Demo

CVR SpMV

Preprocess

	1		1	2		3						5		
8			1	3			2	1		3				4
	5				5					8				
											9	1		
	4	4				2							3	
3							3				7		7	6

CVR

lane	val							tail	col_idx						
0	1	1	2	3	5	7	7	0	1	3	4	6	12	11	13
1	8	1	3	2	1	3	4	1	0	3	4	7	8	10	14
2	5	5	8	3	3	6	0	6	1	5	10	0	7	14	14
3	9	1	4	4	2	3	0	5	11	12	1	2	6	13	14

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

lr_rec = 16

SpMV

x^T	2	3	5	7	1	1	1	3	1	7	1	9	2	3	2

CVR

lane	val							tail	col_idx						
0	1	1	2	3	5	7	7	0	1	3	4	6	12	11	13
1	8	1	3	2	1	3	4	1	0	3	4	7	8	10	14
2	5	5	8	3	3	6	0	6	1	5	10	0	7	14	14
3	9	1	4	4	2	3	0	5	11	12	1	2	6	13	14

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

lr_rec = 16

SpMV

lr_rec = 16

rec								
	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	0
1	0
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	3
1	0
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	3
1	16
2	15
3	81

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	10
1	23
2	20
3	83

lane	val						tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	10
1	23
2	20
3	83

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

pos = i * n_lanes + lane

i = 0 i = 1

lane = 3

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	10
1	23
2	20
3	83

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	0
5	0
6	0

temp

lane	val
0	10
1	23
2	20
3	83

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	83
5	0
6	0

temp

lane	val
0	10
1	23
2	20
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

y

idx	val
0	0
1	0
2	0
3	0
4	83
5	0
6	0

matrix A

	1		1	2		3					5		
8			1	3			2	1		3			4
	5				5					8			
											9	1		
	4	4				2						3	
3							3				7		7	6

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	83
5	0
6	0

temp

lane	val
0	12
1	26
2	28
3	12

lane	val						tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	0
3	0
4	83
5	0
6	0

temp

lane	val
0	12
1	26
2	28
3	12

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	12
1	26
2	0
3	12

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	15
1	32
2	6
3	32

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

y

idx	val
0	0
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	25
1	33
2	15
3	34

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	25
1	33
2	15
3	34

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

y

idx	val
0	0
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	25
1	33
2	15
3	34

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	0
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	25
1	33
2	15
3	34

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	0
1	33
2	15
3	34

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	63
1	36
2	27
3	43

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	63
1	36
2	27
3	43

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	0
6	0

temp

lane	val
0	63
1	36
2	27
3	43

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	0
6	27

temp

lane	val
0	63
1	36
2	0
3	43

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec								
	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	0
6	27

temp

lane	val
0	63
1	36
2	0
3	43

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
11	12	1	2	6	13	14

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

1	3	4	6	12	11	13
0	3	4	7	8	10	14
1	5	10	0	7	14	14
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Write back

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
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col_idx

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idx	val
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8	1
9	7
10	1
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12	2
13	3
14	2

SpMV

lr_rec = 16

rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

x

idx	val
0	2
1	3
2	5
3	7
4	1
5	1
6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	43
6	27

temp

lane	val
0	84
1	44
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
3	9	1	4	4	2	3	0	5

col_idx

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rec	pos	7	10	16	22	23	24	25
	wb	4	2	0	2	3	2	1

y

idx	val
0	25
1	0
2	28
3	0
4	83
5	43
6	27

temp

lane	val
0	84
1	44
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
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lane	val							tail
0	1	1	2	3	5	7	7	0
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y

idx	val
0	25
1	0
2	28
3	0
4	83
5	43
6	111

temp

lane	val
0	0
1	44
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
2	5	5	8	3	3	6	0	6
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col_idx

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6	111

temp

lane	val
0	0
1	44
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
1	8	1	3	2	1	3	4	1
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6	1
7	3
8	1
9	7
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12	2
13	3
14	2

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	wb	4	2	0	2	3	2	1

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idx	val
0	25
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5	43
6	111

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lane	val
0	0
1	44
2	0
3	0

lane	val							tail
0	1	1	2	3	5	7	7	0
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temp

lane	val
0	0
1	0
2	0
3	0

lane	val							tail
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idx	val
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4	1
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6	1
7	3
8	1
9	7
10	1
11	9
12	2
13	3
14	2

SpMV

y

25
44
28
0
83
43
111

matrix A

	1		1	2		3					5		
8			1	3			2	1		3			4
	5				5					8			
											9	1		
	4	4				2						3	
3							3				7		7	6

x

2
3
5
7
1
1
1
3
1
7
1
9
2
3
2