Saarland University
Department 6.2 - Computer Science
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Computer Architecture I - WS 07/08

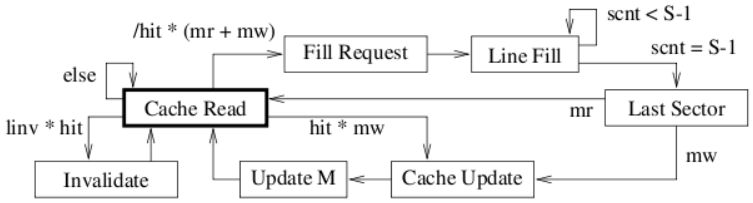
Exercise Sheet 11

Excercise 1: (warm up)

1. Ensure that you understand the direct-mapped cache invariant and the memory simulation invariant.
2. Ensure that you understand why the concept of caches works at all (spatial & temporal locality).

Excercise 2: (direct-mapped cache)

1. Construct a direct mapped cache for 16-bit addresses with the following parameters. It should consist of 16 cache lines. Each line should consist of 4 sectors. Each sector should consist of 2 words. Assume, all 16 valid bits are cleared initially.
2. Show the state of your cache after following transactions:
   (a) a read from memory address 32769
   (b) a write of word $w = b_3b_2b_1b_0$ to the address 23462
   (c) a read from memory address 10000
   (d) a snoop request to the memory address 23462
3. Consider the following flow chart of memory transactions for the write through policy:



   Modify it for the write back policy.

Excercise 3: (encoder)
An encoder is a circuit, which transforms a unary number into its binary representation. Formaly, it computes the function $enc : \mathbb{B}^m \rightarrow \mathbb{B}^{log_2(m)}, enc(a) = bin_{log_2(m)}(a)$ for unary a and m a power of two. Construct it, and prove its correctness.