B1

b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

b1_m1 - Level 1

B1

Mesh 1

Poisson matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	-2	1					1																	
2	1	-3	1					1																
3		1	-3	1					1															
4			1	-3	1					1														
5				1	-3	1					1													
6					1	-4						1												
7	1						-3	1					1											
8		1					1	-4	1					1										
9			1					1	-4	1					1									
10				1					1	-4	1					1								
11					1					1	-4	1					1							
12						1					1	-5						1						
13							1						-3	1					1					
14								1					1	-4	1					1				
15									1					1	-4	1					1			
16										1					1	-4	1					1		
17											1					1	-4	1					1	
18												1					1	-5						1
19													1						-2	1				
20														1					1	-3	1			
21															1					1	-3	1		
22																1					1	-3	1	
23																	1					1	-3	1
24																		1					1	-4

Aggregation operator

	1	2	3	4	5	6
1	●					
2	●					
3		●				
4				●		
5				●		
6					●	
7	●					
8		●				
9		●				
10				●		
11					●	
12					●	
13			●			
14		●				
15		●				
16						●
17					●	
18					●	
19			●			
20			●			
21		●				
22						●
23						●
24					●	

B1

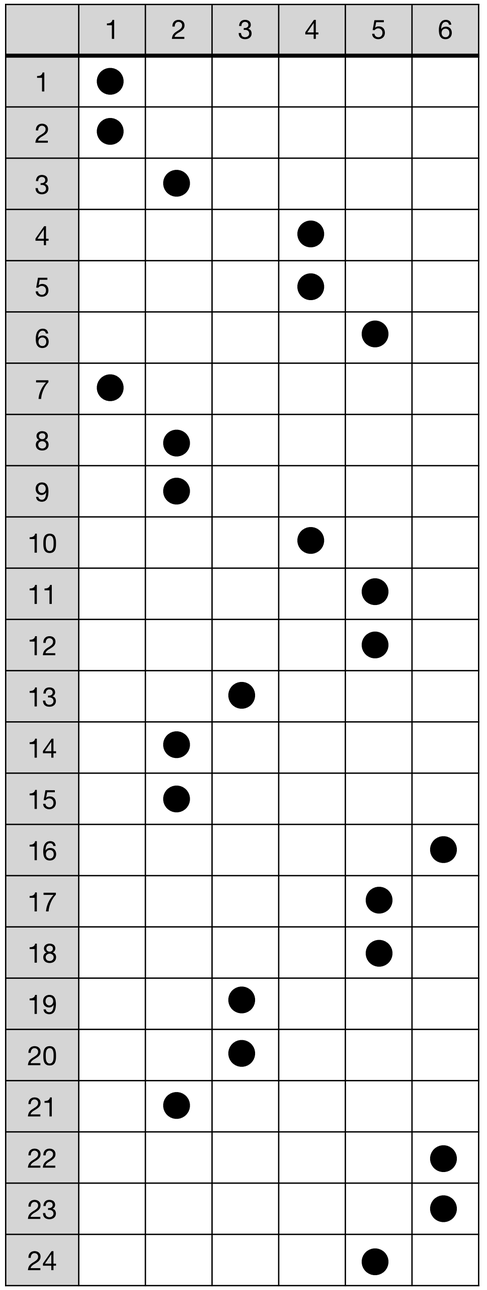
b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

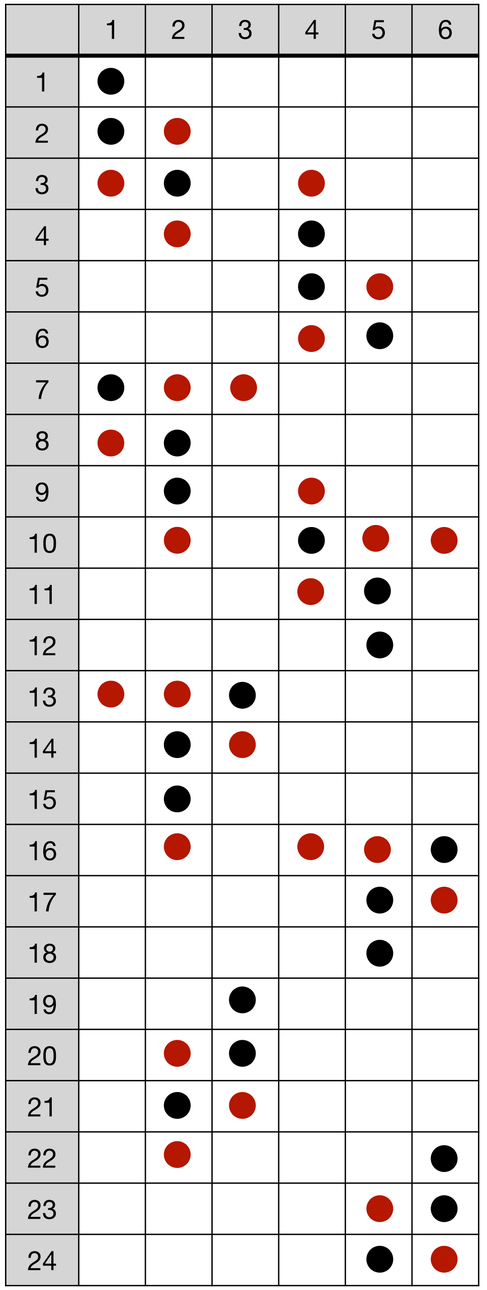
b1_m1 - Level 1

3	3	2	6	6	5
3	2	2	6	5	5
1	2	2	4	5	5
1	1	2	4	4	5

Aggregation operator



Prolongation matrix



B2

b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

b2_m2 - Level 0

16	10	11	12
15	7	8	9
14	4	5	6
13	1	2	3

b2_m1 - Level 1

3	3	2	-6
3	2	2	6
1	2	2	4
1	1	2	-4

b2_m2 - Level 1

2	6	6	5
2	6	5	5
2	4	5	5
2	4	4	5

B2

Mesh 1

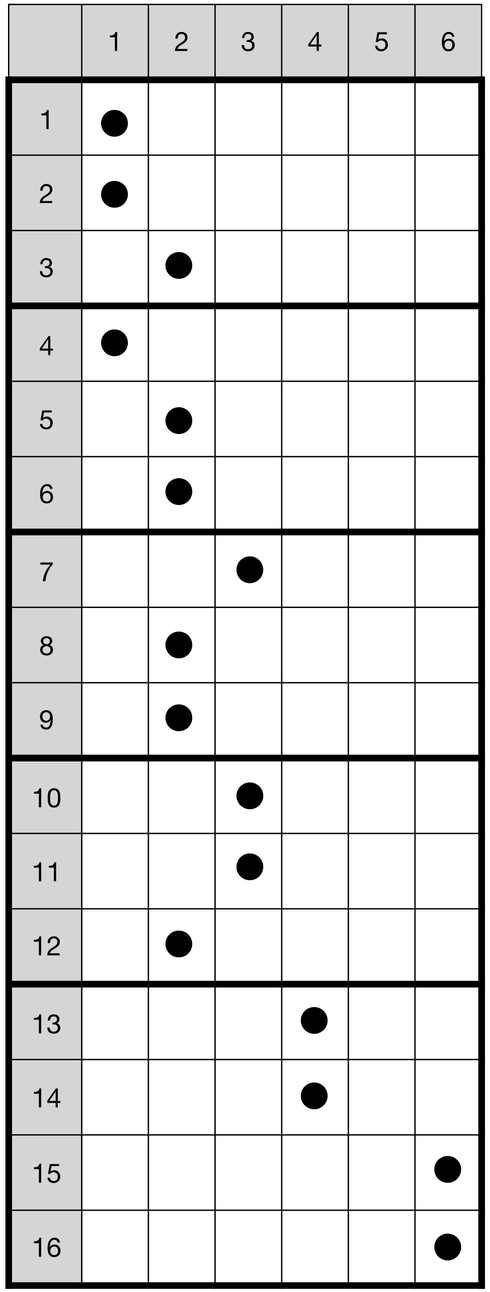
b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

