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**Data Analytics**

**Problem 1**

**Naive Bayes Theorem**

**Problem Statement:**

Assume that a patient named Mary took a lab test for a certain disease and the result came back positive. The test returns a positive result in 95% of the cases in which the disease is actually present, and it returns a positive result in 6% of the cases in which the disease is not present. Furthermore, 1% of the entire population has this disease. What is the probability that Mary actually has the disease, given that the test is positive?

**Given:**

*Let B = (Having the Disease)*

*Let A = (Testing Postive)*

*Probability of Mary having Disease, given testing positive ?  
Therefore it’s P(B|A)*

***Solution:***

P(B) = 0.01 P(¬B) = 0.99

P(A|B) = 0.95

P(A|¬B) = 0.06

*Bayes Theorem*

P(B|A) = P(A|B) . P(B) / P(A)

To find P(A)  
P(A) = P(A∩B) + P(A ∩ ¬B)  
 = P(B) . P(A|B) + P(¬B) . P(A|¬B)  
 = 0.01\*0.95 + 0.99\*0.06 = 0.069

P(A) = 0.069

Therefore,  
P(B|A) = 0.95\*0.01 / 0.069

P(B|A) = 0.1377

***Therefore, the probability of Mary having the disease given that the test is positive is only approximately 13.77%.***