

Background

Last time we introduced two types of discrete random variables – *binomial* and *geometric* variables. Both deal with the situation where independent trials of the same process are repeated, and the probability of success in any one trial is p .

- 1) The prototypical *binomial* random variable is the number of “successes”. The probability mass function for a binomial Y looks like

$$p_Y(y) = \binom{n}{y} p^y q^{n-y},$$

where $q = 1 - p$ is the complementary (“failure”) probability.

- 2) The prototypical *geometric* random variable is the number of the trial on which the first success is observed. The probability mass function for a geometric Z looks like

$$p_Z(z) = q^{z-1} p.$$

Today, we will deal with both types of situations, and practice telling them apart.

Discussion Questions

A) An oil prospector drills a succession of wells in a given area. The probability that she is successful on a given trial is $p = .2$, and the trials are independent. She has financing to drill 10 wells in all.

- 1) On average, how many wells would she expect to have to drill before finding a productive well?
- 2) On average, how many productive wells would she expect to find among the 10?
- 3) What is the probability that she will find at least 2 productive wells?
- 4) What is the probability that she will fail to find a productive well?

B) In responding to a sensitive question such as “Have you ever used marijuana?” on a survey, many people prefer not to answer “yes” even if that is true. Suppose 80% of the population will truthfully answer “no”, and of the 20% who should truthfully answer “yes”, 70% will lie.

- 1) If 100 people are selected randomly and asked this question, what is the expected number of “yes” responses?
- 2) What is the expected number of people you would need to question before obtaining a “yes” response?

C) Of the volunteers donating blood at the Worcester Red Cross, 80% have the Rh (+) factor (i.e. one of the blood types $A+$, $B+$, $O+$, $AB+$).

- 1) If 5 volunteers are randomly selected, what is the probability that least one does not have the Rh factor?
- 2) What is the probability that 6 volunteers will be tested before we find one that does have the Rh factor?
- 3) Say you want to be “90% sure” that you have at least 5 donors who do have the Rh factor. What is the smallest number of volunteers you would need to select in order for the probability that at least 5 have the Rh factor to be at least .9? (Note: You can use Maple or a calculator here as you prefer. The binomial tables in our text don’t cover all the cases you need.)

Assignment

Group writeups due Monday, October 5.