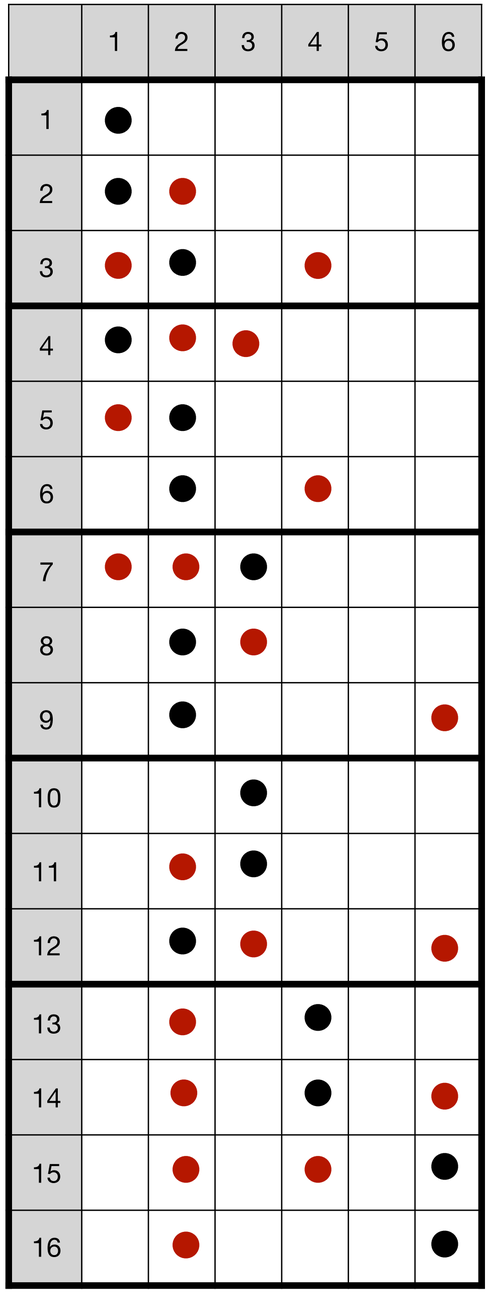
b2_m1 - Level 1

3	3	2	6
3	2	2	6
1	2	2	4
1	1	2	4

Aggregation operator



Prolongation matrix



B2

Mesh 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	-2	1		1												
2	1	-3	1		1											
3		1	-3			1							1			
4	1			-3	1		1									
5		1		1	-4	1		1								
6			1		1	-4			1					1		
7				1			-3	1		1						
8					1		1	-4	1		1					
9						1		1	-4			1			1	
10							1			-2	1					
11								1		1	-3	1				
12									1		1	-3				1

b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

Aggregation operator

	1	2	3	4	5	6
1	●					
2	●					
3		●				
4	●					
5		●				
6		●				
7			●			
8		●				
9		●				
10			●			
11			●			
12		●				
13				●		
14				●		
15						●
16						●

B2

Mesh 2

b2_m2 - Level 0

16	10	11	12
15	7	8	9
14	4	5	6
13	1	2	3

b2_m2 - Level 1

2	6	6	5
2	6	5	5
2	4	5	5
2	4	4	5

Aggregation operator

	1	2	3	4	5	6
1				●		
2				●		
3					●	
4				●		
5					●	
6					●	
7						●
8					●	
9					●	
10						●
11						●
12					●	
13		●				
14		●				
15		●				
16		●				

Prolongation matrix

	1	2	3	4	5	6
1		●		●		
2				●	●	
3				●	●	
4		●		●	●	●
5				●	●	
6					●	
7		●		●	●	●
8					●	●
9					●	
10		●				●
11					●	●
12					●	●
13		●		●		
14		●		●		
15		●				●
16		●				●

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
10				1					1	-4	1					1								

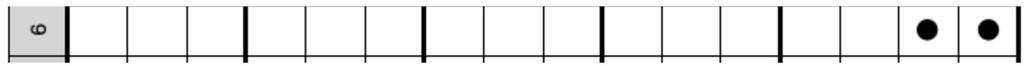
b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

b1_m1 - Level 1

3	3	2	6	6	5
3	2	2	6	5	5
1	2	2	4	5	5
1	1	2	4	4	5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
6			1		1	-4			1					1		



b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

b2_m1 - Level 1

3	3	2	6
3	2	2	6
1	2	2	4
1	1	2	4

b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

b2_m2 - Level 0

16	10	11	12
15	7	8	9
14	4	5	6
13	1	2	3

b1_m1 - Level 1

3	3	2	6	6	5
3	2	2	6	5	5
1	2	2	4	5	5
1	1	2	4	4	5

b2_m1 - Level 1

3	3	2	6
3	2	2	6
1	2	2	4
1	1	2	4

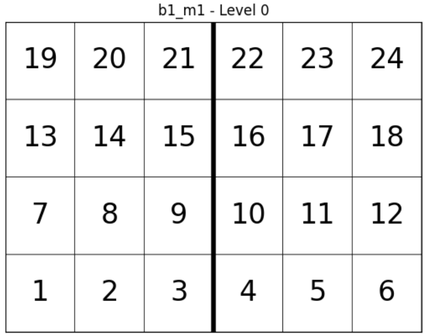
b2_m2 - Level 1

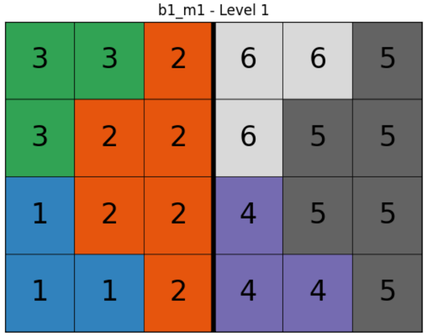
2	6	6	5
2	6	5	5
2	4	5	5
2	4	4	5

B1

Restriction

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	x	x	x				x	x					x											
2		x	x	x			x	x	x	x			x	x	x	x				x	x	x		
3							x						x	x					x	x	x			
4			x	x	x	x			x	x	x					x								
5					x	x				x	x	x				x	x	x					x	x
6										x						x	x					x	x	x





Poisson

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	-2	1					1																	
2	1	-3	1					1																
3		1	-3	1					1															
4			1	-3	1					1														
5				1	-3	1					1													
6					1	-4						1												
7	1						-3	1					1											
8		1					1	-4	1					1										
9			1					1	-4	1					1									
10				1					1	-4	1					1								
11					1					1	-4	1					1							
12						1					1	-5						1						
13							1						-3	1					1					
14								1					1	-4	1					1				
15									1					1	-4	1					1			
16										1					1	-4	1					1		
17											1					1	-4	1					1	
18												1					1	-5						1
19													1						-2	1				
20														1					1	-3	1			
21															1					1	-3	1		
22																1					1	-3	1	
23																	1					1	-3	1
24																		1					1	-4

Prolongation

	1	2	3	4	5	6
1	x					
2	x	x				
3	x	x		x		
4		x		x		
5				x	x	
6				x	x	
7	x	x	x			
8	x	x				
9		x		x		
10		x		x	x	x
11				x	x	
12					x	
13	x	x	x			
14		x	x			
15		x				x
16		x		x	x	x
17					x	x
18					x	
19			x			
20		x	x			
21		x	x			
22		x				x
23					x	x
24					x	x

B2

Mesh 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	x	x	x	x	x		x									
2		x	x	x	x	x	x	x	x		x	x	x	x	x	x
3				x			x	x		x	x	x				
4			x			x							x	x	x	
5																
6									x			x		x	x	x

b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

b2_m1 - Level 1

3	3	2	6
3	2	2	6
1	2	2	4
1	1	2	4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	-2	1		1												
2	1	-3	1		1											
3		1	-3			1							1			
4	1			-3	1		1									
5		1		1	-4	1		1								
6			1		1	-4			1					1		
7				1			-3	1		1						
8					1		1	-4	1		1					
9						1		1	-4			1			1	
10							1			-2	1					
11								1		1	-3	1				
12									1		1	-3				1

	1	2	3	4	5	6
1	x					
2	x	x				
3	x	x		x		
4	x	x	x			
5	x	x				
6		x		x		
7	x	x	x			
8		x	x			
9		x				x
10			x			
11		x	x			
12		x	x			x
13		x		x		
14		x		x	x	x
15		x		x	x	x
16		x				x

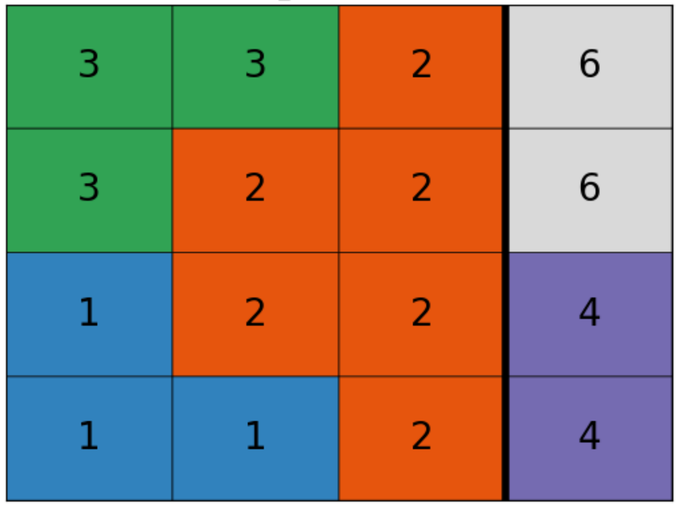
b2_m1 - Level 0

10	11	12	16 22
7	8	9	15 19
4	5	6	14 16
1	2	3	13 13

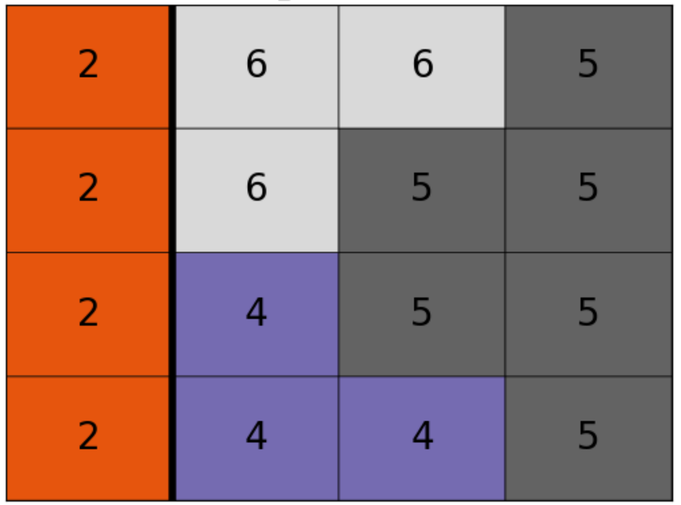
b2_m2 - Level 0

12 16	22 10	23 11	24 12
13 15	19 7	20 8	21 9
6 14	16 4	17 5	18 6
3 13	13 1	14 2	15 3

