CSE3038 - Quiz 3 - 20 Minutes

Q1. (40)

Assume that we have a 16-way set associative cache where cache size is 8192 KB. Assume that the block size is 256 words, and 32-bit memory address is considered. (Assume that we consider byte addressing)

How many bits are needed for the following fields? **Show your work to get full credit.**

Tag	Index	Offset (total)
13	9	10

$256 \times 4 = 1024$ bytes $= 2^{10}$ bytes (block size) (10-bits offset)

$8192KB = 8 \times 1024KB = 2^{23}$ bytes.

$\frac{2^{23}}{(256 \times 4)} = 2^{13}$ $\quad$ $2^{13} / 16\text{-way} = \frac{2^{13}}{2^4} = 2^9$ (# of sets) (10 bit index)

(32 − 10 − 9 = 13 bits) → TAG

Q2. (60)

Suppose you have a **two-way set associative cache** with **two-word blocks** and a **total cache size of 32 words**. Assume LRU replacement. After running a certain program, the observed string of **word** addresses for instruction fetch is given below.

Show the final content of the cache. **Show your work to get full credit.**

22 33 6 17 9 23 1 30 32 2 12 38

Set # $= \left\lfloor \frac{\text{Word addr}}{\text{\# of words per block}} \right\rfloor \bmod N$ (N → # of sets for set assoc.)

2-way & 2-word blocks

32 word / (2×2) = 8 sets

22 32 6 17 9 23 1 30 32 2 12 38

[22/2] mod 8 = 3 → 3

[32/2] mod 8 = 0 → 4

6 → 3

17 → 0

9 → 4

23 → 3

1 → 0

30 → 7

32 → 0

2 → 1

12 → 6

38 → 3

0	32 33 01	16 17 32 33
1	2 3	
2		
3	22 23	6 7 38 39
4	8 9	
5	.	
6	12 13	
7	30 31	

Final Content of the cache

0	0 1	32 33
1	2 3	
2		
3	22 23	38 39
4	8 9	
5	.	
6	12 13	
7	30 31	