


## Quiz 7: do it yourself; use class notes – Results



### Attempt 1 of 1

Written Jul 12, 2024 9:01 PM – Jul 12, 2024 10:00 PM

Attempt Score  7 / 7 – 100 %

Overall Grade (Highest Attempt)  7 / 7 – 100 %

### Question 1

3 / 3 points

- Always show your work
- Always work in powers of 2
- Always show your units
- Always double check your work

How many bits make up the TAG, LINE, and WORD fields in the (direct-mapped) cache's virtual address for this architecture:

Memory: 1 cell/word; 24-bit address; 128kB total

Cache: direct mapped; 256 bits in each line; 8 lines

Line :  $2^3$  lines / cache  $\rightarrow \log_2(2^3) = 3$  bits

Total bits: 24-bit address  $\rightarrow 2^{24}$  cells/memory = 24 bits

Total memory =  $2^{17}$  B/memory

Total cache =  $2^5$  B/line \*  $2^3$  lines/cache =  $2^8$  B/cache

Tag:  $\log_2(\text{total memory}/\text{total cache})$

$$= 2^{17} \text{ B/memory divided by } 2^8 \text{ B/cache} = 2^9$$

cache/memory

$$= \log_2(2^9) = 9 \text{ bits}$$

$$24 = T-L-W = 9-3-W$$

$$W = 24-9-3 = 12 \text{ bits}$$

Answer:

$$T-L-W = 9-3-12 \text{ bits each}$$

Tag: 9 bits

Line: 3 bits

Word: 12 bits

Double Check:

$$2^{17} \text{ B/memory divided by } 2^5 \text{ B/line} = 2^{12} \text{ line/memory}$$

$$2^{24} \text{ words/memory divided by } 2^{12} \text{ line/memory} = 2^{12} \text{ words/line}$$

**The correct answer is not displayed for Written Response type questions.**

▼ [Hide question 1 feedback](#)

Question should have said 128MB total memory; everyone gets 3/3 on this question

## Question 2

3 / 3 points

Always show your work

Always work in powers of 2

Always show your units

Always double check your work

How many bits make up the TAG, LINE, and WORD fields in the (direct-mapped) cache's virtual address for this architecture:

Memory: 1 cell/word; 1GB total memory, 4 bytes/word

Cache: direct mapped; 4MB total cache; 512 words per line

Word:  $\log_2(512) = 9$  bits

$2^9$  words / line

Total cache:  $2^{22}$  B/cache

Total memory:  $2^{30}$  B/memory

Tag:  $\log_2(\text{total memory} / \text{total cache})$

$= 2^{30} \text{ B/memory} \text{ divided by } 2^{22} \text{ B/cache} = 2^8$   
cache/memory

$= \log_2(2^8) = 8$  bits

Total cells:  $2^{30} \text{ B/memory} \text{ divided } 2^2 \text{ B/word} = 2^{28}$   
words/memory =  $2^{28}$  cells/memory

28 bits total

$28 = T - L - W = 8 - L - 9$

$L = 28 - 9 - 8 = 11$

Answer:

$T-L-W = 8-11-9$  bits each

Tag: 8 bits

Line: 11 bits

Word: 9 bits

Double Check:

Total line size:  $2^9$  words/line \*  $2^2$  B/word =  $2^{11}$  B/line

Total number of lines =  $2^{22}$  B/cache divided by  $2^{11}$  B/line =  
 $2^{11}$  lines/cache

$\log_2(2^{11}) = 11$  bits

The correct answer is not displayed for Written Response type questions.

Question 3

1 / 1 point

What does it mean (in clear language) if the TAG length is 4 bits long?

A 4-bit tag means that the main memory is  $2^4$  times larger than cache.

The correct answer is not displayed for Written Response type questions.

Done