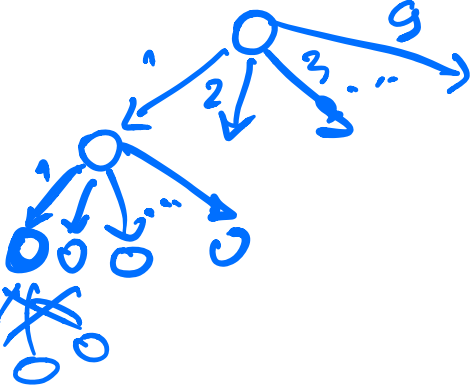


Прегледътъ без оригиналних цѣна:

- Dancing Links - Donald Knuth (2018) youtube
- Изучение на цѣна: <https://github.com/blynn/dlx>.

Brute force: $O(2^n)$ Как решить задачу?

Backtracking: $O(2^n)$



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

Како решити sudoku?

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

Exact cover

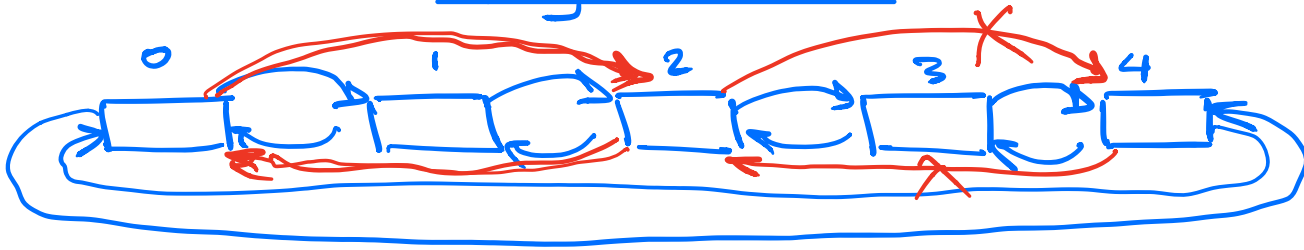
Brute force

	A	B	C	D	E	F	G
→	1	0	0	1	0	0	1
	0	0	1	0	1	0	0
	0	1	1	0	0	1	0
X	1	0	0	1	0	0	0
	0	1	0	0	0	0	1
	0	0	0	1	1	0	0



B	C	E	F
0	1	1	0
1	1	0	1

Doubly Linked List



delete (p):

$p \rightarrow pre \rightarrow next = p \rightarrow next$
 $p \rightarrow next \rightarrow pre = p \rightarrow pre$

restore :

$p = \text{delete_stack.pop}()$
 $p \rightarrow pre \rightarrow next = p$
 $p \rightarrow next \rightarrow pre = p$

delete_stack: 1, 3, 4, 2

delete (1)

delete (3),
restore

delete (4)

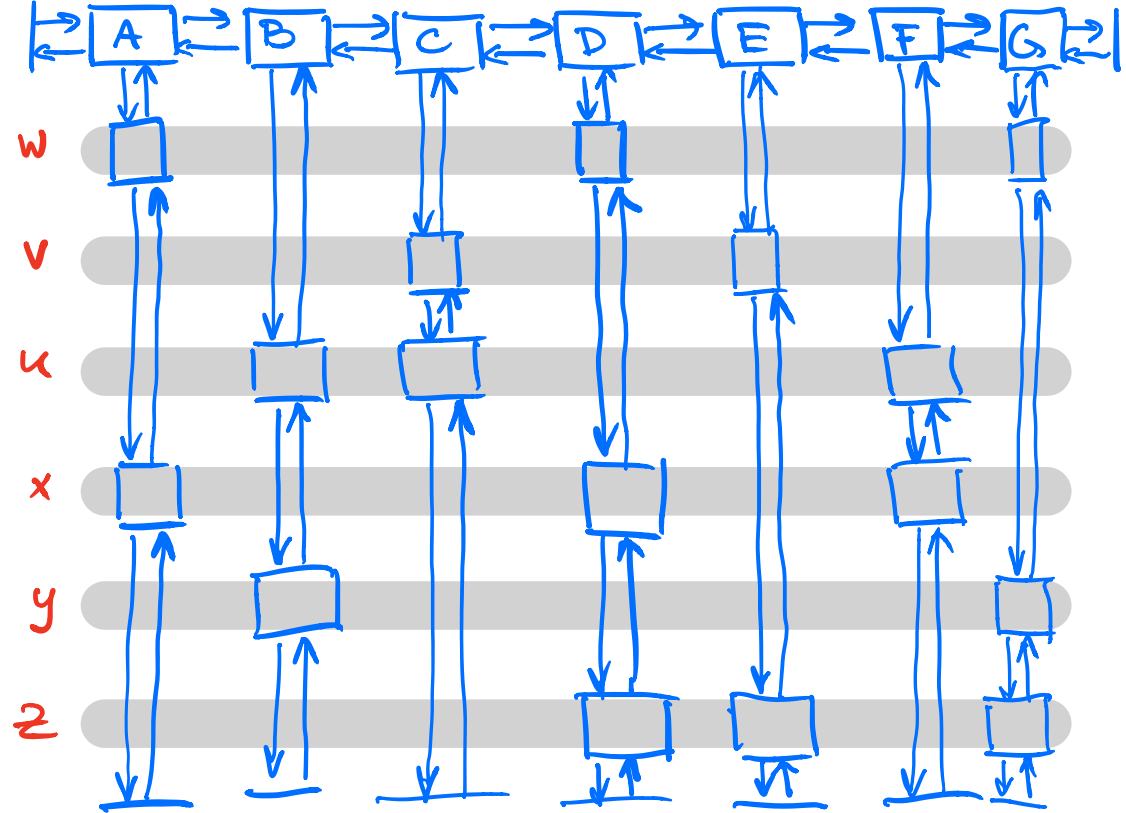
delete (2)

