{10}) = 10 \text{ bits}$

8.37

a)
access violation (no address mapping)
b)
read successful
c)
access violation