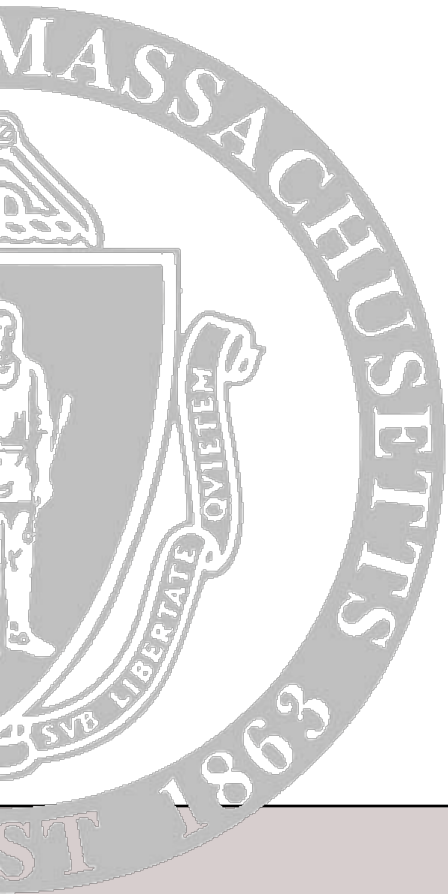


# Spim-Cache Tutorial

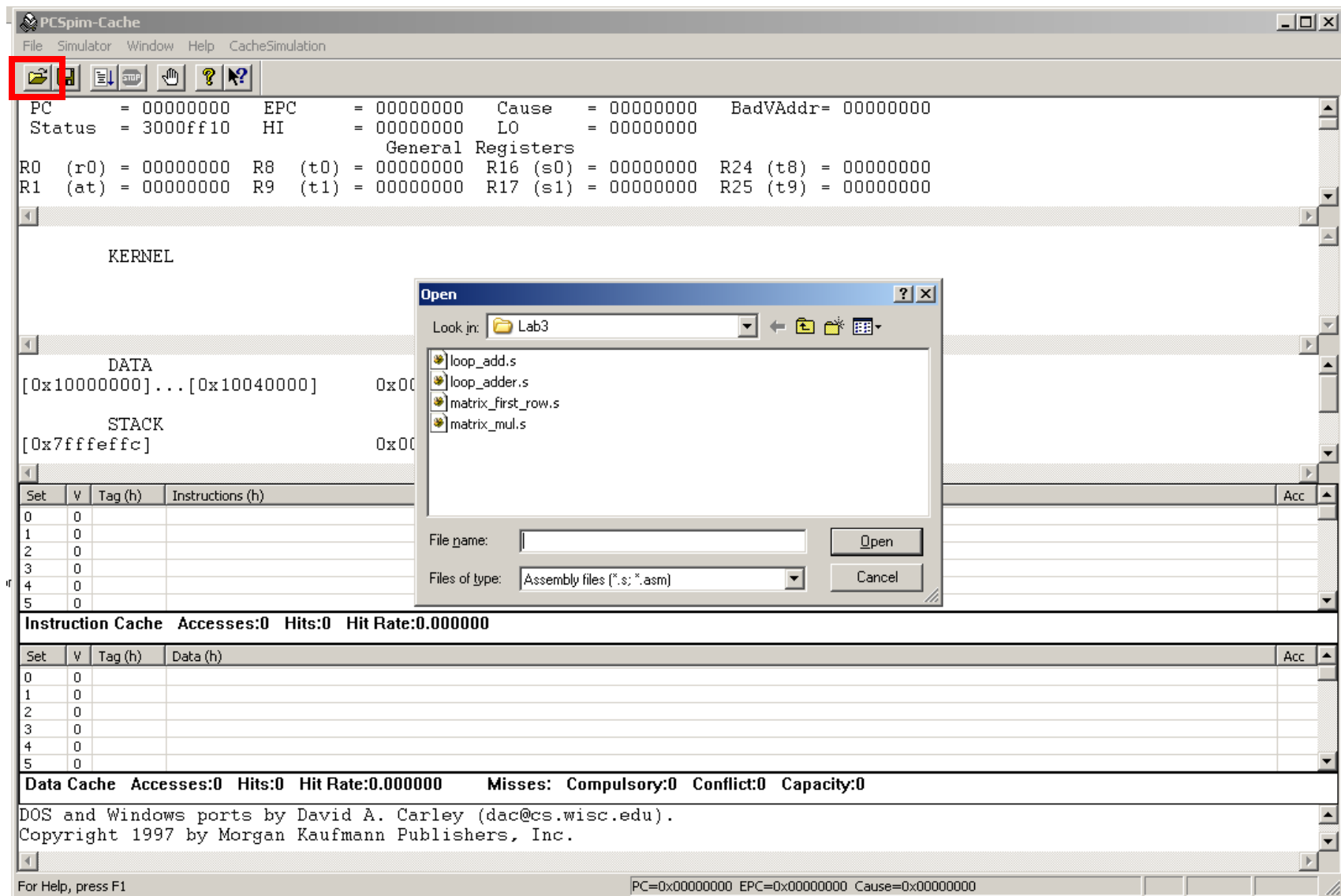
ECE232 TA  
Spring 2012



# Spim-Cache

- Spim-cache is an educational tool developed at Polytechnic University of Valencia, Spain
- It is based on the Spim MIPS simulator
- Similar to the QTSpim tool
- Similar breakpoint insertion approach
- Configurable cache parameters
- Visualized cache behaviors and cache statistics
- [Download link](#)

# Open an Assembly Code Program



# Simulate an Assembly Code Program

**PCSpim-Cache**

File Simulator Window Help CacheSimulation

Clear Registers  
Reinitialize  
Reload D:\jiazhao\ECE232\_S12\Lab3\matrix\_first\_row.s  
**Go F5**  
Continue  
Single Step F10  
Multiple Step... F11  
Breakpoints... Ctrl+B  
Set Value...  
Display symbol table  
Settings...  
Set Font

PC = 0x00000000  
S0 = 0x00000000  
R0 = 0x00000000  
R1 = 0x00000000  
R16 (s0) = 0x00000000 R24 (t8) = 0x00000000  
R17 (s1) = 0x00000000 R25 (t9) = 0x00000000

Cause = 00000000 BadVAddr= 00000000  
LO = 00000000

```

; 11: add $t0,$0,0      # offset from the base add
Matrix_B] ; 12: la $t1,Matrix_B # get the based address of
76 [Matrix_B]
4 ; 13: addi $s0,$0,4      # counter for the loop
0 ; 14: addi $t3,$0,0      # initialize the sum

```

Set	V	Tag (h)	Instructions (h)	Acc
0	0			
1	0			
2	0			
3	0			
4	0			
5	0			

**Instruction Cache** Accesses:0 Hits:0 Hit Rate:0.000000

Set	V	Tag (h)	Data (h)	Acc
0	0			
1	0			
