Tutorial #6

CSE 321a: Computer Organization (I)
Third Year, Computer and Systems Engineering

Questions (15 – 20) Midterm 2013:

Consider a computer with an *x*-byte memory and a *y*-byte cache divided into *z* byte lines.

15. If the cache is direct-mapped, what will be the size of the tag?
(a) log2 (*x* / *y*)
(b) log2(*y* / *z*)
(c) log2(*z*/ *x*)
(d) log2(*x* / *z*)
(e) None of the above

16. If the cache is fully-associative, what will be the size of the tag?
(a) log2(*x* / *y*)
(b) log2(*y* / *z*)
(c) log2(*z* / *x*)
(d) log2(*x* / *z*)
(e) None of the above

17. If the cache is 2-way set-associative, what will be the size of the tag?
(a) log2(2x / *y*)
(b) log2(2y/ *z*)
(c) log2(2z/ *x*)
(d) log2(2x /*z*)
(e) None of the above

18. If the cache is direct-mapped, then block *j* will be mapped to line:
(a) (*j* **mod** *y*)
(b) (*j* mod (*y* / *z*))
(c) ((*j*/ *z*) **mod** *y*)
(d) ((*j*/ *z*) **mod** (*y* / *z*))
(e) None of the above

19. If the cache is 2-way set-associative, then block *j* will be mapped to set:
(a) (*j* **mod** 2y)
(b) (*j* **mod** 2(*y* / *z*))
(c) ((*j*/ *z*) **mod** 2y)
(d) ((*j*/ *z*) **mod** 2(*y* / *z*))
(e) None of the above

20. Suppose the cache is 2-way set-associative, and consider a scenario in which the lines of a set *k* are read in the following order: line 0 → line 0 → line 1 → line 1 → line 0. Which replacement strategy does the cache implement if the following read from set *k* is a miss that causes line 1 contents to be replaced?
(a) LRU
(b) LFU
(c) Random
(d) All of the above
(e) None of the above

External problem

Suppose the average access time of the memory system (i.e., the cache combined with the main memory) measured during the execution of a program is 18 μs. Calculate the access time of the cache given that the access time of the main memory is 25 μs if the hit ratio of the cache is 30%.

$T_{avg} = T_c + (1-H) * T_m$
$18 = T_c + (1-0.3)*25$
$T_c = 0.5$ μs