First Approach

Density of a robber = (number of robber surrounding it + itself) / number of possible places

Case 1

e.g., Density of Robber in the corner = 2 / 4 = 0.50

Average Density of a formation/placement= (0.50 x 3 + 0.56 x 2 + 0.67 x 3) / 8 = 0.58

				R 0.50
			R 0.56	R 0.67
		R	R 0.67	
	R	R		R 0.50

Case 2

Average density of robber in all configurations/formation.

	Number of Robbers								
Grid Size	2	3	4	5	6	7	8	9	10
3 x 3	0.298	0.398	0.498						
4 x 4	0.229	0.284	0.339	0.394	0.449	0.504			
5 x 5	0.195	0.230	0.265	0.299	0.389	0.370	0.405	0.440	

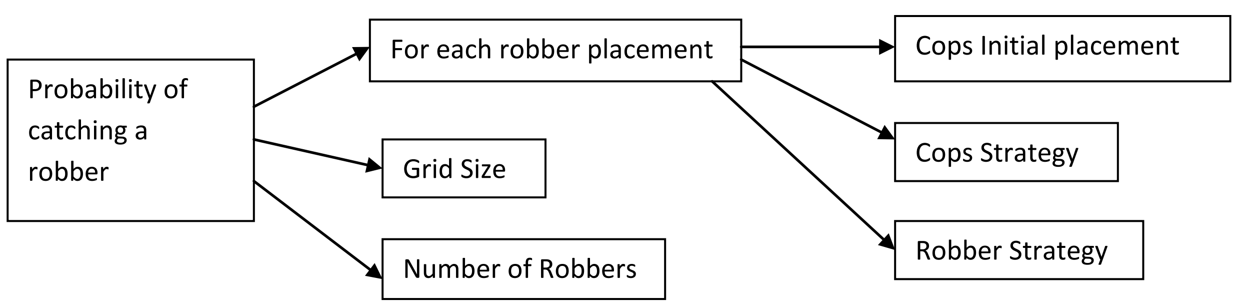
Conclusion

Average density of a single configuration (case 1) cannot say anything about the probability of catching it. Average density of robbers in all configuration/formation (case 2) is similar to the fraction of robber present in the grid.

New Approach

Fraction of the grid occupied/filled by the Robbers, F_r = Number of Robber / (Size of the grid x Size of the grid)

We can say that. Fraction of the grid occupied by Robbers ∞ 1 / (Probability of the robbers getting caught)



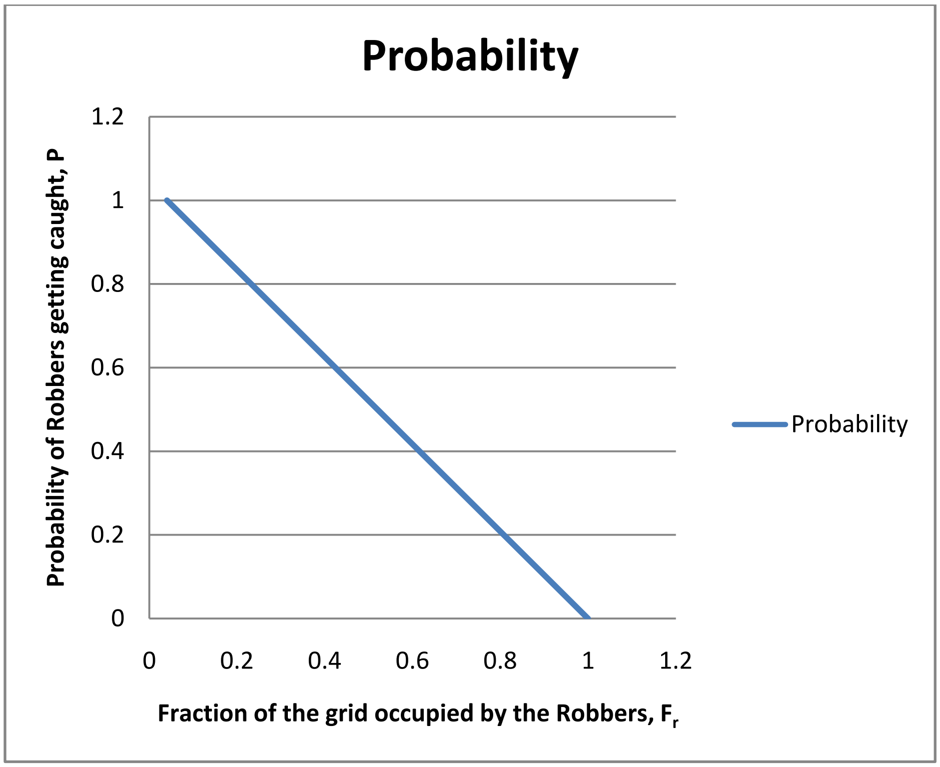
If,

$$P = 1 - K \times F_r$$

P = Probability of robber being caught

F_r = Fraction of the grid occupied by the Robbers

K = constant, Depends on Number of Cops, Cops Strategy and Robber Strategy



The value of K,

For number of Robber, R = 1; Grid Size = 5; Probability, P = 1

F_r = 1 / 25 = 0.04

For number of Robber, R = 25; Grid Size = 5; Probability, P = 0

F_r = 25 / 25 = 1

So, K > 1.

Conclusion

Working on the value of K.