2	0			
3	0			
4	0			
5	0			

**Data Cache** Accesses:0 Hits:0 Hit Rate:0.000000 Misses: Compulsory:0 Conflict:0 Capacity:0

Memory and registers cleared and the simulator reinitialized.

Run the program PC=0x00400000 EPC=0x00000000 Cause=0x00000000

# Monitor Cache Behaviors and Statistics

PCSpim-Cache

File Simulator Window Help CacheSimulation

Register files

```

PC      = 00000000  EPC      = 00000000  Cause   = 00000000  BadVAddr= 00000000
Status  = 3000fff0  HI       = 00000000  LO       = 00000000
General Registers
R0 (r0) = 00000000  R8 (t0) = 00001000  R16 (s0) = 00000000  R24 (t8) = 00000000
R1 (a0) = 00000000  R9 (t1) = 10000880  R17 (s1) = 00000000  R25 (t9) = 00000000

```

```

[0x00400000] 0x20080000 addi $8, $0, 0 ; 11: add $t0,$0,0 # offset from the base add
[0x00400004] 0x3c011000 lui $1, 4096 [Matrix_B] ; 12: la $t1,Matrix_B # get the based address of
[0x00400008] 0x34290880 ori $9, $1, 2176 [Matrix_B]
[0x0040000c] 0x20100004 addi $16, $0, 4 ; 13: addi $s0,$0,4 # counter for the loop
[0x00400010] 0x200b0000 addi $11, $0, 0 ; 14: addi $t3,$0,0 # initialize the sum

```

DATA

```

[0x10000000]...[0x10000880] 0x00000000
[0x10000880] 0x00000001 0x00000002 0x00000003 0x00000004
[0x10000890] 0x00000005 0x00000006 0x00000007 0x00000008
[0x100008a0]...[0x10000c80] 0x00000000

```

Set	V	Tag (h)	Instructions (h)	Acc
10	1	8000	slt \$1, \$0, \$16	
11	1	8000	bne \$1, \$0, -24	
12	1	8000	NULL	miss
13	0			
14	0			
15	0			

