Justification of cache-oblivious model

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Block-replacement strategy

- when you read a block, need to evict another
- in external-memory model, you get to choose which one
- in cache-oblivious model, cache is maintained automatically so it must choose...

Assumption: OPTimal replacement – evict block that will be accessed furthest in future

Theorem: [Sleator & Tarjan 1985 ~ MTF paper]

cost(LRU with cache of size $2M$)
$\leq 2 \times$ cost(OPT with cache of size M)

& ditto for FIFO.

usually, changing M by const. factor doesn't change running time by more.

Associativity

Assumption: any block can be stored anywhere in cache (full associativity)

- real caches only allow each block to go in certain set of slots (if all sets size k, a cache is called k-way associative).

theorem: [Frigo et al. 1999]

can simulate automatic replacement + full associativity using manual replacement + 1-way associativity

– idea: 2-universal hashing

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