Stat 134: Section 7

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Problem 1

A box contains 3 red balls, 4 blue balls, and 6 green balls. Balls are drawn one-by-one without replacement until all the red balls are drawn. Let D be the number of draws made. Calculate:

a. P($D \leq 9$);

If $D \leq 9$, how many red balls could have been drawn in the 9 draws?

b. P($D = 9$);

c. $\mathbb{E}D$

Ex 3.2.17 in Pitman's Probability

Problem 2

Suppose three marksmen shoot at a target. The ith marksman fires n_i times, hitting the target each time with probability p_i, independently of his other shots and the shots of the other marksmen. Let X be the total number of times the target is hit.

a. Is the distribution of X binomial?

b. Find $\mathbb{E}X$ and $Var(X)$.

Ex 3.3.7 in Pitman's Probability

Problem 3

Suppose that in a particular application requiring a single battery, the mean lifetime of the battery is 4 weeks, with a standard deviation of 1 week. The battery is replaced by a new one when it dies, and so on. Assume lifetimes of batteries are independent. What, approximately, is the probability that more than 26 replacements will have to be made in a two-year period, starting at the time of installation of a new battery, and not counting that new battery as a replacement?
Ex 3.3.23 in Pitman's Probability

Use the normal approximation to the distribution of the total lifetime of n batteries for a suitable n.

Problem 4

A box contains four tickets, numbered 0, 1, 1, and 2. Let S_n be the sum of the numbers obtained from n draws at random with replacement from the box.

a. Display the distribution of S_2 in a suitable table.

b. Find $\mathrm{P}(S_{50} = 50)$ approximately.

c. Find an exact formula for $P(S_n = k)$, $(k = 0, 1, 2, \ldots)$.

Ex 3.3.24 in Pitman's Probability