b2_m1 - Level 1



b2_m2 - Level 1



b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

b2_m1 - Level 0

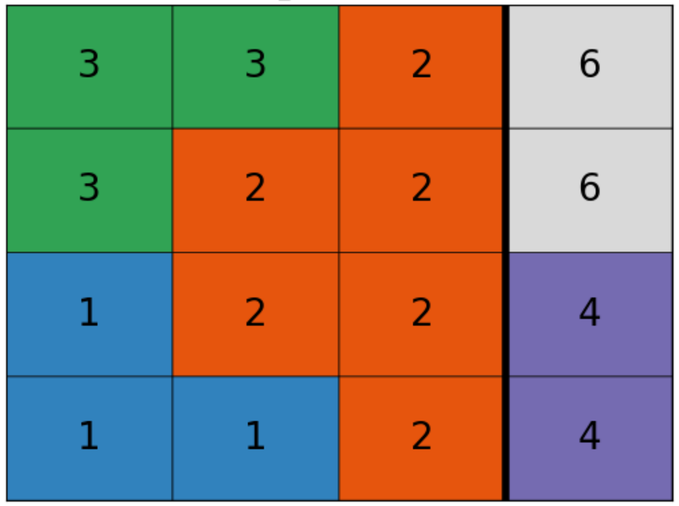
10	11	12	16 22
7	8	9	15 19
4	5	6	14 16
1	2	3	13 13

b2_m2 - Level 0

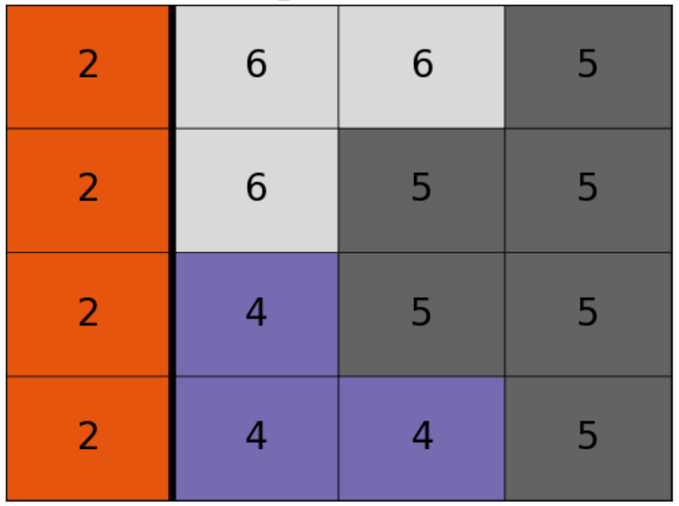
12 16	22 10	23 11	24 12
13 15	19 7	20 8	21 9
6 14	16 4	17 5	18 6
3 13	13 1	14 2	15 3

b1_m1 - Level 1

b2_m1 - Level 1



b2_m2 - Level 1



B1 Restriction

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	x	x	x				x	x					x											
2		x	x	x			x	x	x	x			x	x	x	x				x	x	x		
3							x						x	x					x	x	x			
4			x	x	x	x			x	x	x					x								
5					x	x				x	x	x					x	x					x	x
6										x					x	x	x				x	x	x	x

b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

b1_m1 - Level 1

3	3	2	6	6	5
3	2	2	6	5	5
1	2	2	4	5	5
1	1	2	4	4	5

B1 AP

	1	2	3	4	5	6
1	x	x	x			
2	x	x		x		
3	x	x		x		
4	x	x		x	x	x
5		x		x	x	
6				x	x	
7	x	x	x			
8	x	x	x	x		
9	x	x		x	x	x
10		x		x	x	x
11		x		x	x	x
12				x	x	
13	x	x	x			
14	x	x	x			x
15		x	x	x	x	x
16		x		x	x	x
17		x		x	x	x
18					x	x
19	x	x	x			
20		x	x			x
21		x	x			x
22		x	x	x	x	x
23		x			x	x
24					x	x

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	x	x	x	x	x		x									
2		x	x	x	x	x	x	x	x		x	x	x	x	x	x
3				x			x	x		x	x	x				
4			x			x							x	x	x	
5														x	x	
6									x			x		x	x	x

B2-1 Restriction

b2_m1 - Level 0

10	11	12	16
7	8	9	15
4	5	6	14
1	2	3	13

b2_m1 - Level 1

3	3	2	6
3	2	2	6
1	2	2	4
1	1	2	4

B2-1 AP

	1	2	3	4	5	6
1	x	x	x	x	x	x
2	x	x		x		
3	x	x		x		
4	x	x	x			
5	x	x	x	x		
6	x	x		x	x	x
7	x	x	x			
8	x	x	x			x
9		x	x	x	x	x
10	x	x	x			
11		x	x			x
12		x	x			x
13	x	x		x	x	x
14		x		x	x	x
15		x		x	x	
16		x	x	x	x	x

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	x	x	x	x	x		x						x	x		
2		x	x	x	x	x	x	x	x		x	x				
3				x			x	x		x	x	x			x	x
4	x			x			x			x			x	x	x	x
													x			
																x

B2-2 Restriction

b2_m2 - Level 0

16	10	11	12
15	7	8	9
14	4	5	6
13	1	2	3

b2_m2 - Level 1

2	6	6	5
2	6	5	5
2	4	5	5
2	4	4	5

B2-2 AP

	1	2	3	4	5	6
1	x	x		x	x	x
2		x		x	x	
3				x	x	
4		x		x	x	x
5		x		x	x	x
6				x	x	
7		x		x	x	x
8		x		x	x	x
9					x	x
10		x	x	x	x	x
11		x			x	x
12					x	x
13	x	x		x		
14	x	x		x	x	x
15		x	x	x	x	x
16		x	x			x

B2 Prolongation local numbering

```
------------>PROLONGATION-FINE%COL:
  1:      1      2
  2:      2      3
  3:      2      3
  4:      1      2      3      4
  5:      2      3
  6:      3
  7:      1      2      3      4
  8:      3      4
  9:      3
 10:      1      4
 11:      3      4
 12:      3      4
 13:     -1     -2     -4
 14:     -2     -4
 15:     -2     -5
 16:     -2     -3     -5
------------>PROLONGATION-FINE%COLG:
  1:      2      4
  2:      4      5
  3:      4      5
  4:      2      4      5      6
  5:      4      5
  6:      5
  7:      2      4      5      6
  8:      5      6
  9:      5
 10:      2      6
 11:      5      6
 12:      5      6
 13:      1      2      4
 14:      2      4
 15:      2      6
 16:      2      3      6
```

b1_m1 - Level 0

19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

	1	2	3	4	5	6
1	X	X				
2		X	X			
3		X	X			
4	X	X	X	X		
5		X	X			
6			X			
7	X	X	X	X		
8			X	X		
9			X			
10	X			X		
11			X	X		
12			X	X		
13	X			X	X	
14	X			X		
15			X	X		
16			X	X		X

b2_m2 - Level 0

16	10	11	12
15	7	8	9
14	4	5	6
13	1	2	3

b2_m2 - Level 1

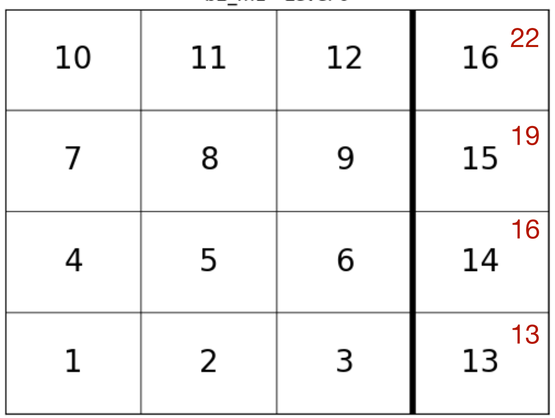
2	6	6	5
2	6	5	5
2	4	5	5
2	4	4	5

local	global
1	4
2	5
3	6
4	2
5	1
6	3

B2 - Mesh 1

```
ICG_TO_LCELL:     1    4    7   10
                  2    5    8   11

ICG_TO_GCELL:    13   16   19   22
                 14   17   20   23

ICG_TO_LZONE:     1    1    3    3
                  1    2    2    3

ICG_TO_GZONE:     4    4    6    6
                  4    5    5    6
```

