

Math 55 Quiz 10
November 2, 2016

This quiz will be graded out of 15 points; the True/False question is worth 3 points, and the exercise is worth 12 points. Please read the instructions carefully.

True or False. Mark the following statements as either true or false, or leave a blank if you don't know. A correct answer is worth +1 point, a blank is worth 0 points, and an incorrect answer is worth -1 points, so be smart about guessing!

- a. F The binomial distribution $b(k; n, p)$ describes the probability of k successes out of n arbitrary Bernoulli trials with success probability p .
- b. T A random variable is a function from the sample space of an experiment to the set of real numbers.
- c. F The generalized pigeonhole principle states that if N objects are placed into k boxes, then there is at least one box containing $\lfloor N/k \rfloor$ objects.



Exercise. Suppose that there are two boxes, the first of which has 3 red balls and 1 yellow ball in it, and the second of which has 1 red ball and 2 yellow balls in it. I will select one of the two boxes at random, and then I will choose a random ball from the selected box.

Suppose that through this process I chose a yellow ball. What is the probability that I selected the first box?

Let Y denote the event that a yellow ball was selected, and B_i denote the event that box i ~~was~~ was chosen, $i=1,2$. We use Bayes' theorem to compute:

$$P(B_1|Y) = \frac{P(Y|B_1) \cdot P(B_1)}{P(Y|B_1) \cdot P(B_1) + P(Y|B_2) \cdot P(B_2)} = \frac{1/4 \cdot 1/2}{1/4 \cdot 1/2 + 2/3 \cdot 1/2}$$
$$= \frac{1/8}{11/24} = 3/11.$$