Finding Data in a Cache

Start with address (bits are interpreted as unsigned numbers)

<table>
<thead>
<tr>
<th>TAG</th>
<th>INDEX*</th>
<th>OFFSET</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*no index if cache is fully associative

Look at INDEX's valid bit tag in the cache. Is the data valid?

- No, cache is empty at this index
- Yes!

Compulsory cache miss. Load data from memory. Set valid bit of block to 1.

Is the cache direct-mapped?

- Yes!
- No, set associative or fully associative

Look at block at INDEX. Does the tag match TAG?

- Yes!
- No

Search all tags in INDEX, or all tags if fully associative. Does any tag match TAG?

- Yes!
- No

Cache hit! Find data at OFFSET and return this value.

Does the number of blocks in the set match the max number of blocks per set?

- Yes. The set is full
- No, set is not full

Is the cache write-back?

- Yes!
- No, write-through

Cache miss and replacement. Replace block with correct data from memory.

Select block for replacement. If dirty bit is on, write that block back to memory.