STA 138 - Discussion 2

Fall 2020

For our discussion this week, we will discuss the use of compuational tools to obtain probabilities following from some of the probability models that are useful in categorical data analysis.

p; d; q; r

1. Suppose that $Y \sim \text{Binomial}(120, 0.2)$.

   (a) What is $P(Y \leq 30)$? =1-P(Y<24)=1-P(Y<=23)

   (b) What is $P(Y \geq 24)$?

   (c) What is $P(Y \geq 25)$?

   =1-P(Y<25)=1-P(Y<=24)

2. Suppose that $Y \sim \text{Hypergeometric}(80, 20, 20)$

   please note that the parameterization for our class of the Hypergeometric distribution is Hypergeometric(N,M,n), where N is the population size, M is the number of 'marked' elements of the population, and n is the sample size. This is different from the parameterization used in base R.

   phyper(q, m, n, k)

   q: vector of quantiles representing the number of white balls drawn without replacement from an urn which contains both black and white balls.

   m: the number of white balls in the urn.

   n: the number of black balls in the urn.

   k: the number of balls drawn from the urn, hence must be in 0,1,..., m+n.

   (a) What is $P(Y \leq 4)$?

   (b) What is $P(Y \leq 3)$?

   (c) What is $P(Y \leq 10)$?

   (d) What is $P(4 \leq Y \leq 6)$?

   m=M, n=N-M, k=n

   =P(Y<=6)-P(Y<4)=P(Y<=6)-P(Y<=3)

3. Suppose that $Y \sim \text{Poisson}(9)$

   (a) What is $P(Y > 8)$? =1-P(Y<=8)

   (b) What is $P(3 \leq 15)$? P(3<=Y<=15)=P(Y<=15)-P(Y<=2)

4. Suppose that $(Y_1, \boxed{Y_2, \ldots, Y_{10}}) \sim \text{Multinomial}(10, 0.1, 0.1, \ldots, 0.1)$. Y_1~Binomial(10, 0.1)

   X

   (a) What is the probability that all 10 subjects are assigned to category one (i.e. $Y_1 = 10$)? P(Y_1=10)

   (b) What is the probability that all 10 subjects are assigned to the same category? P(Y_1=10)*10

   (c) What is the probability that every category is represented exactly once? P(Y_i=1, i=1, ..., 10)

   (d) What is the probability that the first eight categories are represented ~~at least~~ exactly once?

P(Y_i=1, i=1, ..., 8)=P(Y_i=1, i=1, ..., 8, Y_9=1, Y_10=1)+P(Y_i=1, i=1, ..., 8, Y_9=0, Y_10=2)+P(Y_i=1, i=1, ..., 8, Y_9=2, Y_10=0)