b2_m1 - Level 0

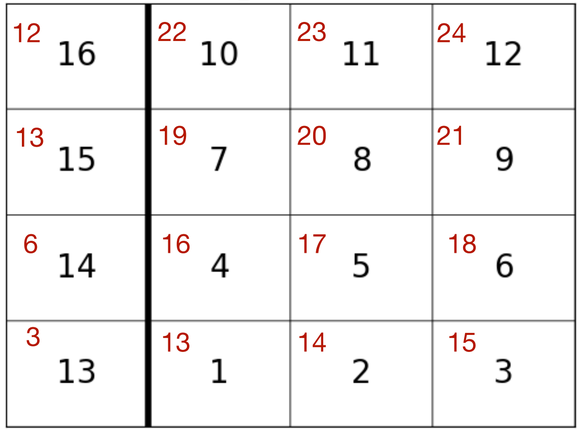


b2_m1 - Level 1

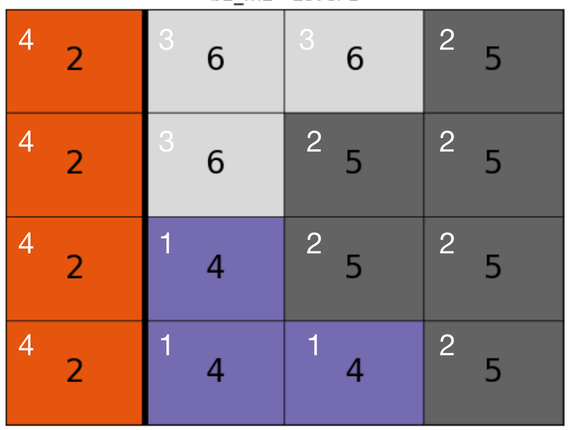
B2 - Mesh 2

```
ICG_TO_LCELL:     3    6    9   12
                  2    5    8   11

ICG_TO_GCELL:     3    6    9   12
                  2    5    8   11

ICG_TO_LZONE:     2    2    2    2
                  1    2    2    3

ICG_TO_GZONE:     2    2    2    2
                  1    2    2    3
```

b2_m2 - Level 0



b2_m2 - Level 1

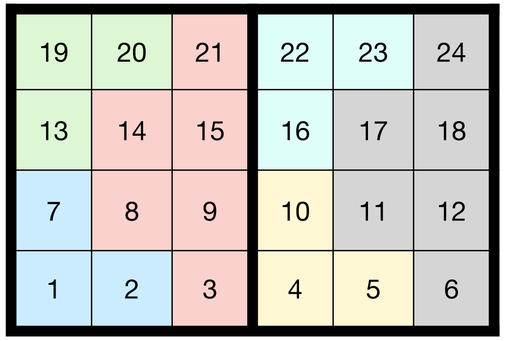


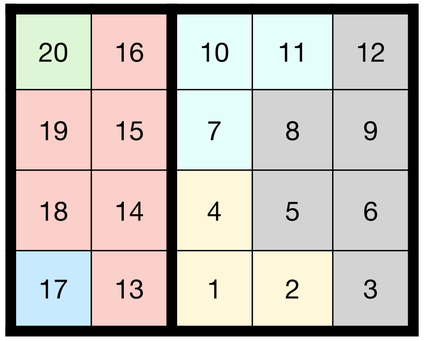
B1 - Mesh 1

B2 - Mesh 2

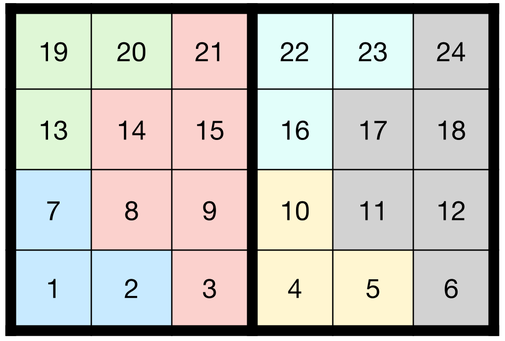
B2 - Mesh 2

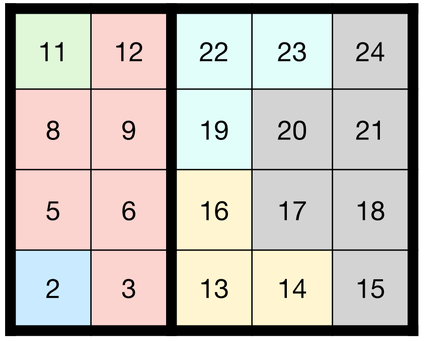
GF: lokale Zell-Nummern





GF: globale Zell-Nummern





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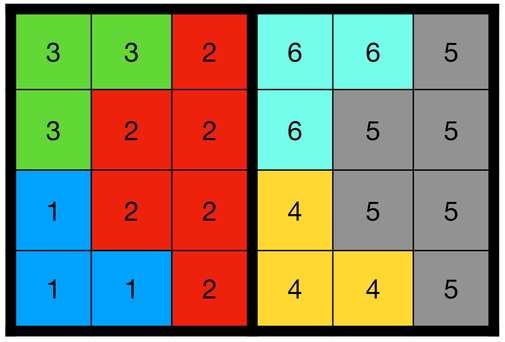

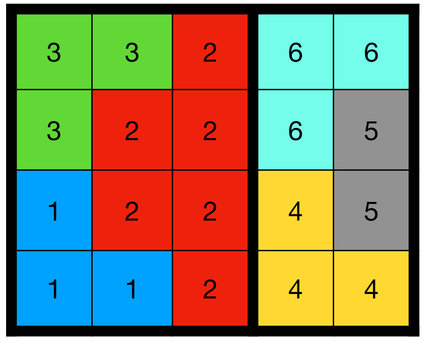

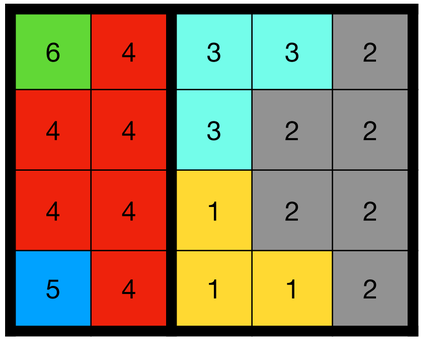

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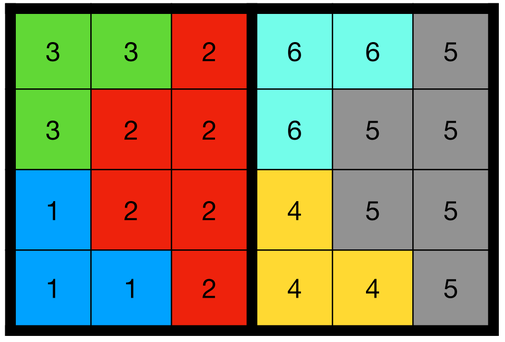
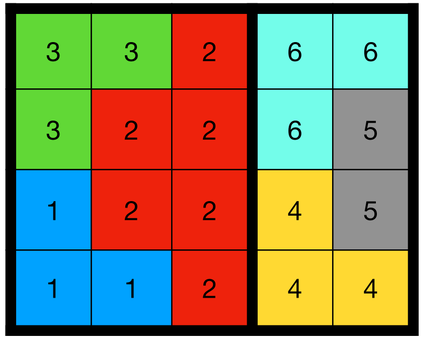
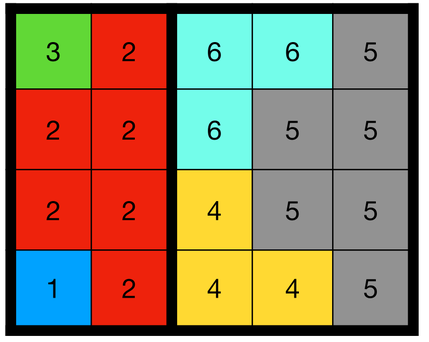






Lokal

Global

31	32	33	34	35	36
25	26	27	28	29	30
19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

B4 - Mesh 3

7	8	9	12	21
4	5	6	11	20
1	2	3	10	19
13	14	15		
16	17	18		

B4 - Mesh 4

21	12	7	8	9
20	11	4	5	6
19	10	1	2	3
		13	14	15
		16	17	18

B4 - Mesh 3

25	26	27		
22	23	24		
19	20	21		

B4 - Mesh 4

		34	35	36
		31	32	33
		28	29	30

		6			8
5			7		
		2			4
1			3		

B4 - Mesh 1

19	20	21		
13	14	15		
7	8	9	12	18
4	5	6	11	17
1	2	3	10	16

B4 - Mesh 2

		19	20	21
		13	14	15
18	12	7	8	9
17	11	4	5	6
16	10	1	2	3

B4 - Mesh 1

13	14	15		
7	8	9	12	
4	5	6	11	
1	2	3	10	

B4 - Mesh 2

		16	17	18
		13	14	15
		10	11	12

Lokal

```
G%ICE_TO_ECELL:
   10    11    12    13    14    15    16    17    18    19    20    21
G%ICE_TO_ICELL:
    3     6     9     7     8     9     2     5     8     4     5     6
G%ICE_TO_GCELL:
   10    13    16    19    20    21    11    14    17    22    23    24
G%ICE_TO_OCELL:
    1     4     7     1     2     3     2     5     8     4     5     6
```

