Case Study-5
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Solution 1:

Every location can have Queen or not,{Q,Q`},so we have two possibities at each location

Total number of locations=64

Total number of combinations=2^{64}=$1.84 * 10^{19}$

8	Q`	Q`	Q`	Q`	Q`	Q	Q`	Q`
7	Q`	Q`	Q`	Q	Q`	Q`	Q`	Q`
6	Q`	Q`	Q`	Q`	Q`	Q`	Q`	Q
5	Q`	Q`	Q	Q`	Q`	Q`	Q`	Q`
4	Q`	Q`	Q`	Q`	Q`	Q`	Q	Q`
3	Q`	Q	Q`	Q`	Q`	Q`	Q`	Q`
2	Q`	Q`	Q`	Q`	Q`	Q	Q`	Q`
1	Q	Q`	Q`	Q`	Q`	Q`	Q`	Q`
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**

Solution 2:

Randomly place all the 8 Queens on the board and check, if all Queens does not come in region of other Queen, then this is the solution. If not, then replace the Queens and checQ again and repeat the process N times.

Total combinations:

$$\frac{N!}{(N-r)!}$$

Total number of locations/positions=64

Total number of Queens to be placed=8

Total combinations= $\frac{64!}{(64-8)!} = \frac{64!}{56!}$= 64*63*62*61*60*59*58*57=$1.74 * 10^{14}$

8						Q		
7				Q				
6								Q
5			Q					
4							Q	
3		Q						
2					Q			
1	Q							
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**

Solution 3:

- First place, Queen 1 at the position shown in figure below i-e(2,a) ,Queen 1 can be places in any 64 places, boxes/locations left after placing first Queen are 42

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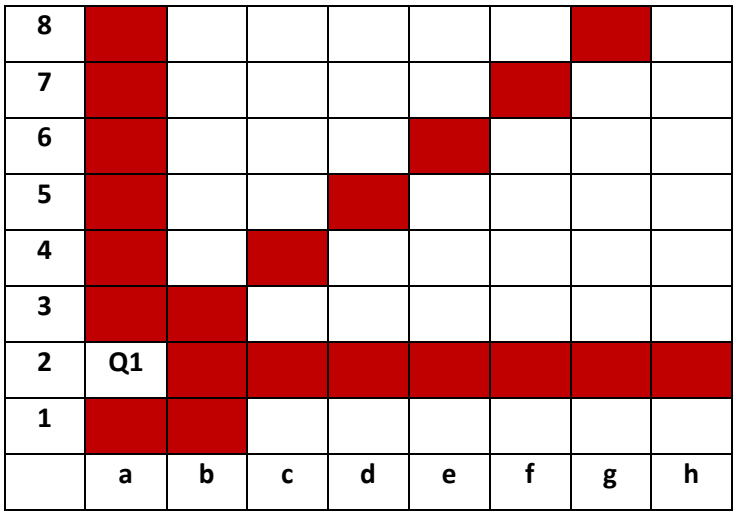
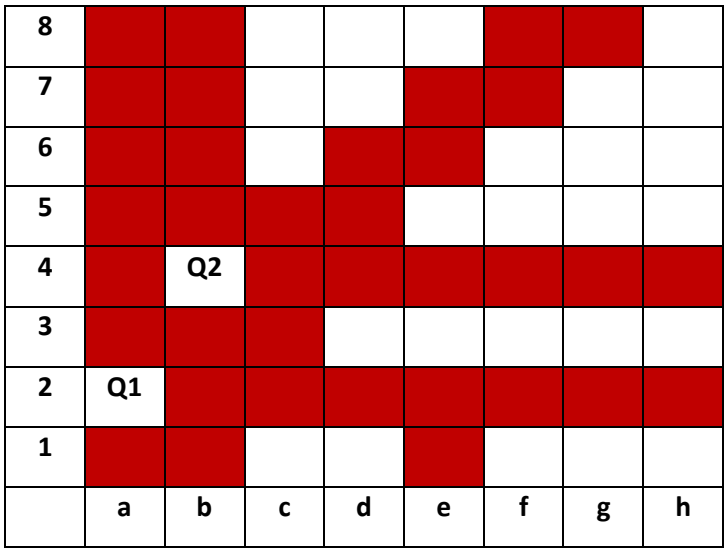


- Place Queen 2 at the postion (4,2), locations left are 26



- 26 safe locations are available, place the Queen 3 at the position (6,c),after placing 14 positions are left where the other Queens can be placed

8								
7								
6			Q3					
5								
4		Q2						
3								
2	Q1							
1								
	a	b	c	d	e	f	g	h

- Place Queen 4 at the postion(5,h),locations left are 8

8								
7								
6			Q3					
5								Q4
4		Q2						
3								
2	Q1							
1								
	a	b	c	d	e	f	g	h

- Place Queen 5 at location (8,d),5 location left

8				Q5				
7								
6			Q3					
5								Q4
4		Q2						
3								
2	Q1							

1								
	a	b	c	d	e	f	g	h

- Place Queen 6 at position (3,e), location left are 2

8				Q5				
7								
6			Q3					
5								Q4
4		Q2						
3					Q6			
2	Q1							
1								
	a	b	c	d	e	f	g	h

- Place Queen 7 and 8 at each location

8				Q5				
7							Q8	
6			Q3					
5								Q4
4		Q2						
3					Q6			
2	Q1							
1						Q7		
	a	b	c	d	e	f	g	h

Analysis:

Total possible placements/orientations=64*42*28*14*8*5*2*1=84,295,680

$=84.29 * 10^6$

Solution 4:

- Only place one Queen in one row or column
- Total possible placements/orientations=8!=8*7*6*5*4*3*2*1=40,320=$4 * 10^4$

8				Q5				
7							Q8	
6			Q3					
5								Q4
4		Q2						
3					Q6			
2	Q1							
1						Q7		
	a	b	c	d	e	f	g	h

Time/speed comparison table:

speed	Sol1 $1.84 * 10^{19}$	Sol2 $1.74 * 10^{14}$	Sol3 $84.29 * 10^{6}$	Sol4 $4 * 10^{4}$
w.r.t sol1	1	$1 * 10^{5}$	$2.18 * 10^{11}$	$4.6 * 10^{14}$
w.r.t sol2		1	$2 * 10^{6}$	$4.3 * 10^{9}$
w.r.t sol3			1	$2 * 10^{3}$