# STAT310
# Practice Problems
# Week 3

February 6, 2012

## 1 Discrete random variables.

For each of the following random variables, identify the distribution (including the parameters) that most closely matches the situation.

1. Based on NBA career statistics, the probability of Lebron James making any given 3-point shot is 0.330. Let $X_1$ be the number of shots he must take during a basketball practice in order to make ten 3-point shots. (1) What is the distribution of $X_1$? (2) What is the mean number of shots he must take in order to make 10 3-pointers? (3) What is the probability, if he takes ten shots, that he will make all ten 3-pointers?

2. Suppose now that Lebron takes a single 3-point shot. Let $X_2$ be 1 if he makes the shot, and 0 otherwise. (1) What is the distribution of $X_2$? (2) What is the mean value of $X_2$? (3) What is the probability that he will miss the shot? (Hint: you have been given the parameter value already.)

3. In the last game on January 24, 2012, against the the Cleveland Cavaliers, Lebron attempted four 3-pointers. Let $X_3$ be the number of 3-pointers that he actually made of these four attempts. (1) What is the distribution of $X_3$? (2) What is the mean number of successful shots that he will make out of four attempts? (3) In this particular game, Lebron made one of these four 3-point attempts. What is the probability that he had a night like this (i.e. made only one of four 3-point attempts)?

4. Suppose there are 15 numbered puppies at the pound and I like each of them equally (i.e. I am equally likely to pick any given puppy to take home.) Let $X_4$ be the number of the puppy that I choose. (1) Assuming that I only choose one puppy, what is the distribution of $X_4$? (2) What is the mean number that I will pick? (3) What is the probability that I will pick Puppy #10?

5. Consider a Rice student sitting outside of Duncan Hall, who on average sees five Inner Loop buses pass by every 3 minutes. Let $X_5$ be the number of buses that pass by in a minute. (1) What is the distribution of $X_5$? (2) What is the expected number of buses that should pass by in the next minute? (3) What is the probability of at least two buses in the next minute?

## 2 Probability mass functions

For each of the following functions: (1) Determine whether it is a probability mass function (PMF). (2) If it is, determine the mean of a random variable with this PMF.

1. $f(x) = \frac{x^2}{4}$, for $x = -1, 0, 1, \sqrt{2}$.
2. $f(x) = e^x$, for $x = 1, 2, 3, 4, 5$.
3. $f(x) = \sqrt{x}$, for $x = 1, 3, 5, 9, 12$.
4. $f(x) = \frac{x^4}{10}$, for $x = -4^{1/4}, -1, 1, 4^{1/4}$.

# 3 Recognizing PMF's.

What is the distribution (and parameters) of a random variable with the following PMF's?

1. $\frac{6}{(a)!(3-a)!}c^a(1-c)^{3-a}$, for $c \in [0, 1]$
2. $\frac{e^a e^b(-a-b)^c}{c!}$
3. $a^b\left(\sum_{k=0}^{\infty} a^k\right)^{b-1}$, for $a \in [0, 1]$
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