**Data sets involved**

-Three tests: 1,2,3

-Two populations: A,B

-Two vaccine statuses: +,-

**Quantities and statistical parameters involved:**

-Sensitivity for each test, under positive and negative vaccination (reference for why this is needed?) (unknown, latent).

-Specificity for each test (unknown, latent).

-Prevalence of BTB for each population (unknown, latent)

-Number of vaccinated and unvaccinated animals in each population (known).

-Number of animals tested positive in each subpopulation for each test (measured)

-Number of animals tested negative in each subpopulation for each test

(measured)

This gives 3\*2\*2=12 measured counts, four known sizes, and 3\*2+2=8 unknowns. This should be an identifiable problem.

**Equations needed**

Denote by the event that the first two tests, according to a specified ordering, are positive and the third is negative. Denote in a similar fashion the event of all three being positive (), the first and second test negative and the third positive () etcetera. Using this notation, we can write out the probability for a comined test result given population, vaccination status, and infection status, as:

For each triplet belonging to the set of permutations , we have

that :

and