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CSE 5441, T/Th 2:20 P.M.

Homework 2

1. (a)

$b = 8$	$s = 8$	$t = 16$	$m = 32$
$B = 256$	$S = 256$	$E = 4$	$C = 262,144$

   (b) Hit rate x = hit rate y = hit rate a = hit rate $b = {}^{31}/_{32}$

   (c) ${}^{31}/_{32}$

   (d) Set 0: {x[0-31], y[0-31], ?, ?}
   Set 1 - 127: ?
   Set 128: {a[0-31], b[0-31], ?, ?}

   (e) Set 0: {x[0-31], y[0-31], ?, ?}
   Set 1: {x[32-63], y[32-63], ?, ?}
   Set 2: {x[64-95], y[64-95], ?, ?}
   ...
   Set 7: {x[224-255], y[224-255], ?, ?}
   Set 8 - 127: ?
   Set 128: {a[0-31], b[0-31], ?, ?}
   Set 129: {a[32-63], b[32-63], ?, ?}
   Set 130: {a[64-95], b[64-95], ?, ?}
   ...
   Set 143: {a[480-511], b[480-511], ?, ?}

2. Use the eviction bits as a counter to determine which line will be occupied by the next fetch. Have the counter start at 000 to signify the first line, and on each fetch increment the counter by one until it reaches 111 for the last line. After storing data in the last line, wrap back around to 000 for the next fetch. This scheme will work best when a cache line is only needed for a short time. However, it will work poorly when there is a lot of contention and some cache lines need to have priority over others.

3. Scan 1: Look at each line's tag bits to see if the address is in cache
   Scan 2: Scan each line's valid bit to see if there are any lines to occupy
   Scan 3: If there are no empty lines, scan each line's eviction bits to see which is the least frequently used

4. An LRU cache will work well when, in any given time period, a program only uses a small subsection of its data. An LFU cache will work well when some pieces of data are accessed very frequently, but the majority of data is accessed only a few times.

5. (a)

$b = 8$	$s = 0$	$m = 32$	$t = 24$
$B = 256$	$S = 1$	$E = 256$	$C = 65,536$

   (b) Hit rate x = hit rate $y = {}^{31}/_{32}$

   (c) ${}^{31}/_{32}$

   (d) Line 0: x[4096-4127]
   Line 1: y[4096-4127]
   Line 2: x[4128-4159]
   Line 3: y[4128-4159]
   ...
   Line 254: x[8160-8191]
   Line 255: y[8160-8191]

6. Hierarchy A