Stat 134: Section 10

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Problem 1

A coin which lands heads with probability p is tossed repeatedly.
Assuming independence of the tosses, find formulae for

a. $P(\text{exactly 5 heads appear in the first 9 tosses})$;

b. $P(\text{the first head appears on the 7th toss})$;

c. $P(\text{the fifth head appears on the 12th tosses})$;

d. $P(\text{the same number of heads appear in the first 8 tosses as in the next 5 tosses})$.

Ex 3.4.1 in Pitman's Probability

Problem 2

An urn contains 10 red balls and 10 black balls. Balls are drawn out at random with replacement until at least one ball of each color has been drawn out. Let D be the number of draws. Find:

Hint: $D - 1$ follows a distribution we learn in this section. What is it?

a. the distribution of D;

b. $E(D)$;

c. $SD(D)$.

Ex 3.4.2 in Pitman's Probability

Problem 3

Suppose you pick people at random and ask them what month of the year they were born. Let X be the number of people you have to question until you find a person who was born in December. What is $E(X)$, approximately?
Ex 3.4.3 in Pitman's Probability

What assumptions are you making when solving this problem?

Problem 4

Bill, Mary, and Tom have coins with respective probabilities p_1, p_2, p_3 of turning up heads. They toss their coins independently at the same times.

a. What is the probability it takes Mary more than n tosses to get a head?

b. What is the probability that the first person to get a head has to toss more than n times?

c. What is the probability that the first person to get a head has to toss exactly n times?

d. What is the probability that neither Bill nor Tom get a head before Mary?

Ex 3.4.5 in Pitman's Probability

It might be helpful to think in terms of q_1, q_2, q_3, where $q_i = 1 - p_i$.