restore

restore

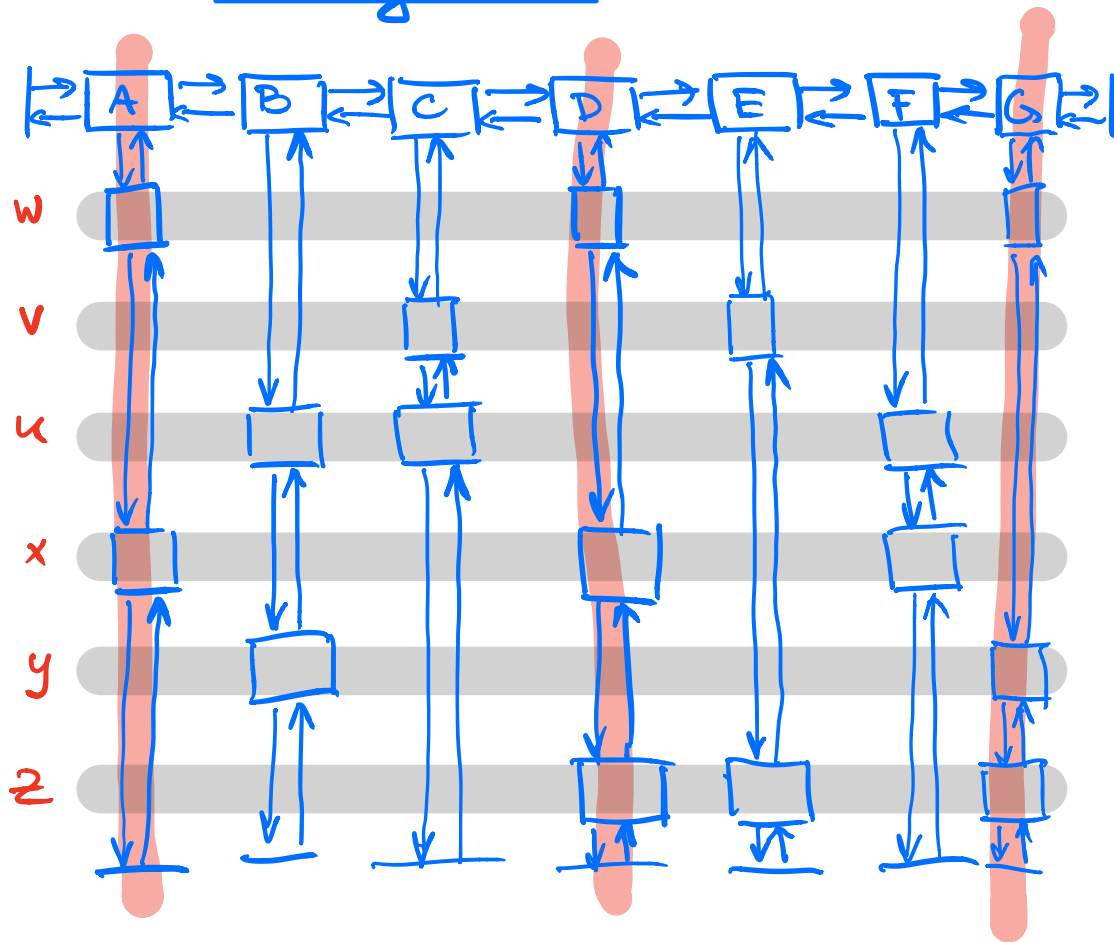
Dancing Links

	A	B	C	D	E	F	G
W	1	0	0	1	0	0	1
V	0	0	1	0	1	0	0
U	1	0	1	0	0	1	0
X	0	1	0	0	0	0	1
Y	0	0	0	1	0	0	1
