

Computer Science Problem of the Month

(<http://narnia.homeunix.com/~robert/PoTM/>)

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Background:

One way of improving performance of a computer's memory hierarchy is to use a "set-associative cache". Basically this is a block of very expensive, but very fast memory which can hold only a few addresses. Because accessing main memory can take much longer than accessing the cache, this can greatly improve performance.

Problem:

Given a two-way set associative cache which can store 8 sets of blocks, calculate the total time it takes the computer to read data from the following address in the given order:

0, 1, 2, 3, 16, 2, 8, 3, 3, 8, 8, 0, 3, 0, 8, 3, 0, 16, 4, 5, 10, 0, 16.

You should assume:

- A. Loading a value from the cache takes 30ms.
- B. Loading a value from main memory takes 200ms.
- C. Initially the cache is empty
(i.e. all cache blocks are marked "invalid").
- D. The cache-replacement policy is "Least Recently Used".

Solutions:

To submit a solution to the problem of the month, e-mail your answer and a complete, rigorous justification of your answer, to robert@narnia.homeunix.com. I will give a cash prize of one dollar to the person who submits the first correct solution. Subsequent solvers will be recognized on the web page, but not awarded the cash prize.