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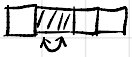
1. The previous statement is true because spatial locality refers to items with nearby addresses being referenced close together in time.

2. The previous statement is true because temporal locality says that an accessed word will be accessed again in the near future and this is due to the presence of loops.



3. 1024B cache, 32-bit address, 4B block, 1 line per set
a) # of cache sets = 1024/4 = 256 ∴ 256 cache sets

b) $2^8 = 256$ so there are 8 index bits
c) Block size = 4 so each line contains 4 bytes ∴ we take the first 2 bits as $2^2 = 4$. So # of block offset bits = 2
d) 32 - 8 - 2 = 22 ∴ 22 tag bits

4. 1024B cache, 32-bit address, 8B block, 4 lines per set
a) # of cache sets = 1024/(8·4) = 32 ∴ 32 cache sets

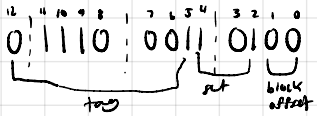
b) $2^5 = 32$ so there are 5 index bits
c) Block size = 8 so we take first 3 bits as $2^3 = 8$ ∴ # of block offset bits = 3
d) 32 - 5 - 3 = 24 ∴ 24 tag bits

5. 1024B cache, 32-bit address, 32B blocks, 32 lines per set
a) # of cache sets = 1024/(32·32) = 1 ∴ 1 cache set (fully associative cache)

b) no index bit since only 1 cache block and $2^0 = 1$ ∴ 0 index bits
c) Block size = 32 so we take first 5 bits as $2^5 = 32$ ∴ # of block offset bits = 5
d) 32 - 0 - 5 = 27 ∴ 27 tag bits

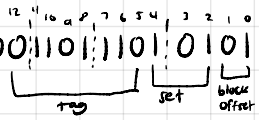
6.
a) $B_0 - B_1$ since block size is 4 and $2^{②} = 4$.
b) since 8 sets, $2^{③} = 8$ so next 3 bits which are $B_2 - B_4$
c) tag bits are left which are $B_5 - B_{12}$

7. Binary value = 0000 1110 0011 0100



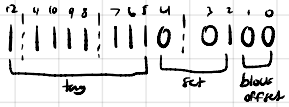
a) 0x0
b) 101_2 = 0x5
c) 01110001_2 = 0x71
d) Y
e) 0x0B

8. Binary value = 0000 1101 1101 0101



a) 0x1
b) 101_2 = 0x5
c) 01101110_2 = 0x6E
d) N
e) "M"

9. Binary Value = 0001 1111 1110 0100



a) 0x0

b) 001_2 = 0x1

c) 11111111_2 = 0xFF

d) N

e) "M"

10. Tag = 0x32 = 00110010_2

Set = 011_2

Possible block offsets: 00_2, 01_2, 10_2, 11_2

∴ memory addresses that will hit in set 3 are:

$0011\,0010\,0111\,00_2$ = 0x064C

$0011\,0010\,0111\,01_2$ = 0x064D

$0011\,0010\,0111\,10_2$ = 0x064E

$0011\,0010\,0111\,11_2$ = 0x064F

11. AMAT = hit time + miss rate x miss penalty

if 88% hit rate, then 12% miss rate

so...

AMAT = 3 nanoseconds + 0.12 x 29

= 6.48 nanoseconds

∴ the average read access time in nanoseconds is 6.48