Instruction Cache Accesses:34 Hits:21 Hit Rate:0.617647

Set	V	Tag (h)	Data (h)	Acc
0	1	200029	00000004	miss
1	0			
2	0			
3	0			
4	0			
5	0			

Data Cache Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazhao\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

For Help, press F1

PC=0x00000000 EPC=0x00000000 Cause=0x00000000

# Monitor Cache Behaviors and Statistics

PCSpim-Cache

File Simulator Window Help CacheSimulation

PC = 00000000 EPC = 00000000 Cause = 00000000 BadVAddr= 00000000  
 Status = 3000fff0 HI = 00000000 LO = 00000000

General Registers  
 R0 (r0) = 00000000 R8 (t0) = 00001000 R16 (s0) = 00000000 R24 (t8) = 00000000  
 R1 (at) = 00000000 R9 (t1) = 10000880 R17 (s1) = 00000000 R25 (t9) = 00000000

**Instruction memory**

[0x00400000]	0x20080000	addi \$8, \$0, 0	; 11: add \$t0,\$0,0	# offset from the base add
[0x00400004]	0x3c011000	lui \$1, 4096 [Matrix_B]	; 12: la \$t1,Matrix_B	# get the based address of
[0x00400008]	0x34290880	ori \$9, \$1, 2176 [Matrix_B]		
[0x0040000c]	0x20100004	addi \$16, \$0, 4	; 13: addi \$s0,\$0,4	# counter for the loop
[0x00400010]	0x200b0000	addi \$11, \$0, 0	; 14: addi \$t3,\$0,0	# initialize the sum

DATA  
 [0x10000000]...[0x10000880] 0x00000000  
 [0x10000880] 0x00000001 0x00000002 0x00000003 0x00000004  
 [0x10000890] 0x00000005 0x00000006 0x00000007 0x00000008  
 [0x100008a0]...[0x10000c80] 0x00000000

Set	V	Tag (h)	Instructions (h)	Acc
10	1	8000	slt \$1, \$0, \$16	
11	1	8000	bne \$1, \$0, -24	
12	1	8000	NULL	miss
13	0			
14	0			
15	0			

Instruction Cache Accesses:34 Hits:21 Hit Rate:0.617647

Set	V	Tag (h)	Data (h)	Acc
0	1	200029	00000004	miss
1	0			
2	0			
3	0			
4	0			
5	0			

Data Cache Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazha0\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

For Help, press F1

PC=0x00000000 EPC=0x00000000 Cause=0x00000000

# Monitor Cache Behaviors and Statistics

PCSpim-Cache

File Simulator Window Help CacheSimulation

PC = 00000000 EPC = 00000000 Cause = 00000000 BadVAddr= 00000000  
 Status = 3000ff10 HI = 00000000 LO = 00000000

General Registers  
 R0 (r0) = 00000000 R8 (t0) = 00001000 R16 (s0) = 00000000 R24 (t8) = 00000000  
 R1 (at) = 00000000 R9 (t1) = 10000880 R17 (s1) = 00000000 R25 (t9) = 00000000

```

[0x00400000] 0x20080000 addi $8, $0, 0 ; 11: add $t0,$0,0 # offset from the base add
[0x00400004] 0x3c011000 lui $1, 4096 [Matrix_B] ; 12: la $t1,Matrix_B # get the based address of
[0x00400008] 0x34290880 ori $9, $1, 2176 [Matrix_B]
[0x0040000c] 0x20100004 addi $16, $0, 4 ; 13: addi $s0,$0,4 # counter for the loop
[0x00400010] 0x200b0000 addi $11, $0, 0 ; 14: addi $t3,$0,0 # initialize the sum
  
```

**DATA**

[0x10000000]...[0x10000880]	0x00000000			
[0x10000880]	0x00000001	0x00000002	0x00000003	0x00000004
[0x10000890]	0x00000005	0x00000006	0x00000007	0x00000008
[0x100008a0]...[0x10000c80]	0x00000000			

**Data memory**

Set	V	Tag (h)	Instructions (h)	Acc
10	1	8000	slt \$1, \$0, \$16	
11	1	8000	bne \$1, \$0, -24	
12	1	8000	NULL	miss
13	0			
14	0			
15	0			

Instruction Cache Accesses:34 Hits:21 Hit Rate:0.617647

Set	V	Tag (h)	Data (h)	Acc
0	1	200029	00000004	miss
1	0			
2	0			
3	0			
4	0			
5	0			

Data Cache Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazha0\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

