Bayes

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1/22/2020

## First Test

p\_pos\_cancer <- 0.99  
p\_cancer <- 0.01  
p\_not\_cancer <- 1 - 0.01  
p\_pos\_not\_cancer <- 0.05  
  
# bayes theorem  
p\_cancer\_pos <- (p\_pos\_cancer\*p\_cancer) / (p\_pos\_cancer\*p\_cancer + p\_pos\_not\_cancer\*p\_not\_cancer)  
print(p\_cancer\_pos)

## [1] 0.1666667

cancer <- sample(c('No','Yes'), size=1000000, replace=TRUE, prob=c(0.99,0.01))  
test <- rep(NA, 1000000)  
test[cancer=='No'] <- sample(c('Neg','Pos'), size=sum(cancer=='No'), replace=TRUE, prob=c(0.95,0.05))  
test[cancer=='Yes'] <- sample(c('Neg','Pos'), size=sum(cancer=='Yes'), replace=TRUE, prob=c(0.01,0.99))  
  
mean(cancer[test=='Pos']=='Yes')

## [1] 0.1669486

## Second Test

p\_pos\_cancer <- 0.99  
p\_cancer <- p\_cancer\_pos  
p\_not\_cancer <- 1 - 0.01  
p\_pos\_not\_cancer <- 0.05  
  
# bayes theorem  
p\_cancer\_second\_pos <- (p\_pos\_cancer\*p\_cancer) / (p\_pos\_cancer\*p\_cancer + p\_pos\_not\_cancer\*p\_not\_cancer)  
print(p\_cancer\_second\_pos)

## [1] 0.7692308

## Third Test

p\_pos\_cancer <- 0.99  
p\_cancer <- p\_cancer\_second\_pos  
p\_not\_cancer <- 1 - 0.01  
p\_pos\_not\_cancer <- 0.05  
  
# bayes theorem  
p\_cancer\_third\_pos <- (p\_pos\_cancer\*p\_cancer) / (p\_pos\_cancer\*p\_cancer + p\_pos\_not\_cancer\*p\_not\_cancer)  
print(p\_cancer\_third\_pos)

## [1] 0.9389671