

CSE140-HWS

1- for ($I=0; I<8; I++$)
 for ($J=0; J<8; J++$)
 $A[I][J] = B[I][0] + A[J][I]$

a) Which variable references (out of $A[I][J]$, $B[I][0]$ and $A[J][I]$) exhibit temporal locality?

- Variable I, J is a temporary locality due to their value is changed in the loop and making it not be useful after scope

c) Which variable references (out of $A[I][J]$, $B[I][0]$, and $A[J][I]$) exhibit spatial locality?

- Variable A, B is a spatial locality that is used at the end of the program

2- Assume that the system uses 32-bit address

a) Consider a cache with 32 MB of data, 2-way set associativity, and 128-byte line (block) size? What is the size of each line's tag in bits?

• address = 32 bits

• cache size = 32 MB = 2^{25} .

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Tag	Set	Offset
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 = set associative cache

• Set: used to find which set does the block size get mapped

• offset: used to identify each byte within a block uniquely

• Tag: These bits to find whether the given block is present

- offset = $\log_2(\text{BlockSize})$

$$= \log_2(2^7)$$

$$= 7 \cdot \log_2(2) = 7 \cdot 1 = 7 \text{ bits} = \boxed{\text{offset}}$$

$$\begin{aligned} - \text{Set: } \text{No of Sets} &= \text{Cache Size} / (\text{Block size} \cdot \text{Associativity}) \\ &= 2^{25} / (2^7 \cdot 2) = 2^{27} / 2^8 = 2^{17} = \text{No of Sets} \end{aligned}$$

$$\text{Set: } \log_2(\text{no of sets}) = \log_2(2^{17}) = 17 \cdot \log_2(2) = 17 \cdot 1 = 17$$

$$\boxed{\text{set} = 17 \text{ bits}}$$

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