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Q1:

a) Fit a cubic regression, as a function of age, to the kidney data of Figures 1.1 and 1.2, calculating estimates and standard errors at ages 20, 30, 40, 50, 60, 70, 80.

(b) How do the results compare with those in Table 1.1?

With a cubic regression the following equation is generated y=−0.0000017198x3+0.0001015826x2−0.0758906572x+2.740551889 with which we can obtain the following values

Age	tot	Std error
20	1.25	0.359
30	0.509	0.245
40	-0.24	0.129
50	-1.01	0.01
60	-1.82	0.114
70	-2.66	0.244
80	-3.56	0.38333

We can see that the cubic regression behaves similarly to the linear regression but as we reach bigger numbers the difference becomes more evident and as for the standard error we can see that in most of the cases are smaller.

##

Q2:

The lowess curve in Figure 1.2 has a flat spot between ages 25 and 35. Discuss how one might use bootstrap replications like those in Figure 1.3 to suggest whether the flat spot is genuine or just a statistical artifact.

To use of bootstrap replications helps in order to analyze if the behavior of the regression is accurate by making samples and applying a regression to each sample in order to know if the behavior was caused by certain data that doesn't represent the actual behavior. In this case we can see that most of the lines in the bootstrap replication present a flat spot, which represents that it's not a statistical artifact

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Q3:

Page 14 presents two definitions of frequentism, one in terms of probabilistic accuracy and one in terms of an infinite sequence of future trials. Give a heuristic argument relating the two.

The two definitions are complementary, because the first one talks about how frequentism is about the accuracy of the parameters that we are obtaining and the second is about how frequentism tries to predict how the data will behave in future trials

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Q4:

In Figure 3.1, suppose the doctor had said "1/2, 1/2" instead of "1/3, 2/3". What would be the answer to the physicist's question?

In this case the answer would be:

$$\frac{1/2}{1/2} \cdot \frac{1}{1/2} = \frac{1/2}{1/4} = 0.5$$

###

Q5:

Give a brief nontechnical explanation of why x610 = 5.29 was likely to be an overestimate of θ610 in Figure 3.4.

Looking at the graph we can see that that observation is found far away from the center of the graph, where most of the observations are, and the frequency of that value is very low so it most likely is an overestimation

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Q6:

Given prior density g(μ) and observation x ~ Poi(μ), you compute g(μ | x), the posterior density of μ given x. Later you are told that x could only be observed if it were greater than

0. (Table 6.2 presents an example of this situation.) Does this change the posterior density of μ given x?

This doesn't change the posterior density, because the distribution would follow a similar behavior and Poisson is about the frequency of occurrences of an event which can't take a negative value.

##

Q7:

Suppose that in (2.15) we plugged in $\hat{\sigma}$ to get an approximate 95% normal theory hypothesis test for $H_0 : \theta = 0$. How would it compare with the student-t hypothesis test?

Knowing that T test needs a t distribution which is similar to the normal distribution but a little flatter by plugging in $\hat{\sigma}$ to approximate to 95% normal theory and H0 then it would be similar to the student t hypothesis test