STAT452/652 Exercise Solution to Lecture 2d

1 Lecture 2d: How the Universe Works

1.1 Question 1

Looking at the bottom two plots in Figures 1 and 2, we see that the quartic model tends to be closer to the true structure when

$$n = 25$$

. This difference is largest in regions with strong curvature. The difference is smallest at the edges of the data, where neither model does very well (although the quartic has the most extreme deviations).

Results for

$$n = 50$$

are given in Figures 3 and 4. The variance in the bottom left plots in these figures is smaller with larger sample size. The biases however, look about the same.

1.2 Question 2

For a similar structure to the one in Figure 2 of Lecture 2d but with less curvature, we would expect to see less bias but the same amount of variance. The decrease in bias is because our model now more closely matches the true structure. The variance remains unchanged because there is the same amount of variability in the data, and we have not changed the sample size.

As we increase the sample size, the variance will decrease, but the bias will not change.

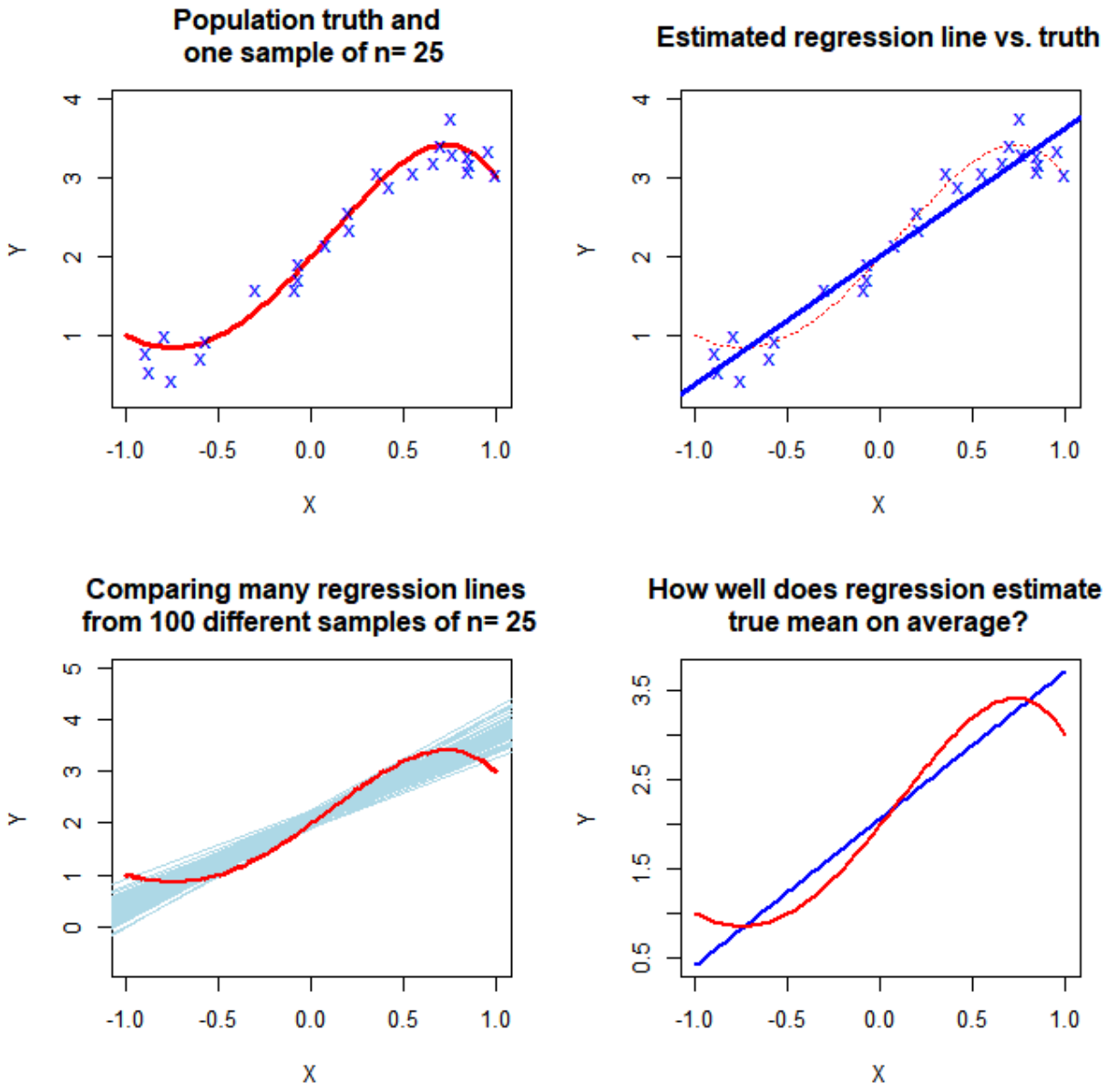

Figure 1: Plots for linear models with n=25.

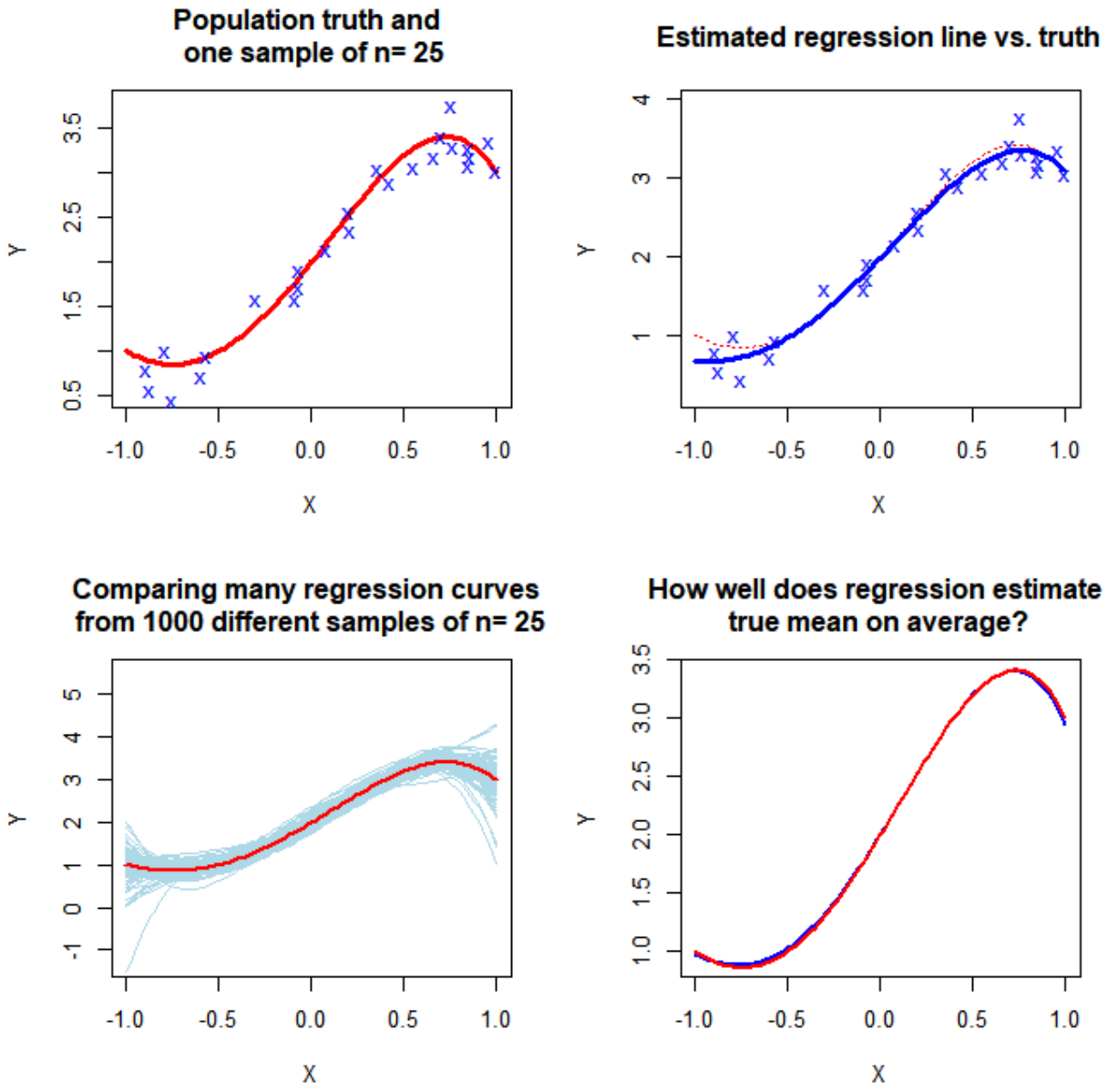

Figure 2: Plots for quartic models with n=25.

