DSD HW4 Report

(a) General specification of the cache unit (such as numbers of words, placement policy, and so on):

direct map:

8 blocks, 4 words per block (store continuous memory data).

2-way associative:

4 sets, 2 blocks per set, 4 words per block (store continuous memory data).

(b) Read/write policy (write-through or write-back):

direct map: Write-back, Write allocate

2-way associative: Write-back, Write allocate

When write-hit occurs, just change the value in the cache.

When write-miss occurs, allocate data from the memory, and modify the data in the cache.

(c) Design architecture or the finite state machine of the cache unit:

Three states in total, as the graph no next page.

State 1 is the initial state.

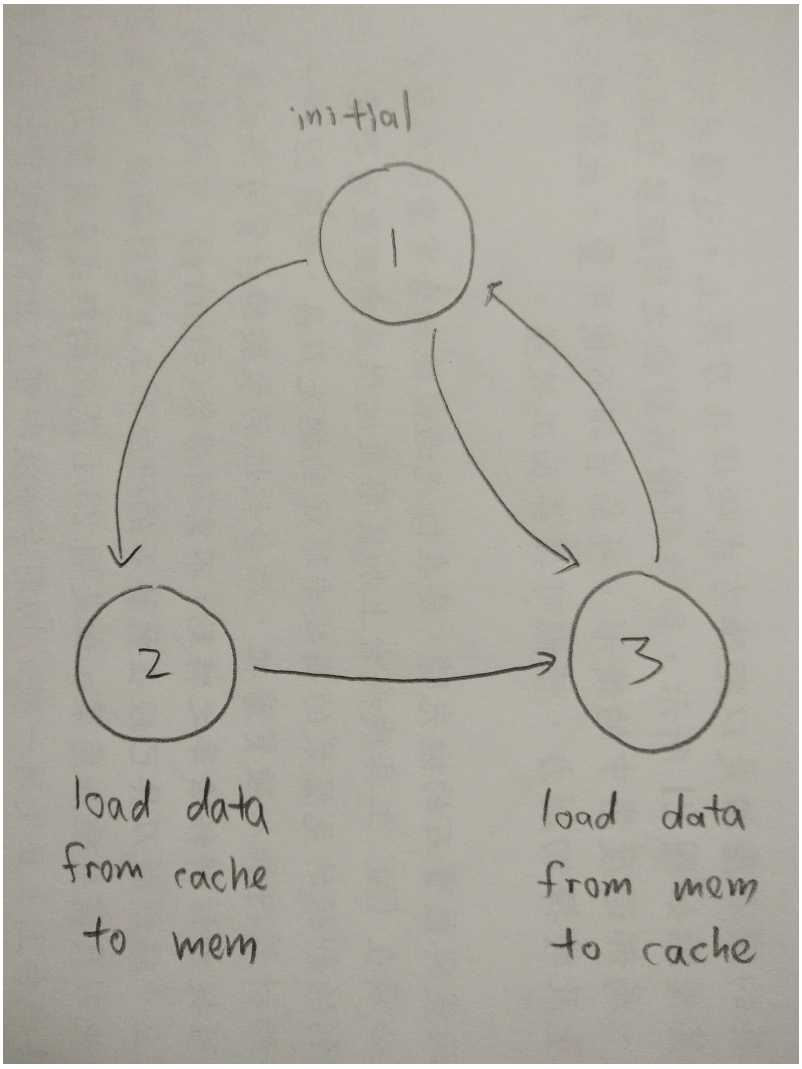
State 2 indicates that the cache just wrote data to the memory, and is waiting for the mem_ready signal.

State 3 indicates that the cache just requested data from the memory, and is waiting for the mem_ready signal.

‘’read/write miss” and ‘’dirty” will change state from 1 to 2.

‘’read/write miss” and “clean” will change state from 1 to 3.

‘’mem_ready” signal will change state from 2 to 3, and 3 to 1.



So the following cases will go through the state sequence below:

read/write miss dirty ==> 1, 2, 3, 1

read/write miss clean ==> 1, 3, 1

read/write hit ==> 1

(d) Performance evaluation of your cache design, including the miss rates of read/write operations, the execution cycles, the stalled cycles, and so on.

for both direct map and 2-way associative architecture:

miss rate of read: 25%

miss rate of write: 25%

execution cycles: 10239

stalled sysle: 7167

(e) Comparing the performance of two kinds of architecture, discussing the reason of such result.

在這個test bench下，兩者的表現一模一樣，那是因為read跟write都是依照順序一路讀下去，無法讓associative architecture發揮功用。

在本次作業中，direct map是把除以8後同餘的資料放在同一個block；2-way associative是把除以4後同餘的資料放在同一個set，而每個set可以放兩筆資料，如果遇到以下的情況：

read 4, read 12, read 4, read 12, write 4, write 12, write 4, write 12

direct map需要不斷從memory中讀寫資料，而2-way associative只要讀寫一次就好，效率大幅提升。但是本次作業test bench的設計，無法讓2-way associative發揮作用。