Summary

- There are circumstances when three states are appropriate. For example,
  - A bicycle has three principal states: Parked, Ridden or Pushed.
  - The traffic lights can be Red, Green or Changing.
- If a random variable take values, success, failure and none and let X be the number of trails where 1 occurs, and Y be the number of trials where 0 occurs. The joint distribution of pare (X, Y) is called the trinomial distribution.
- The joint pmf for (X, Y) is given by $f_{XY}(x,y) = P(X = x, Y = y) = \dfrac{n!}{x!\,y!(n-x-y)!} p^x \theta^y (1-p-\theta)^{n-x-y}$, where x, y ≥0 and x+y≤n
- The marginal distributions of X and Y are just X~ Binomial(n,p) and Y~ Binomial(n,θ). This follows the fact that X is the number of 'successes' in n independent trials with p being the probability of 'successes' in each trial. Similar argument works with Y.
- If Y=y, then the conditional distribution of X|(Y=y) is Binomial (n-1,$^{p}/_{1-\theta}$)
- The coefficient of correlation of trinomial distribution is given by $-\left(\dfrac{p\theta}{(1-p)(1-\theta)}\right)^{1/2}$
- We can generalise the trinomial distribution. i.e. there are k outcomes possible at each of the n independent trials. Denote the outcomes A_1, A_2, … , A_k and the corresponding probabilities p_1, … ,p_k where $\Sigma_j p_j=1$, j=1, 2, …,k. Let X_j count the number of A_j occurs. Then $P(X_1 = x_1, \ldots, X_{k-1} = x_{k-1}) = \dfrac{n!}{x_1! \ldots x_{k-1}!(n - \sum_{j=1}^{k-1} x_j)!} p_1^{x_1} p_2^{x_2} \ldots p_{k-1}^{x_{k-1}} p_k^{n-\sum_{j=1}^{k-1} x_j}$