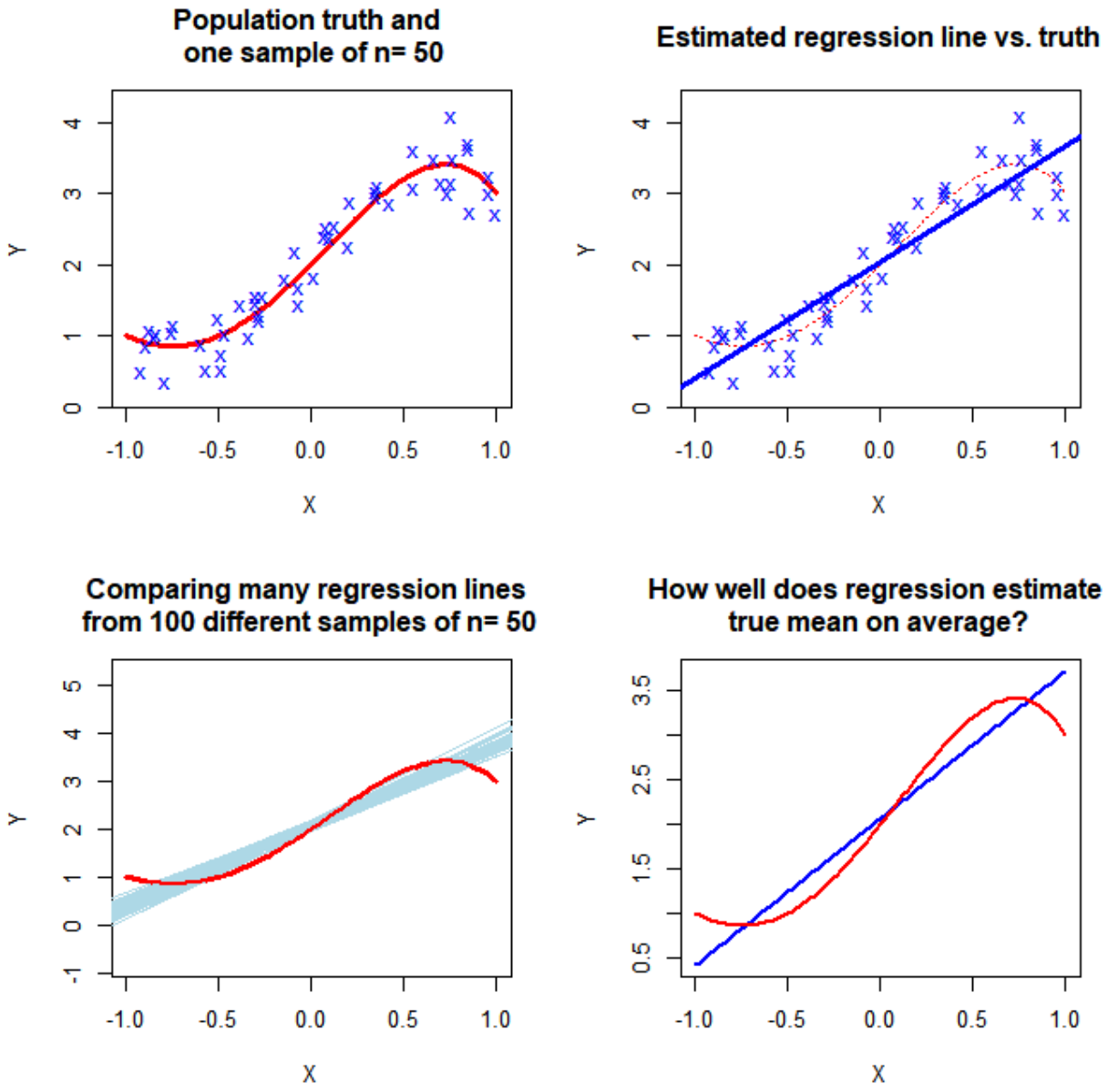

Figure 3: Plots for linear models with n=50.