31	32	33	34	35	36
25	26	27	28	29	30
19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

B4 - Mesh 3

7	8	9	12	21
4	5	6	11	20
1	2	3	10	19
13	14	15		
16	17	18		

B4 - Mesh 4

21	12	7	8	9
20	11	4	5	6
19	10	1	2	3
		13	14	15
		16	17	18

25	26	27		
22	23	24		
19	20	21		

		6		8
5			7	
		2		4
1			3	

19	20	21		
13	14	15		
7	8	9	12	18
4	5	6	11	17
1	2	3	10	16

B4 - Mesh 1

		19	20	21
		13	14	15
18	12	7	8	9
17	11	4	5	6
16	10	1	2	3

B4 - Mesh 2

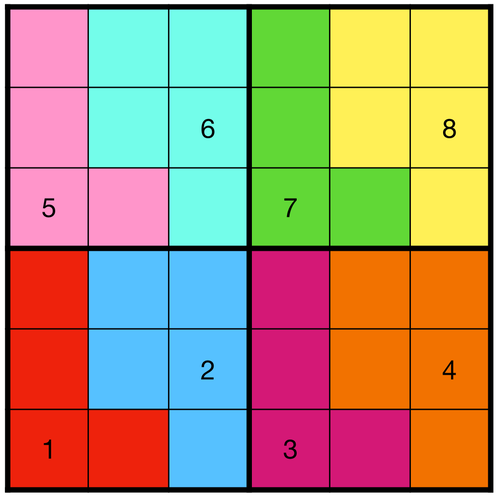
7	8	9		
4	5	6		
1	2	3		

		16	17	18
		13	14	15
		10	11	12

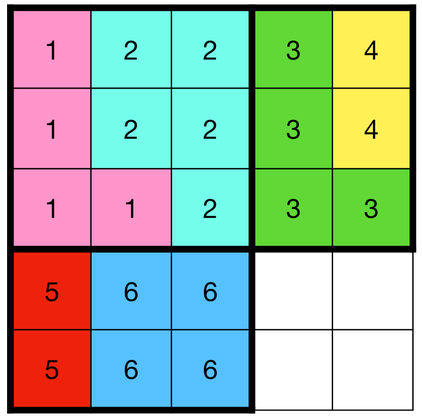
```
GF%ICE_TO_IZONE:
     2     2     2     1     2     2     1     2     2     1     2     2
GF%ICE_TO_EZONE:
     5     5     5     3     3     4     5     6     6     3     4     4
GF%ICE_TO_GZONE:
     3     3     3     5     5     6     3     4     4     5     6     6
GF%ICE_TO_OZONE:
     1     1     1     1     1     2     1     2     2     1     2     2
```

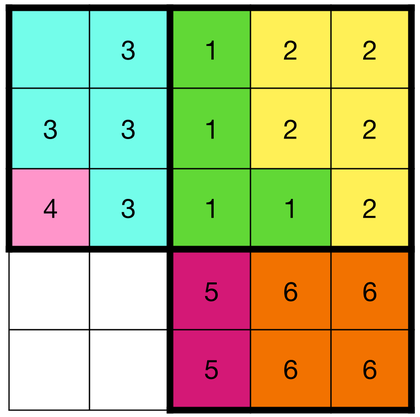
1. layer first, then 2. layer

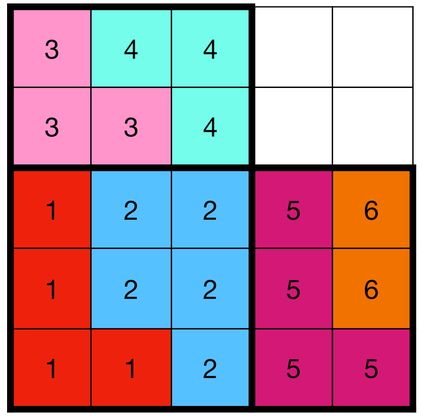
31	32	33	34	35	36
25	26	27	28	29	30
19	20	21	22	23	24
13	14	15	16	17	18
7	8	9	10	11	12
1	2	3	4	5	6

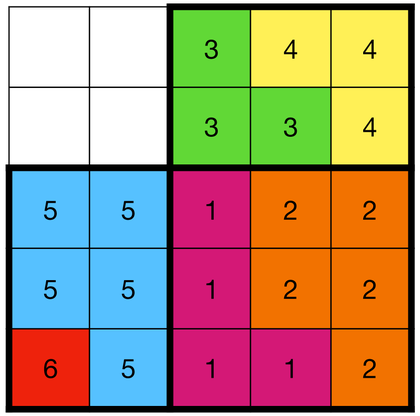


B4 - local zones

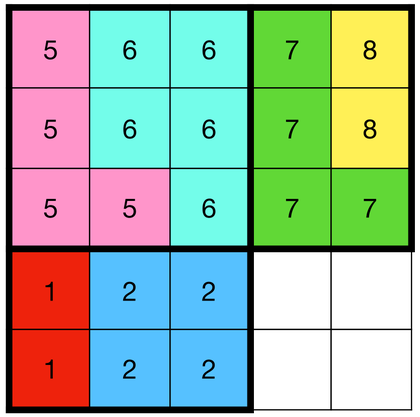


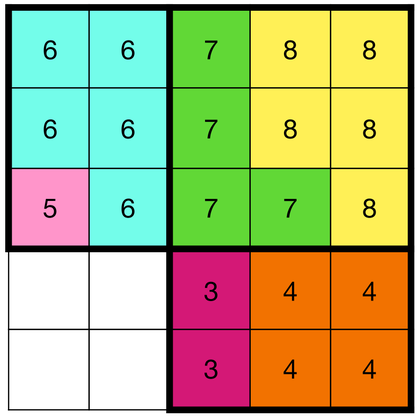


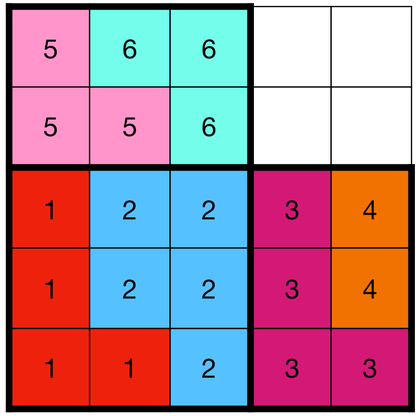


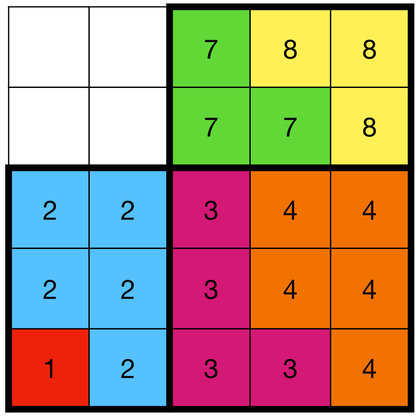


B4 - global zones









Mesh 2: ICE_TO_GZONE: 2 2 2 L1-M1 | 7 7 8 L1-M4 | 1 2 2 L2-M1 | 7 8 8 L2-M4

22	23	24	25	26	27	28	32	43
15	16	17	18	19	20	21	31	42
8	9	10	11	12	13	14	30	41
1	2	3	4	5	6	7	29	40
33	34	35	36	37	38	39		
44	45	46	47	48	49	50		

33	24	16	17	18	19	20
32	23	11	12	13	14	15
31	22	6	7	8	9	10
30	21	1	2	3	4	5
		25	26	27	28	29
		34	35	36	37	38

4	4	4	5	5	6	6	8	8
4	4	4	5	5	5	6	8	8
1	4	2	2	5	3	3	7	8
1	1	2	2	2	3	3	7	7
9	9	11	11	11	13	13		
9	10	10	11	12	13	13		

6	6	3	3	3	4	4
7	6	3	3	3	4	4
5	5	1	3	2	2	4
5	5	1	1	2	2	2
		8	8	10	10	10
		8	9	9	10	11

53	54	55	56	57	58	59		
41	42	43	44	45	46	47		
29	30	31	32	33	34	35	40	52
22	23	24	25	26	27	28	39	51
15	16	17	18	19	20	21	38	50
8	9	10	11	12	13	14	37	49
1	2	3	4	5	6	7	36	48

		41	42	43	44	45
		31	32	33	34	35
40	30	21	22	23	24	25
39	29	16	17	18	19	20
38	28	11	12	13	14	15
37	27	6	7	8	9	10
36	26	1	2	3	4	5