For Help, press F1

PC=0x00000000 EPC=0x00000000 Cause=0x00000000

# Monitor Cache Behaviors and Statistics

PCSpim-Cache

File Simulator Window Help CacheSimulation

PC = 00000000 EPC = 00000000 Cause = 00000000 BadVAddr= 00000000  
 Status = 3000ff10 HI = 00000000 LO = 00000000

General Registers  
 R0 (r0) = 00000000 R8 (t0) = 00001000 R16 (s0) = 00000000 R24 (t8) = 00000000  
 R1 (at) = 00000000 R9 (t1) = 10000880 R17 (s1) = 00000000 R25 (t9) = 00000000

[0x00400000] 0x20080000 addi \$8, \$0, 0 ; 11: add \$t0,\$0,0 # offset from the base add  
 [0x00400004] 0x3c011000 lui \$1, 4096 [Matrix\_B] ; 12: la \$t1,Matrix\_B # get the based address of  
 [0x00400008] 0x34290880 ori \$9, \$1, 2176 [Matrix\_B]  
 [0x0040000c] 0x20100004 addi \$16, \$0, 4 ; 13: addi \$s0,\$0,4 # counter for the loop  
 [0x00400010] 0x200b0000 addi \$11, \$0, 0 ; 14: addi \$t3,\$0,0 # initialize the sum

DATA  
 [0x10000000]...[0x10000880] 0x00000000  
 [0x10000880] 0x00000001 0x00000002 0x00000003 0x00000004  
 [0x10000890] 0x00000005 0x00000006 0x00000007 0x00000008  
 [0x100008a0]...[0x10000c80] 0x00000000

**Instruction cache**

Set	V	Tag (h)	Instructions (h)	Acc
10	1	8000	slt \$1, \$0, \$16	
11	1	8000	bne \$1, \$0, -24	
12	1	8000	NULL	miss
13	0			
14	0			
15	0			

**Instruction Cache** Accesses:34 Hits:21 Hit Rate:0.61764

Set	V	Tag (h)	Data (h)	Acc
0	1	200029	00000004	miss
1	0			
2	0			
3	0			
4	0			
5	0			

**Data Cache** Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazha0\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

For Help, press F1

PC=0x00000000 EPC=0x00000000 Cause=0x00000000



# Monitor Cache Behaviors and Statistics

PCSpim-Cache

File Simulator Window Help CacheSimulation

PC = 00000000 EPC = 00000000 Cause = 00000000 BadVAddr= 00000000  
 Status = 3000fff0 HI = 00000000 LO = 00000000

General Registers  
 R0 (r0) = 00000000 R8 (t0) = 00001000 R16 (s0) = 00000000 R24 (t8) = 00000000  
 R1 (at) = 00000000 R9 (t1) = 10000880 R17 (s1) = 00000000 R25 (t9) = 00000000

```
[0x00400000] 0x20080000 addi $8, $0, 0 ; 11: add $t0,$0,0 # offset from the base add
[0x00400004] 0x3c011000 lui $1, 4096 [Matrix_B] ; 12: la $t1,Matrix_B # get the based address of
[0x00400008] 0x34290880 ori $9, $1, 2176 [Matrix_B]
[0x0040000c] 0x20100004 addi $16, $0, 4 ; 13: addi $s0,$0,4 # counter for the loop
[0x00400010] 0x200b0000 addi $11, $0, 0 ; 14: addi $t3,$0,0 # initialize the sum
```

DATA  
 [0x10000000]...[0x10000880] 0x00000000  
 [0x10000880] 0x00000001 0x00000002 0x00000003 0x00000004  
 [0x10000890] 0x00000005 0x00000006 0x00000007 0x00000008  
 [0x100008a0]...[0x10000c80] 0x00000000

Set	V	Tag (h)	Instructions (h)	Acc
10	1	8000	slt \$1, \$0, \$16	
11	1	8000	bne \$1, \$0, -24	
12	1	8000	NULL	miss
13	0			
14	0			
15	0			

Instruction Cache Accesses:34 Hits:21 Hit Rate:0.617647

Set	V	Tag (h)	Data (h)	Acc
0	1	200029	00000004	miss
1	0			
2	0			
3	0			
4	0			
5	0			

**Data cache**

Data Cache Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazha0\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

For Help, press F1 PC=0x00000000 EPC=0x00000000 Cause=0x00000000

# Change Cache Configuration

PCSpim-Cache

File Simulator Window Help CacheSimulation

Cache Configuration

CacheSettings

PC = 00000000 Cause = 00000000 BadVAddr= 00000000  
 Status = 3000ff1b LO = 00000000