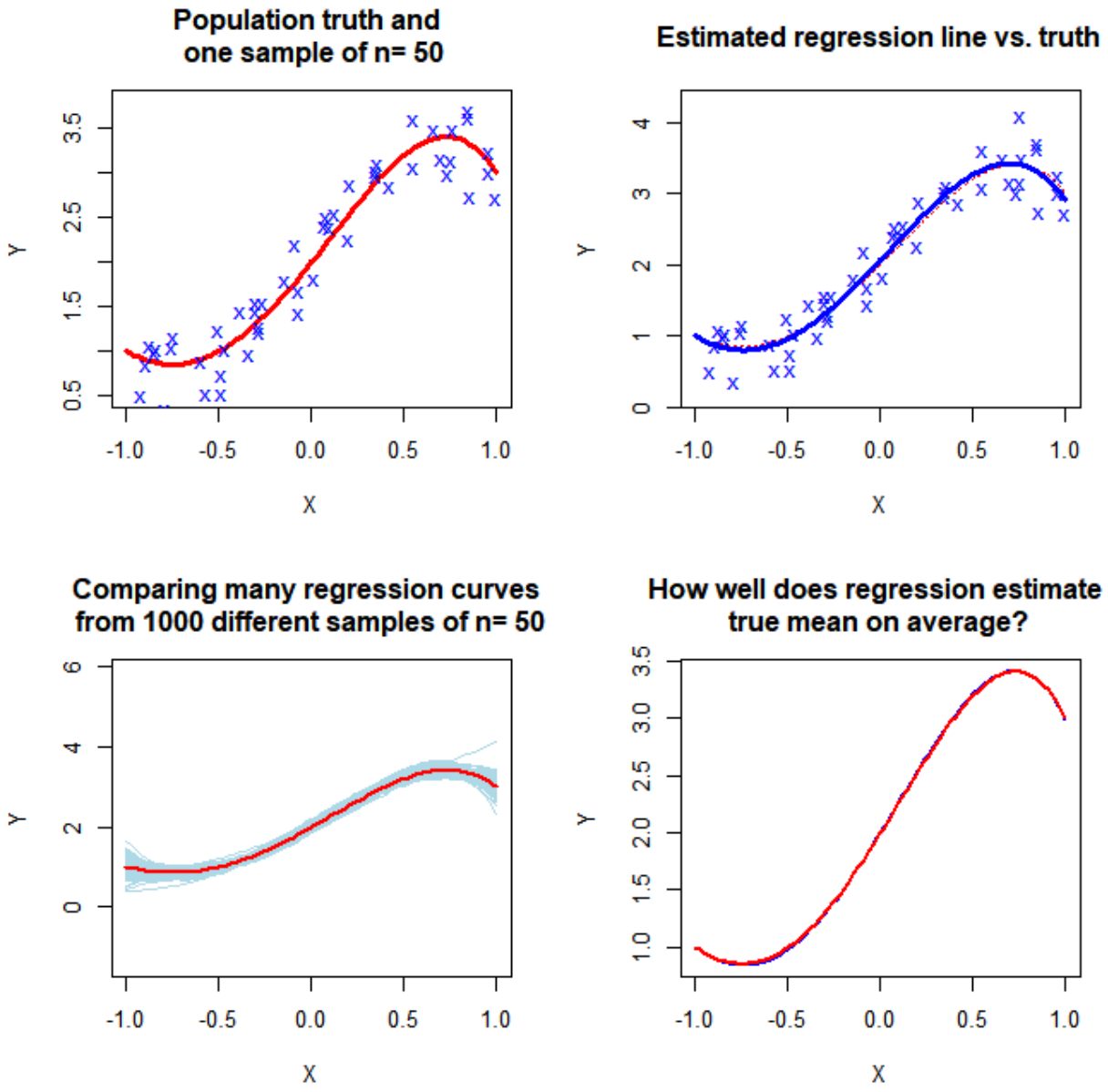

Figure 4: Plots for quartic models with n=50.