Z	0	0	0	1	1	0	1



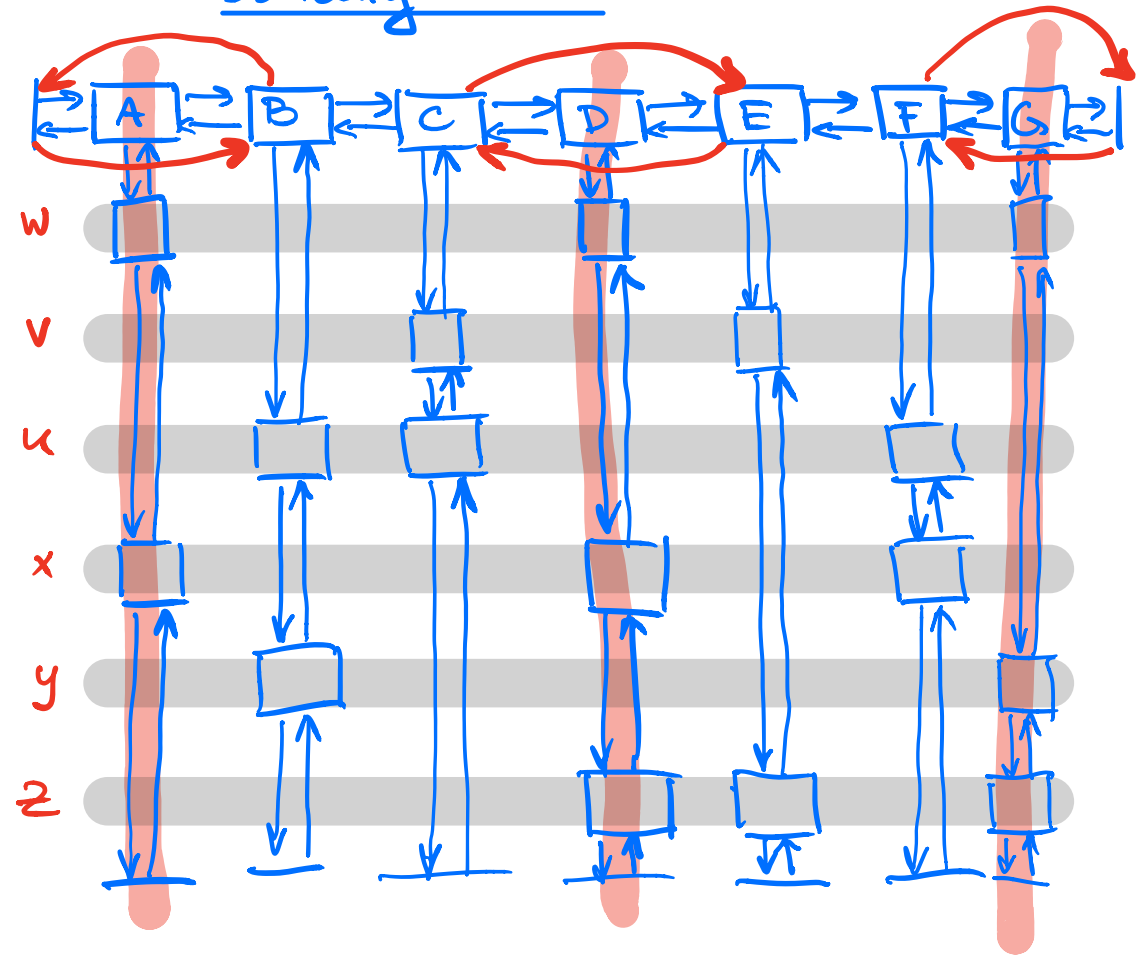
Dancing Links

	A	B	C	D	E	F	G
W	1	0	0	1	0	0	1
V	0	0	1	0	1	0	0
U	0	1	1	0	0	1	0
X	1	0	0	1	0	1	0
Y	0	1	0	0	0	0	1
