Homework 1

Problem 1:

Test Sensitivity (SS) of Tinel's sign, Phalen's test, and nerve conduction velocity test are"

SSa = 0.97, SSb = 0.92, SSc =0.93

Test Specificity (SP) of Tinel's sign, Phalen's test, and nerve conduction velocity test are:

SPa = 0.91, SPb = 0.88, SPc = 0.87

a) In serial manner: **SSs = 0.97*0.92*0.93 = 0.83**

   SPs = 0.91*0.88*0.87 = 0.697

b) In parallel manner (at least 1 test having positive result given patient has carpal tunnel syndrome):

   SSp = 0.97*0.92*0.93 + 0.97*(1-0.92)*(1-0.93) + (1-0.97)*0.92*(1-0.93) + (1-0.97)*(1-0.92)*0.93+ 0.97*0.92*(1-0.93) +0.97*(1-0.92)*0.93+(1-0.97)*0.92*0.93

   SSp= 0.99983

   Similarly, **SPp = 0.9906**

c) Assuming 1000 people are tested with 3 combined test with 50 patient carrying carpal tunnel syndrome (prevalence = 50/1000)

Sensitivity = TP/(TP+FN)

Specificity = TN/(TN+FP)

-In serial manner: TP + FN =50 and Sensitivity = 0.83 => TP = 41.5 and FN = 8.5

TN +FP = 950 and specificity = 0.697 => TN = 662.15 and FP = 287.85

PPV in series manner = TP /(TP+FP) = 0.126

Similarly, PPV in parallel manner = 0.8484

Problem 2:

Pr (Went Beach =0) = 0.6, Pr(Midterm =0\Went Beach =0) = 0.55

Pr(Finances =0\Went Beach =0) = 0.583

Pr(Friends Go =0\Went Beach =0) = 0.883

Pr(Forecast =0\Went Beach =0) = 0.283

Pr(Gender = 0\ Went Beach =0)= 0.616

a) Probability that Michael will not go to the beach with given conditions:

   Prn = 0.55 * 0.583 * (1-0.883)*(1-0.283) *(1-0.616)*0.6 = 0.619%

   Pr= 0.495%

   Probability that Michael will go P = 0.495/(0.495+0.619) =44.4% => He wont go

b) Meliisa

   Prn = (1-0.55)*(1-0.583)*(1-0.283)*0.883*0.616*0.6 = 4.39%

   Pr = 9.126%

   Probablity that Melissa will go

   P = 9.126/(9.126+4.39) = 67.5% => Melissa will go to the beach

Problem 3:

a) Probability that student knows both of the answers is 0.8*0.8 =0.64

Probability that students knows the answer of 1 question and correctly guess the other is 2*0.8*0.2*0.25 = 0.08

Probability that students guesses correctly both the answers is (0.2*0.25)^2 = 0.0025

Probability that student answers correctly both questions is

Pr = 0.64 +0.08 +0.0025 = 0.7225

b) If answering correctly, probability that student knows both of the answer is

Pr = 0.64/0.7225 = 0.8858

c) Generalized formula in case of n questions

Probability that student answers correctly n questions

Pr = $(0.8 + 0.2 * 0.25)^n = 0.85^n$

Probability that student knows the answers of n questions given answering correctly n questions

Pr = $(\frac{0.8}{0.85})^n$

Proof: Induction Method

Assuming that the equation holds true for n: Proving that the equationis true in case of (n+1)

Probability that student answer correctly n questions and knowing the answer of (n+1)th question

Pr = 0.85^n*0.8

Probability that student answer correctly n questions and guess correctly the answer of (n+1)question :

Pr = 0.85^n *0.2*0.25

Therefore, probability that student answers correctly n+1 questions:

$Pr = 0.85^n*0.8 + 0.85^n*0.2*0.25 = 0.85^{n+1}$

Probabilities in (a) and (b) approach 0 as n approaches infinity.