Stat 134: Indicator and Covariance Review

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December 5th, 2018

Conceptual Review

a. What is the computational formula for $\text{Var}(X + Y)$?

b. Suppose X is the sum of n identical indicators I_j's. What is $\text{Var}(X)$?

Problem 1

In a bin, there are r red balls and b blue balls. Suppose I take the balls out, one by one (i.e. without replacement), until there are no more red balls in the bin. Let X denote the number of balls taken out. Find:

a. $\mathbb{E}(X)$;

b. $\text{Var}(X)$.

Problem 2

Toss a p-coin n times. Let W_r refer to the number of trials until the r_{th} head. Find $Corr(W_1, W_r)$.

Problem 3

A p-coin is a coin that lands heads with probability p. Flip a p-coin n times. A "run" is a maximal sequence of consecutive flips that are all the same. For example, the sequence $HTHHHTTH$ with $n = 8$ has five runs, namely H, T, HHH, TT, H. Let X denote the number of runs in these n flips. Find $\mathbb{E}(X)$.