Z	0	0	0	1	1	0	1



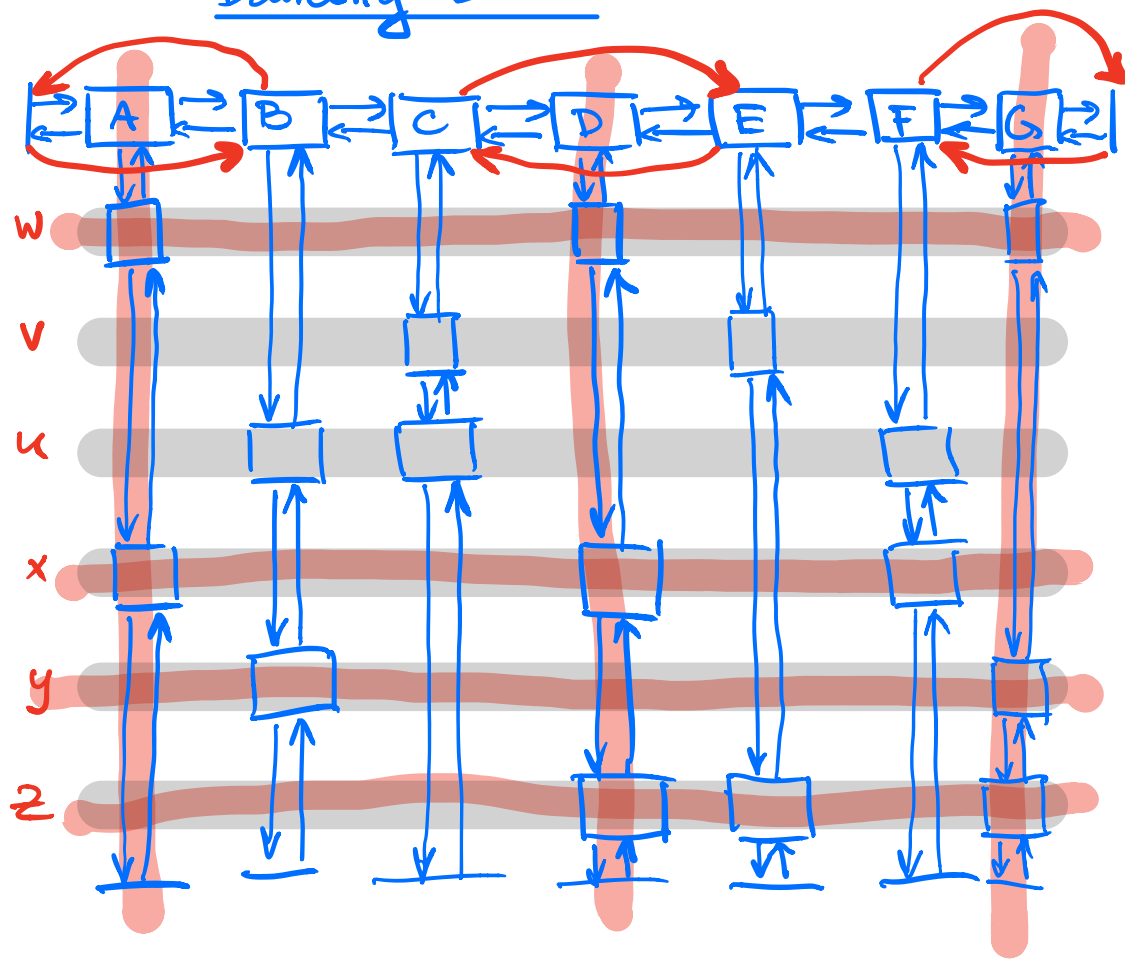
	A	B	C	D	E	F	G
W	1	0	0	1	0	0	1
V	0	0	1	0	1	0	0
U	0	1	1	0	0	1	0
X	1	0	0	1	0	1	0
Y	0	1	0	0	0	0	1
Z	0	0	0	1	1	0	1