9	10	11	11	12	13	13		
9	9	11	11	11	13	13		
7	7	8	8	8	6	6	16	16
7	4	4	8	5	6	6	16	15
4	4	4	5	5	5	6	15	15
1	4	2	2	5	3	3	14	15
1	1	2	2	2	3	3	14	14

		5	5	6	6	6
		5	3	3	6	4
		3	3	3	4	4
		1	3	2	2	4
		1	1	2	2	3

22	23	24	25	26	27	28	32	43
15	16	17	18	19	20	21	31	42
8	9	10	11	12	13	14	30	41
1	2	3	4	5	6	7	29	40
33	34	35	36	37	38	39		
44	45	46	47	48	49	50		

33	24	16	17	18	19	20
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31	22	6	7	8	9	10
30	21	1	2	3	4	5
		25	26	27	28	29
		34	35	36	37	38

53	54	55	56	57	58	59		
41	42	43	44	45	46	47		
29	30	31	32	33	34	35	40	52
22	23	24	25	26	27	28	39	51
15	16	17	18	19	20	21	38	50
8	9	10	11	12	13	14	37	49
1	2	3	4	5	6	7	36	48

		41	42	43	44	45
		31	32	33	34	35
40	30	21	22	23	24	25
39	29	16	17	18	19	20
38	28	11	12	13	14	15
37	27	6	7	8	9	10
36	26	1	2	3	4	5

18	18	18	19	19	20	20		
18	18	18	19	19	19	20		
15	18	16	16	19	17	17		
15	15	16	16	16	17	17		

		23	23	23	24	24
		23	23	23	24	24
		21	23	22	22	24
		21	21	22	22	22

9	10	11	11	12	13	13		
9	9	11	11	11	13	13		
7	7	8	8	8	6	6	16	16
7	4	4	8	5	6	6	16	15
4	4	4	5	5	5	6	15	15
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1	1	2	2	2	3	3	14	14

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		13	11	11	14	12
		11	11	11	12	12
		9	11	10	10	12
		9	9	10	10	10

97	98	99	100	101	102	103	104	105	106	107	108
85	86	87	88	89	90	91	92	93	94	95	96
73	74	75	76	77	78	79	80	81	82	83	84
61	62	63	64	65	66	67	68	69	70	71	72
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25	26	27	28	29	30	31	32	33	34	35	36
13	14	15	16	17	18	19	20	21	22	23	24
1	2	3	4	5	6	7	8	9	10	11	12

97	98	99	100	101	102	103	104	105	106	107	108
85	86	87	88	89	90	91	92	93	94	95	96
73	74	75	76	77	78	79	80	81	82	83	84
61	62	63	64	65	66	67	68	69	70	71	72
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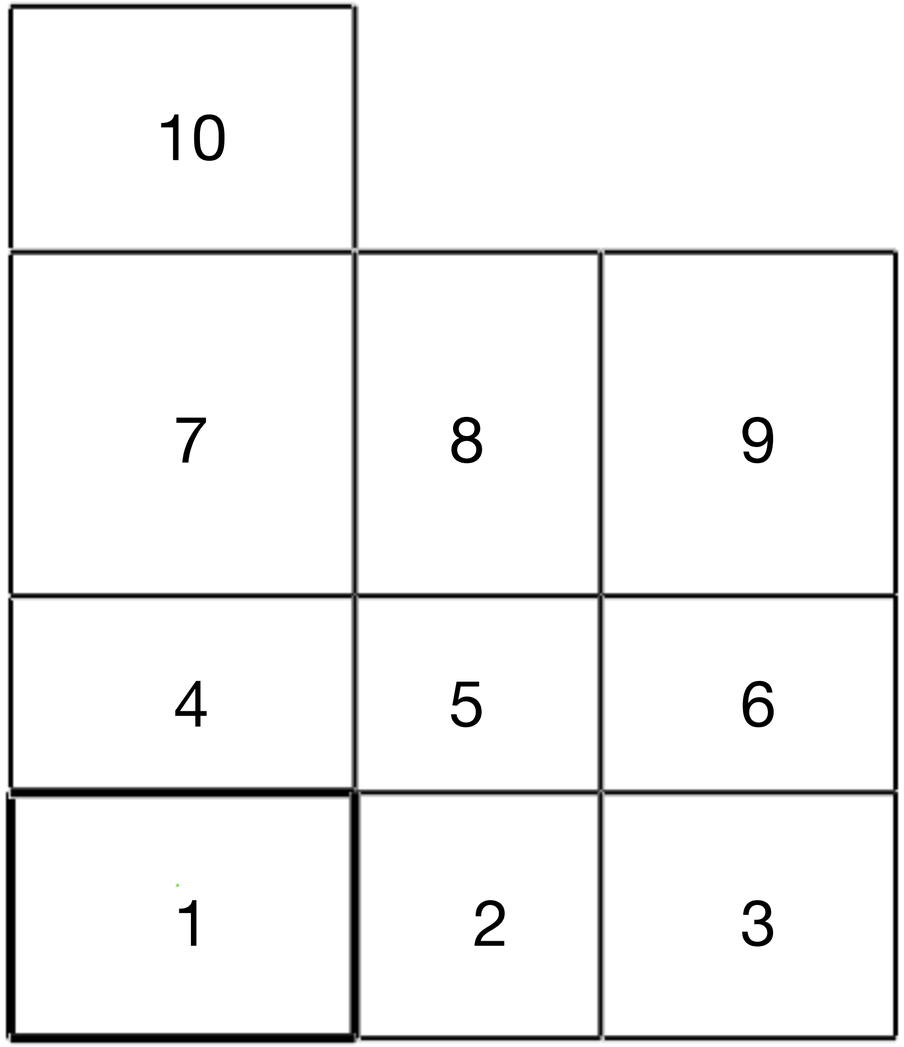
37	38	39	40	41	42	43	44	45	46	47	48
25	26	27	28	29	30	31	32	33	34	35	36
13	14	15	16	17	18	19	20	21	22	23	24
1	2	3	4	5	6	7	8	9	10	11	12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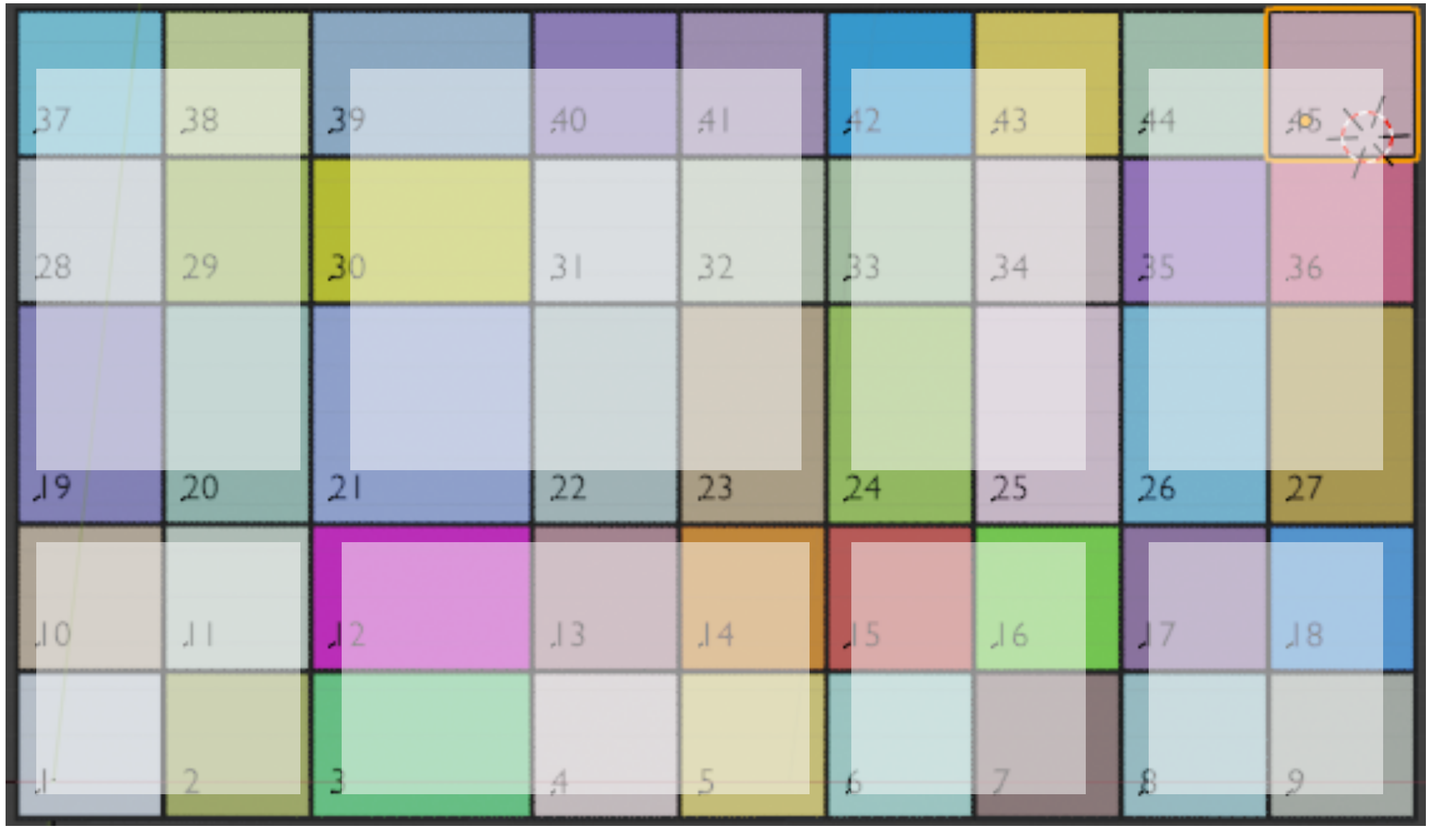
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27
10
11
12
13
14
15
16
17
18
1
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4
5
6
7
8
9

scg2 Case - structured

29	30	31	32	40
25	26	27	28	39
21	22	23	24	38
17	18	19	20	37
13	14	15	16	36
9	10	11	12	35
5	6	7	8	34
1	2	3	4	33

