

Quiz 2

الرقم التسلسلي:

رقم التسجيل:

الاسم:

Instructions: Time 20 minutes. Open book and notes exam. No electronics. Please answer all problems in the space provided and limit your answer to the space provided. **No questions are allowed.**

<Good Luck>

Q1. Assume that you want to design a 4-way associative cache and the size of this cache is 32 KB.

[5 marks]

A) How many blocks does this cache have if the block size is 64 bytes?

Number of blocks = Cache size / block size

$$= 32 \text{ KB} / 64 \text{ B} = 512 \text{ blocks}$$

B) How many bits are needed to index this cache?

<index> = \lg_2 (Number of blocks / Associativity)

$$= \lg_2 (512 / 4)$$

$$= \lg_2 (128) = 7 \text{ bits}$$

C) What is the tag width if the address width is 32 bits?

<tag> = 32 - <index> - <block offset>

$$= 32 - 7 - \lg_2 (64)$$

$$= 32 - 7 - 6 = 19 \text{ bits}$$

D) Assuming that this cache is a write-back cache and uses random replacement, how many memory bits are needed to construct this cache?

Cache memory size = Number of blocks \times Number of block bits

$$= 512 \times (<valid> + <dirty> + <tag> + <data>)$$

$$= 512 \times (1 + 1 + 19 + 64 \times 8)$$

$$= 512 \times (21 + 512) = 512 \times 533 \text{ bits}$$

E) Draw this cache given all the specifications in Page 1.

