Ninety-nine per cent of the restaurants in Kentish Town practise good hygiene. Each time you eat in a clean restaurant, there is a 1 per cent chance that you will get sick, independent of your previous visits. On the other hand, each time you eat in a restaurant that does not practise good hygiene, there is a 50 per cent chance that you will get sick, independent of your previous visits.

**(A)**You eat at a restaurant in Kentish Town and you get sick. What is the probability that the restaurant practices good hygiene?

Key:

S = Sick

C = Clean

NC = Not Clean

NS = Not Sick

P(S|C) = 1/100

P(NS|C) = 99/100

P(C) = 99/100

P(NC) = 1/100

P(S|NC) = 0.5

To Calculate: P(C|S)

P(C|S) = P(S|C) \* P(C) / P(S)

By Law of total probability,

P(S) = P(S|C) \* P(C) + P(S|NC) \* P(NC)

= 1/100 \* 99/100 + 50/100 \* 1/100

= 99+50/(10^4)

= 149/10^4

P(C|S) = 1/100 \* 99/100 \* 10 ^ 4 / 149

= 99/149

= 0.664

There is a 66% chance that the restaurant is clean even if a person has fallen sick.

**(B)**You go to the same restaurant for a second time and you get sick again. What is the probability of the restaurant practicing good hygiene now?

Key:

ST = Sick Twice

S = Sick

C = Clean

NC = Not Clean

NS = Not Sick

To Calculate: P(C|ST)

Given:

P(ST|C) = P(S|C)^2

P(ST|NC) = P(S|NC)^2

By law of total probability,

P(ST) = P(ST|C) \* P(C) + P(ST|NC) \* P(NC)

=(1/100)^2 \* 99/100 + (50/100)^2 \* 1/100

= 99+2500/(10^6)

= 2599/10^6

P(C|ST) = P(ST|C) \* P(C) / P(ST)

= ((1/100)^2 \* 99/100) \* 10^6/ 2599

= 99/2599

= 0.0381

The probability of the restaurant being hygienic when someone has fallen sick twice in a row is very low as expected.