



UNIVERSITY OF ASIA PACIFIC

Department of Computer Science & Engineering

Task on Memory Mapping

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Task on Memory Mapping

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Given addresses: 0, 8, 0, 6, 8, 25, 13, 2, 8, 0

1. Direct Mapped: A direct mapped cache with 16-blocks can only hold one block per set.

Block	Address	Cache Block
0	$0 \rightarrow (0 \bmod 16)$	0
8	$8 \rightarrow (8 \bmod 16)$	8
6	$6 \rightarrow (6 \bmod 16)$	6
25	$25 \rightarrow (25 \bmod 16)$	9
13	$13 \rightarrow (13 \bmod 16)$	13
9	$9 \rightarrow (9 \bmod 16)$	9

Memory Address	Hit/ Miss	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	miss	MEM [0]															
8	miss	MEM [0]								MEM [8]							
0	hit	MEM [0]								MEM [8]							
6	miss	MEM [0]					MEM [6]		MEM [8]								
8	hit	MEM [0]					MEM [6]		MEM [8]								
25	miss	MEM [0]					MEM [6]		MEM [8]	MEM [25]							
13	miss	MEM [0]					MEM [6]		MEM [8]	MEM [25]			MEM [33]				
9	miss	MEM [0]					MEM [6]		MEM [8]	MEM [25]			MEM [33]				
8	hit	MEM [0]					MEM [6]		MEM [8]	MEM [25]			MEM [33]				
0	hit	MEM [0]					MEM [6]		MEM [8]	MEM [25]			MEM [33]				

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2 way-set associative: set $2^6/2=8$, now mod block addresses by 8.

Block Address	Cache	Set
0	$0 \bmod 8 \rightarrow$	0
8	$8 \bmod 8 \rightarrow$	0
6	$6 \bmod 8 \rightarrow$	6
25	$25 \bmod 8 \rightarrow$	1
13	$13 \bmod 8 \rightarrow$	5
9	$9 \bmod 8 \rightarrow$	1

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4 way set associative: set $16/4 = 4$, Now mod block addresses by 4

Block Address	Cache Set
0	$0 \bmod 4 \rightarrow 0$
8	$8 \bmod 4 \rightarrow 0$
6	$6 \bmod 4 \rightarrow 2$
25	$25 \bmod 4 \rightarrow 1$
13	$13 \bmod 4 \rightarrow 1$
9	$9 \bmod 4 \rightarrow 1$

Memory Address	Hit/miss	Set 0	Set 1	Set 2	Set 3
0	Miss	MEM[0]			
8	Miss	MEM[0], MEM[8]			
0	hit	MEM[0], MEM[8]			
6	Miss	MEM[0], MEM[8]		MEM[6]	
8	hit	MEM[0], MEM[8]		MEM[6]	
25	Miss	MEM[0], MEM[8]	MEM[25]	MEM[6]	
13	Miss	MEM[0], MEM[8]	MEM[25], MEM[13]	MEM[6]	
9	Miss	MEM[0], MEM[8]	MEM[25], MEM[13], MEM[9]	MEM[6]	
8	hit	MEM[0], MEM[8]	MEM[25], MEM[13], MEM[9]	MEM[6]	
0	hit	MEM[0], MEM[8]	MEM[25], MEM[13], MEM[9]	MEM[6]	

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8 way set associative : set $16/8 = 2$, Now mod block addresses by 2

Block Address	Cache Set
0	$0 \rightarrow 0 \bmod 2 \rightarrow 0$
8	$8 \rightarrow 8 \bmod 2 \rightarrow 0$
6	$6 \rightarrow 6 \bmod 2 \rightarrow 0$
25	$25 \rightarrow 25 \bmod 2 \rightarrow 1$
13	$13 \rightarrow 13 \bmod 2 \rightarrow 1$
9	$9 \rightarrow 9 \bmod 2 \rightarrow 1$

Memory Address	Hit/Miss	Set 0	Set 1
0	miss	MEM[0]	
8	miss	MEM[0], MEM[8]	
0	hit	MEM[0], MEM[8]	
6	miss	MEM[0], MEM[8], MEM[6]	
8	hit	MEM[0], MEM[8], MEM[6]	
25	miss	MEM[0], MEM[8], MEM[6]	MEM[25]
13	miss	MEM[0], MEM[8], MEM[6]	MEM[25], MEM[13]
9	miss	MEM[0], MEM[8], MEM[6]	MEM[25], MEM[13], MEM[9]
8	hit	MEM[0], MEM[8], MEM[6]	MEM[25], MEM[13], MEM[9]
0	hit	MEM[0], MEM[8], MEM[6]	MEM[25], MEM[13], MEM[9]

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16 way set associative: set $16/16=1$, Now mod block
addresses by 1

Block Address		Cache	Set
0	$\rightarrow 0 \bmod 2$	$\rightarrow 0$	
8	$\rightarrow 8 \bmod 2$	$\rightarrow 0$	
6	$\rightarrow 6 \bmod 2$	$\rightarrow 0$	
25	$\rightarrow 6 \bmod 2$	$\rightarrow 0$	
13	$\rightarrow 25 \bmod 2$	$\rightarrow 0$	
13	$\rightarrow 13 \bmod 2$	$\rightarrow 0$	
9	$\rightarrow 9 \bmod 2$	$\rightarrow 0$	

Fully associative:

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