R Notebook

# 1. §6.1 Modified #9. Each of 150 newly manufactured items is examined, and the numberof scratches per item is recorded. (The items are supposed to be free of scratches.) Hereis the data:

## a. Find an unbiased estimator of and compute the estimate for the data. [Hint: E(X) = forXPoisson, so E(X) = ?] [Hint 2:You can see that “2” is the mostfrequent observed count, so your estimate for should probably be pretty close to 2.]

## b. What is the standard deviation (standard error) of youur estimator? Compute the estimated standard error. [Hint std^2 = mean for X] For poisson distribution

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# 2. 6.1 #11. Of n1 randomly selected male smokers, X1 smoked filter cigarettes, whereasof n2 randomly selected female smokers, X2 smoked filter cigarettes. Let p1 and p2 denote the probabilities that a randomly selected male and femal, respectively, smokefilter cigarettes.

## a. Show that (X1/n1−X2/n2) is an unbiased estimator for p1 − p2.

## b. What is the standard error of the estimator in (a)?

## c. How would you use the observed values x1 and x2 to estimate the standard error of your estimator?

I would find p1 and p2 using

. And then plug into formula found in 2b.

## d. If n1 = n2 = 200,X1 = 127, and x2= 176, use the estimator of (a) to obtain a nestimate of p1−p2.

## e. Use the result of part (c) and the data of part (d) to estimate the standard error ofthe estimator.

# 3. For each of the following estimators of mean if …

## a.

is unbiased for ] because normal distribution is symetric about the mean.

## b.

is unbiased as

,therefore everything except for one X cancels out.

## c.

Therefore

is an unbiased estimate for

## d.

is not an unbiased estimate for

. Standard error is

# 4. Let Xi =, i=1,2..n be continuous random variables with pdf f(x) = {Theta}exp(-Theta x), x>0, We’re given that Theta>0. The Xi’s are independent.

## a. Find the Method of Moments estimator of Theta, Theta\_mom

## b. Is Theta\_mom unbiased for Theta

Theta\_mom is an unbiased estimator

## c. Find the likelihood function,L(θ).

## d. Find the Maximum Likelihood estimator of Theta, Theta\_mle

## e. Is Theta\_mle unbiased for Theta

Is Theta\_mle not an unbiased estimator as 1/E(X) != E(1/X)

# 5. Let Yi=Bernoulli (p) i=1,2,..n

## a. Find the Method of Moments estimator ofp.

Therefore

## b. Find the Maximum Likelihood Estimator of p

## c. Are either of these estimators unbiased forp?

Both of these are unbiased as the mean is unbiased for Bernoullirandom variables.

# 6. Chapter 6 Supplementary exercise # 32

## a. LetX1,…,Xnbe a random sample from a uniform distribution on [0,θ]. (Here,θ >0.) Then the MLE ofθisˆθ=Y= max{X1,…,Xn}. (It takes some work toshow this is the MLE; the text discusses it in Example 6.22. You are not asked toshow this; take it as a given.) Show that the pdf ofY is

## b. Use the result of part (a) to show that the MLE is biased, but y(n+1)/n is unbiased for Theta.

$$ E(Y) = \_0^ = \_0^ = ()|\_0^= E()

$$ Therefore MLE is biased but Y(n+1)/n is unbiased

# 7. The birthday problem. Mars experiences just under 667 Martian days and nights eachtime it revolves around the sun. Let’s pretend it’s exactly 667 days. Little Martianfur-babies have birthdays that are uniformly distributed throughout the Martian year.LetEnbe the event that in a group ofnrandomly selected Martian fur-babies, no twoshare the same Martian birthday; i.e., all of them have distinct birthdays

## a. Find P(E2), the probability that in a group of 2 randomly selected Martian fur-babies, the fur-babies have 2 distinct birthdays.

## b. FindP(E5). FindP(EC5), the probability that in a group of 5 randomly selectedfur-babies, at least two will share the same birthday

## c. Find the formula forP(En).

# 8. (Extra credit) Referring to problem 7: For which group sizen is P(ECn)>1/2? In otherwords, how many fur-babies does it take before there’s a better than 50-50 chance that two or more of them will share the same birthday?

It takes 31 babies for there to be a 50-50 chance that they will share the same birthday