40	29	30	31	32
39	25	26	27	28
38	21	22	23	24
37	17	18	19	20
36	13	14	15	16
35	9	10	11	12
34	5	6	7	8
33	1	2	3	4

29	30	31	32	61
25	26	27	28	57
21	22	23	24	53
17	18	19	20	49
13	14	15	16	45
9	10	11	12	41
5	6	7	8	37
1	2	3	4	33

32	61	62	63	64
28	57	58	59	60
24	53	54	55	56
20	49	50	51	52
16	45	46	47	48
12	41	42	43	44
8	37	38	39	40
4	33	34	35	36

ucg2 Case - unstructured

27	28	29	30	38
23	24	25	26	37
19	20	21	22	36
16	17	18		35
13	14	15		34
9	10	11	12	33
5	6	7	8	32
1	2	3	4	31

38	27	28	29	30
37	23	24	25	26
36	19	20	21	22
35		16	17	18
34		13	14	15
33	9	10	11	12
32	5	6	7	8
31	1	2	3	4

27	28	29	30	38
23	24	25	26	37
19	20	21	22	36
16	17	18		35
13	14	15		34
9	10	11	12	33
5	6	7	8	32
1	2	3	4	31

68	57	58	59	60
67	53	54	55	56
66	49	50	51	52
65		46	47	48
64		43	44	45
63	39	40	41	42
62	35	36	37	38
61	31	32	33	34

BL3 - Cubic Coarsening - Level 2

Local cell numbers level 2

61	62	63	64	80
57	58	59	60	79
53	54	55	56	78
49	50	51	52	77

80	61	62	63	64
79	57	58	59	60
78	53	54	55	56
77	49	50	51	52

45	46	47	48	76
41	42	43	44	75
37	38	39	40	74
33	34	35	36	73

76	45	46	47	48
75	41	42	43	44
74	**37**	38	39	40
73	33	34	35	36

29	30	31	32	72
25	26	27	28	71
21	22	23	**24**	70
17	18	19	20	69

72	29	30	31	32
71	25	26	27	28
70	21	22	23	24
69	17	18	19	20

13	14	15	16	68
9	10	11	12	67
5	6	7	8	66
1	2	3	4	65

68	13	14	15	16
67	9	10	11	12
66	5	6	7	8
65	1	2	3	4

Global cell numbers level 2

61	62	63	64	125
57	58	59	60	121
53	54	55	56	117
49	50	51	52	113

64	125	126	127	128
60	121	122	123	124
56	117	118	119	120
52	113	114	115	116

45	46	47	48	109
41	42	43	44	105
37	38	39	40	101
33	34	35	36	97

48	109	110	111	112
44	105	106	107	108
40	**101**	102	103	104
36	97	98	99	100

29	30	31	32	93
25	26	27	28	89
21	22	23	**24**	85
17	18	19	20	81

32	93	94	95	96
28	89	90	91	92
24	85	86	87	88
20	81	82	83	84

13	14	15	16	77
9	10	11	12	73
5	6	7	8	69
1	2	3	4	65

16	77	78	79	80
12	73	74	75	76
8	69	70	71	72
4	65	66	67	68

Influence range Galerkin matrix

BL3 - Cubic Coarsening - Level 2

Local cell numbers level 2

61	62	63	64	80
57	58	59	60	79
53	54	55	56	78
49	50	51	52	77

80	61	62	63	64
79	57	58	59	60
78	53	54	55	56
77	49	50	51	52

45	46	47	48	76
41	42	43	44	75
37	38	39	40	74
33	34	35	36	73

76	45	46	47	48
75	41	42	43	44
74	**37**	38	39	40
73	33	34	35	36

29	30	31	32	72
25	26	27	28	71
21	22	23	**24**	70
17	18	19	20	69

72	29	30	31	32
71	25	26	27	28
70	21	22	23	24
69	17	18	19	20

13	14	15	16	68
9	10	11	12	67
5	6	7	8	66
1	2	3	4	65

68	13	14	15	16
67	9	10	11	12
66	5	6	7	8
65	1	2	3	4

Global cell numbers level 2

61	62	63	64	125
57	58	59	60	121
53	54	55	56	117
49	50	51	52	113

64	125	126	127	128
60	121	122	123	124
56	117	118	119	120
52	113	114	115	116

45	46	47	48	109
41	42	43	44	105
37	38	39	40	101
33	34	35	36	97

48	109	110	111	112
44	105	106	107	108
40	**101**	102	103	104
36	97	98	99	100

29	30	31	32	93
25	26	27	28	89
21	22	23	**24**	85
17	18	19	20	81

32	93	94	95	96
28	89	90	91	92
24	85	86	87	88
20	81	82	83	84

13	14	15	16	77
9	10	11	12	73
5	6	7	8	69
1	2	3	4	65

16	77	78	79	80
12	73	74	75	76
8	69	70	71	72
4	65	66	67	68

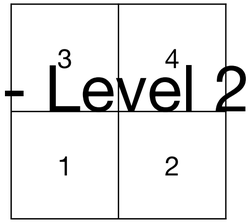
Influence range Galerkin matrix

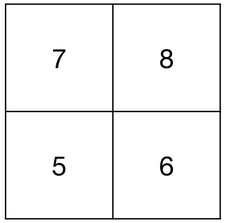
Poisson Coarse Mesh 1

```
24:          3          4          7          8         11         12
            19         20         22         23         24         27         28         32
            35         36         39         40         43         44
            56
            65         69         73
            81         85         89
            97        101        105
            86


   24 :  3.703703703703702E-002  0.227160493827160  0.224691358024691  0.187654320987655  3.703703703703702E-002  0.224691358024691
         0.224691358024691       0.187654320987655  2.469135802469135E-002  0.172839506172840  -4.14814814814814  0.222222222222222  0.172839506172840  2.469135802469135E-002
         3.703703703703702E-002  0.224691358024691  0.222222222222222  0.172839506172840  3.703703703703702E-002  0.222222222222222
         2.469135802469135E-002
         3.703703703703702E-002  0.224691358024691  3.703703703703702E-002
         0.224691358024691       0.172839506172840  0.222222222222222
         3.703703703703702E-002  0.222222222222222  3.703703703703702E-002
         2.469135802469135E-002
```

