CS2323 Assignment -4

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1 Problem 1

The cache is 256 bytes in size, and each block is 8 bytes each. So the number of blocks in the cache will be $256/8 = 32$ so I need 5 buts to access the block address itself ,and each block has 8 bytes, with each memory being addressd to one byte, so we require an offset of 3 bits to keep track of the byte being addressed. The total size of the instruction being given is 3 hexadecimals $= 12$ bit address. So the size of the tag will be equal to $12 - 5 - 3 = 4$ bits. let us see the addresses in binary and check for hits and misses

```
[style=customasm, caption={DMP cache}, label=Direct Mapped Cche]
$0x005$ : $0000 0000 0101$ : Miss - update on block $00000$ = 0  tag = $0000$ = 0
$0x124$ : $0001 0010 0100$ : Miss - update on block $00100$ = 4  tag = $0001$
$0x352$ : $0011 0101 0010$ : Miss - update on block $01010$ = 10  tag = $0011$ = 3
$0x224$ : $0010 0010 0100$ : Miss - update on block $00100$ = 4  tag = $0010$
$0x126$ : $0001 0010 0110$ : Miss - update on block $00100$ = 4  tag = $0001$
$0x350$ : $0011 0101 0000$ : Hit - block $01010$ = 10  tag = $0011$
$0x000$ : $0000 0000 0000$ : Hit - block $00000$ = 0  tag = $0000$
$0x025$ : $0000 0010 0101$ : Miss - update on block $00010$ = 2  tag = $0000$
$0x102$ : $0001 0000 0010$ : Miss - update on block $00000$ = 2  tag = $0001$
$0x120$ : $0001 0010 0000$ : Miss - update on block $00100$ = 4  tag = $0001$
$0x200$ : $0010 0000 0000$ : Miss - update on block $00000$ = 0  tag = $0010$
$0x108$ : $0001 0000 1000$ : Miss - update on block $00001$ = 0  tag = $0001$
$0x000$ : $0000 0000 0000$ : Miss - update on block $00000$ = 0  tag = $0000$
$0x202$ : $0010 0000 0010$ : Miss - update on block $00000$ = 0  tag = $0010$
$0x128$ : $0001 0010 1000$ : Miss - update on block $00101$ = 5  tag = $0001$
$0x350$ : $0011 0101 0000$ : Hit - block $01010$ = 10  tag = $0011$
```

1.1 Calculating hit and miss rate of the cache

The hit and miss rate of the cache can be calculated by taking the ratio of the hits to the total number of accesses. $= 3/16 = 0.1875 = 18.75\%$ The miss rate = 1 - 0.1875 = 81.25\%

2   Problem 2

Here we will analyze the situation for a 2 way assosciateive cache , the split will be 5 + 4 + 3 The number of blocks remain the same, however every 2 blocks will be free to move within one set of 2 elements so the number of sets = 16, all the bits are invalid at first, so they can be replaced!

```
$0x005$ : $00000 0000 101$ : Miss update on set $0000$ = 0  tag = $00000$ = 0
$0x124$ : $00010 0100 100$ : Miss update on set $0100$ = 4  tag = $00010$ = 2
$0x352$ : $00110 1010 010$ : Miss update on set $1010$ = 10  tag = $00110$ = 6
$0x224$ : $00100 0100 100$ : Miss update set filled $0100$ = 4  tag = $00100$ = 4, tag = 2
$0x126$ : $00010 0100 110$ : Hit on set $0100$ = 4  tag = $00010$ = 2
$0x350$ : $00110 1010 000$ : Hit set $1010$ = 10  tag = $00110$ = 6
$0x000$ : $00000 0000 000$ : Hit set $0000$ = 0  tag = $00000$
$0x025$ : $00000 0100 101$ : Miss update + evict on set $0100$ = 4 LRU on tag = $00100$ = 4
$0x102$ : $00010 0000 010$ : Missset filled  update on set $0000$ = 0  tag = $00010$ = 2
$0x120$ : $00010 0100 000$ : Hit on set $0100$ = 4  tag = $00010$ = 2
$0x200$ : $00100 0000 000$ : Miss update + evict LRU on set $0000$ = 0  tag = $00100$
$0x108$ : $00010 0001 000$ : Miss update on set $0001$ = 0  tag = $00010$
$0x000$ : $00000 0000 000$ : Miss update + evict on set $0000$ = 0 LRU on tag = $00010$
$0x202$ : $00100 0000 010$ : Hit on set $0000$ = 0  tag = $00100$
$0x128$ : $00010 0101 000$ : Miss update on set $0101$ = 5  tag = $00010$
$0x350$ : $00110 1010 000$ : Hit set $1010$ = 10  tag = $00110$
```

2.1   Calculating hit and miss rate of the cache

The hit and miss rate of the cache can be calculated by taking the ratio of the hits to the total number of accesses. = 6/16 = 0.375 = 37.5% The miss rate = 1 - 0.375 = 62.5% This is significantly higher than that of the direct mapped cache.