General Registers

R0 (r0) = 00000000 R8 (t0) = 00001000 R16 (s0) = 00000000 R24 (t8) = 00000000  
 R1 (at) = 00000000 R9 (t1) = 10000880 R17 (s1) = 00000000 R25 (t9) = 00000000

[0x00400000] 0x20080000 addi \$8, \$0, 0 ; 11: add \$t0,\$0,0 # offset from the base add  
 [0x00400004] 0x3c011000 lui \$1, 4096 [Matrix\_B] ; 12: la \$t1,Matrix\_B # get the based address of  
 [0x00400008] 0x34290880 ori \$9, \$1, 2176 [Matrix\_B]  
 [0x0040000c] 0x20100004 addi \$16, \$0, 4 ; 13: addi \$s0,\$0,4 # counter for the loop  
 [0x00400010] 0x200b0000 addi \$11, \$0, 0 ; 14: addi \$t3,\$0,0 # initialize the sum

DATA

[0x10000000]...[0x10000880] 0x00000000  
 [0x10000880] 0x00000001 0x00000002 0x00000003 0x00000004  
 [0x10000890] 0x00000005 0x00000006 0x00000007 0x00000008  
 [0x100008a0]...[0x10000c80] 0x00000000

Set	V	Tag (h)	Instructions (h)	Acc
10	1	8000	slt \$1, \$0, \$16	
11	1	8000	bne \$1, \$0, -24	
12	1	8000	NULL	miss
13	0			
14	0			
15	0			

Instruction Cache Accesses:34 Hits:21 Hit Rate:0.617647

Set	V	Tag (h)	Data (h)	Acc
0	1	200029	00000004	miss
1	0			
2	0			
3	0			
4	0			
5	0			

Data Cache Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazha\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

Cache Settings

PC=0x00000000 EPC=0x00000000 Cause=0x00000000

# Change Cache Configuration

PCSpim-Cache

File Simulator Window Help CacheSimulation

PC = 00000000 EPC = 00000000 Cause = 00000000 BadVAddr= 00000000  
 Status = 3000ff10 HI = 00000000 LO = 00000000

General Registers  
 R0 (r0) = 00000000 R8 (t0) = 00001000 R16 (s0) = 00000000 R24 (t8) = 00000000  
 R1 (at) = 00000000 R9 (t1) = 10000880 R17 (s1) = 00000000 R25 (t9) = 00000000

```

[0x00400000] 0x20080000 addi $8, $0, 0 ; 11: add $t0,$0,0 # offset from the base add
[0x00400004] 0x3c011000 lui $1, 4096 #Matrix B1 ; 12: la $t1,Matrix B # get the based address of
[0x00400008] 0x34290880 ori $9, $ # #
[0x0040000c] 0x20100004 addi $1, $ # #
[0x00400010] 0x200b0000 addi $1, $ # #
# counter for the loop
# initialize the sum
  
```

DATA  
 [0x10000000]...[0x10000880] 0x0  
 [0x10000880] 0x0  
 [0x10000890] 0x0  
 [0x100008a0]...[0x10000c80] 0x0

Set	V	Tag (h)	Instructions (h)
10	1	8000	slt \$1, \$0, \$16
11	1	8000	bne \$1, \$0, -24
12	1	8000	NULL
13	0		
14	0		
15	0		

Instruction Cache Accesses:34 Hits:21 Hit Rate:0.6176

Set	V	Tag (h)	Data (h)
0	1	200029	00000004
1	0		
2	0		
3	0		
4	0		
5	0		

Data Cache Accesses:4 Hits:0 Hit Rate:0.000000 Misses: Compulsory:4 Conflict:0 Capacity:0

D:\jiazha\ECE232\_S12\Lab3\matrix\_first\_row.s successfully loaded

For Help, press F1

PC=0x00000000 EPC=0x00000000 Cause=0x00000000

**CacheSettings**

CACHE SIZE: 128B, 256B, 512B, 1024B  
 BLOCK SIZE: 4B, 8B, 16B  
 MAPPING: Direct Mapping, 2 Ways Set-Associative, 4 Ways Set-Associative, Fully Associative  
 WRITING POLICY: WriteThrough-Allocate, WriteThrough-NoAllocate, WriteBack-Allocate, WriteBack-NoAllocate  
 REPLACEMENT ALGORITHM: LRU, FIFO  
☒ ShowRate

**Data\_cache**

In Lab 3, ONLY data cache configuration needs to be changed