Dancing Links



Dancing Links

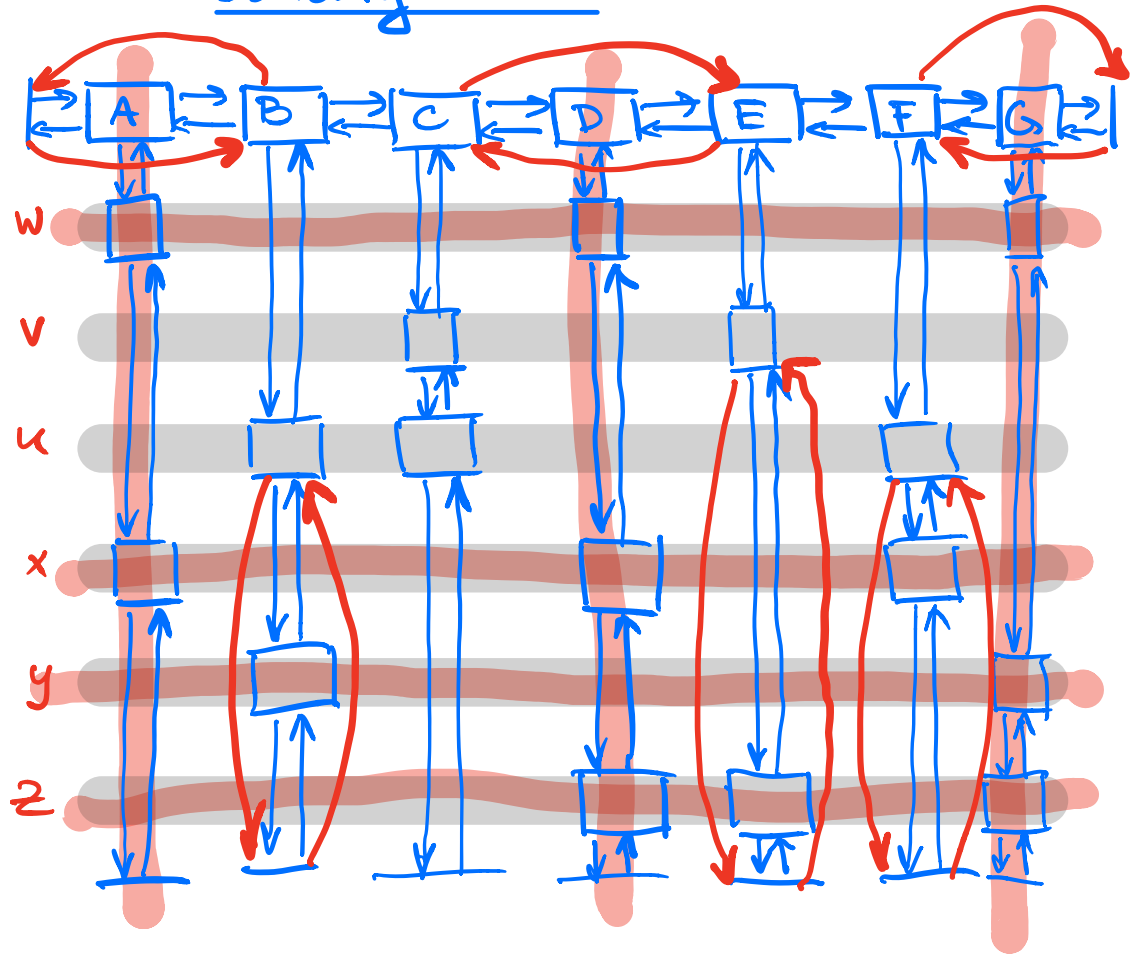
	A	B	C	D	E	F	G
W	1	0	0	1	0	0	1
V	0	0	1	0	1	0	0
U	0	1	1	0	0	1	0
X	1	0	0	1	0	1	0
Y	0	1	0	0	0	0	1
Z	0	0	0	1	1	0	1



Dancing Links

	A	B	C	D	E	F	G
W	1	0	0	1	0	0	1
V	0	0	1	0	1	0	0
U	0	1	1	0	0	1	0
X	1	0	0	1	0	1	0
Y	0	1	0	0	0	0	1
Z	0	0	0	1	1	0	1

	B	C	E	F
V	0	1	1	0
U	1	1	0	1



Какве беге има ово са
судоку?

Судоку као exact cover проблем.

Нотација

	A	B	C	D	E	F	G
W	1	0	0	1	0	0	1
V	0	0	1	0	1	0	0
U	0	1	1	0	0	1	0
X	1	0	0	1	0	1	0
Y	0	1	0	0	0	0	1
Z	0	0	0	1	1	0	1

→

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>	<u>E</u>	<u>F</u>	<u>G</u>
W:	A	D	G			
V:	C	E	G			
U:	B	C	F			
Y:	B	G				

Које ресурсе имамо?

- Цифра 1 у реду 0 (r01)
- Цифра 3 у кол. 5 (k53)
- 3 у 5. боксу b53
- Позиција (0,7) (p07)

(r01) (k71) (b21) (p07)

r02 k72 b22 p07

9.9 + 9.9 + 9.9 + 9.9

0	5	3			7			2	
1	6			1	9	5			
2		9	8					6	
3	8				6				3
4	4			8		3			1
5	7				2				6
6		6					2	8	
7				4	1	9			5
8					8			7	9
	0	1	2	3	4	5	6	7	8

DEMO