BL3 - Cubic Coarsening - Level 2





Cell numbers level 2

61	62	63	64	80
57	58	59	60	79
53	54	55	56	78
49	50	51	52	77

80	61	62	63	64
79	57	58	59	60
78	53	54	55	56
77	49	50	51	52

45	46	47	48	76
41	42	43	44	75
37	38	39	40	74
33	34	35	36	73

76	45	46	47	48
75	41	42	43	44
74	37	38	39	40
73	33	34	35	36

29	30	31	32	72
25	26	27	28	71
21	22	23	24	70
17	18	19	20	69

72	29	30	31	32
71	25	26	27	28
70	21	22	23	24
69	17	18	19	20

13	14	15	16	68
9	10	11	12	67
5	6	7	8	66
1	2	3	4	65

68	13	14	15	16
67	9	10	11	12
66	5	6	7	8
65	1	2	3	4

Local zones level 2

7	7	8	8	12
7	7	8	8	12
5	5	6	6	11
5	5	6	6	11

12	7	7	8	8
12	7	7	8	8
11	5	5	6	6
11	5	5	6	6

7	7	8	8	12
7	7	8	8	12
5	5	6	6	11
5	5	6	6	11

12	7	7	8	8
12	7	7	8	8
11	5	5	6	6
11	5	5	6	6

3	3	4	4	10
3	3	4	4	10
1	1	2	2	9
1	1	2	2	9

10	3	3	4	4
10	3	3	4	4
9	1	1	2	2
9	1	1	2	2

3	3	4	4	10
3	3	4	4	10
1	1	2	2	9
1	1	2	2	9

10	3	3	4	4
10	3	3	4	4
9	1	1	2	2
9	1	1	2	2

Global zones level 2

7	7	8	8	15
7	7	8	8	15
5	5	6	6	13
5	5	6	6	13

8	15	15	16	16
8	15	15	16	16
6	13	13	14	14
6	13	13	14	14

7	7	8	8	15
7	7	8	8	15
5	5	6	6	13
5	5	6	6	13

8	15	15	16	16
8	15	15	16	16
6	13	13	14	14
6	13	13	14	14

3	3	4	4	11
3	3	4	4	11
1	1	2	2	9
1	1	2	2	9

4	11	11	12	12
4	11	11	12	12
2	9	9	10	10
2	9	9	10	10

3	3	4	4	11
3	3	4	4	11
1	1	2	2	9
1	1	2	2	9

4	11	11	12	12
4	11	11	12	12
2	9	9	10	10
2	9	9	10	10

CL3 - Cubic Coarsening - Level 2

Mesh 4

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dargestellt

Local cell numbers level 2

61	62	63	64	80
57	58	59	60	79
53	54	55	56	78
49	50	51	52	77

80	61	62	63	64	96
79	57	58	59	60	95
78	53	54	55	56	94
77	49	50	51	52	93

80	61	62	63	64	96
79	57	58	59	60	95
78	53	54	55	56	94
77	49	50	51	52	93

45	46	47	48	76
41	42	43	44	75
37	38	39	40	74
33	34	35	36	73

76	45	46	47	48	92
75	41	42	43	44	91
74	37	38	39	40	90
73	33	34	35	36	89

76	45	46	47	48	92
75	41	42	43	44	91
74	37	38	39	40	90
73	33	34	35	36	89

29	30	31	32	72
25	26	27	28	71
21	22	23	24	70
17	18	19	20	69

72	29	30	31	32	88
71	25	26	27	28	87
70	21	22	23	24	86
69	17	18	19	20	85

72	29	30	31	32	88
71	25	26	27	28	87
70	21	22	23	24	86
69	17	18	19	20	85

13	14	15	16	68
9	10	11	12	67
5	6	7	8	66
1	2	3	4	65

68	13	14	15	16	84
67	9	10	11	12	83
66	5	6	7	8	82
65	1	2	3	4	81

68	13	14	15	16	84
67	9	10	11	12	83
66	5	6	7	8	82
65	1	2	3	4	81

Global cell numbers level 2

61	62	63	64	125
57	58	59	60	121
53	54	55	56	117
49	50	51	52	113

64	125	126	127	128	189
60	121	122	123	124	185
56	117	118	119	120	181
52	113	114	115	116	177

64	189	190	191	192	257
60	185	186	187	188	250
56	181	182	183	184	246
52	177	178	179	180	242

45	46	47	48	109
41	42	43	44	105
37	38	39	40	101
33	34	35	36	97

48	109	110	111	112	173
44	105	106	107	108	169
40	101	102	103	104	165
36	97	98	99	100	161

48	173	174	175	176	238
44	169	170	171	172	234
40	165	166	167	168	230
36	161	162	163	164	226

29	30	31	32	93
25	26	27	28	89
21	22	23	24	85
17	18	19	20	81

32	93	94	95	96	157
28	89	90	91	92	153
24	85	86	87	88	149
20	81	82	83	84	145

32	157	158	159	160	222
28	153	154	155	156	218
24	149	150	151	152	214
20	145	146	147	148	210

13	14	15	16	77
9	10	11	12	73
5	6	7	8	69
1	2	3	4	65

16	77	78	79	80	141
12	73	74	75	76	137
8	69	70	71	72	133
4	65	66	67	68	129

16	141	142	143	144	206
12	137	138	139	140	202
8	133	134	135	136	198
4	129	130	131	132	194

BL3 - Cubic Coarsening - Level 2 to Level 3

Local cell numbers level 3

7	8	12
5	6	11

12	7	8
11	5	6

3	4	10
1	2	9

10	3	4
9	1	2

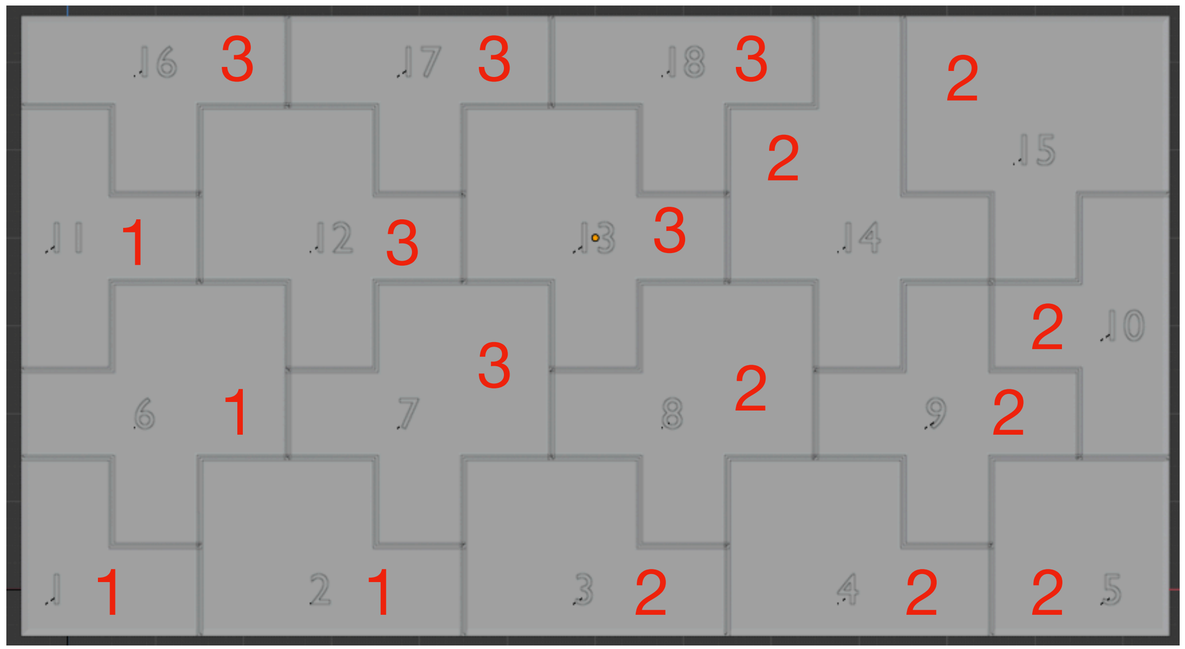
Global cell numbers level 3

7	8	15
5	6	13

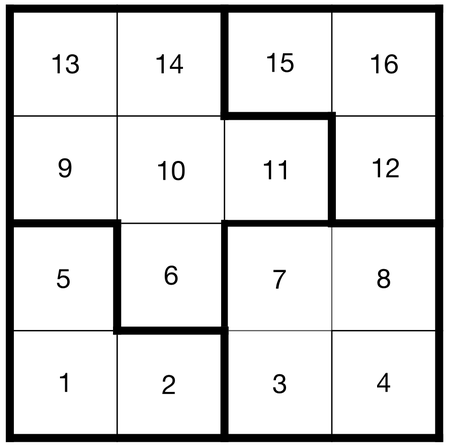
8	15	16
6	13	14

3	4	11
1	2	9

4	11	12
2	9	10


J16 3
J17 3
J18 3
2
2
J15
J11 1
J12 3
J13 3
J14
2
J10
3
6 1
7
8 2
9 2
J 1
2 1
3 2
4 2
2
5

Nullspace and QR-Decomposition



	1	2	3	4
1	1			
2	1			
3		1		
4		1		
5	1			
6			1	
7		1		
8		1		
9			1	
10			1	
11			1	
12				1
13			1	
14			1	
15				1
16				1

B_1

	1
b1	1.0
b2	1.0
b3	1.0
b4	1.0
b5	1.0
b6	1.0
b7	1.0
b8	1.0
b9	1.0
b10	1.0
b11	1.0
b12	1.0
b13	1.0
b14	1.0
b15	1.0
b16	1.0

T_1

	1	2	3	4
1	b1/c1			
2	b2/c1			
3		b3/c2		
4		b4/c2		
5	b5/c1			
6			b6/c3	
7		b7/c2		
8		b8/c2		
9			b9/c3	
10			b10/c3	
11			b11/c3	
12				b12/c4
13			b13/c3	
14			b14/c3	
15				b15/c4
16				b16/c4

B_2

b1	c1
b2	c2
b3	c3
b4	c4

c1 = || [b1, b2, b5] ||

c2 = || [b3, b4, b7, b8] ||

c1 = || [b6, b9, b10, b11, b13, b14] ||

c1 = || [b12, b15, b16] ||

$$B_1 = T_1 B_2 \qquad T_1^T T_1 = I$$

Row:

1	4	8	14	17

Col:

1	2	5	3	4	7	8	6	9	10	11	13	14	12	15	16

$$D_{inv_S} = 4/3 * 1/\rho * D^{-1}A, \quad \rho \sim 1.95, \quad \omega = 4/3 \sim 1.333$$