Week 9 Lab Problems

EEB 429
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Submit all your answers in a single .Rmd file (along with the knitted html).

A. Identifying and plotting stochastic functions

Consider the following data for the weight of squirrels found in the diag as a function of feeding rate:

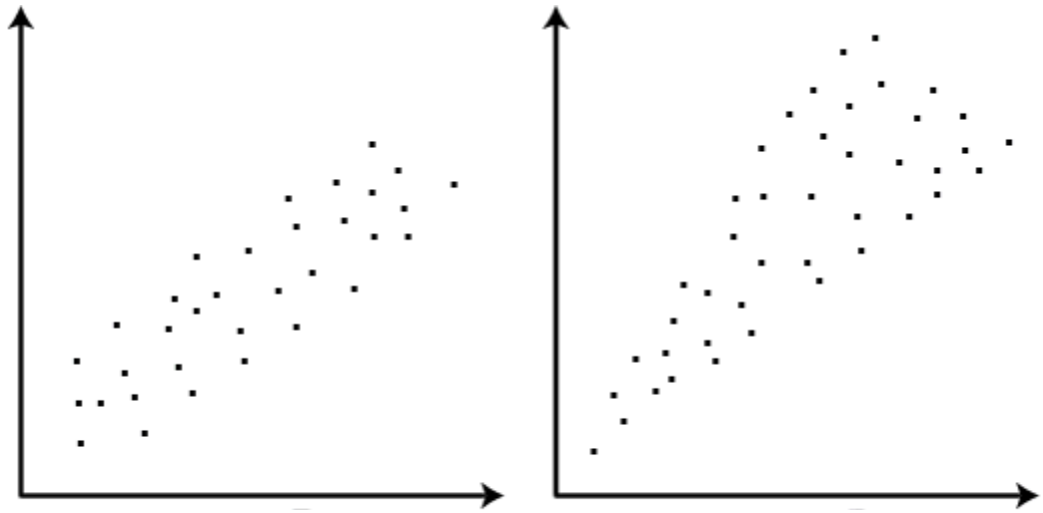
```
feeding_rates <-
c(32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56
,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80)

weights <-
c(362,8,807,796,241,196,333,439,407,360,713,400,616,422,266,651,972,415,415,
510,428,696,438,590,720,1211,1018,1162,861,1327,1280,1007,1073,1290,1447,137
1,1817,1956,1511,2280,2136,2228,2552,2346,2917,2981,3416,3705,3429)
```

1. Plot the weights (on the y-axis) against the feeding rates (on the x-axis).
2. What kind of expression do you think fits this curve the best? Write the mathematical form of the expression. What are the parameters in your expression? (For example, if you think it is linear, the mathematical form is y=ax+b with parameters a and b)
3. Use the runif function to generate 1000 random samples between 32 and 80 (and store these in a vector called “x”).
4. Write a function (call it myfunc_deterministic) that takes in a vector of samples (say x), any required parameter values, and generates the y values denoted by your expression in part 2 from these x values. Plot your vector x against the output of this function for any arbitrary value of the parameters.
5. Now, write another function (call it myfunc_noisy) that takes in a vector of samples (say x), any required parameter values, and generates the y values with,
    a. A mean denoted by your expression in A.2, and
    b. A Gaussian noise around this mean with a standard deviation that is also provided as a parameter input to the function.
    c. Plot your vector x against the output of this function for any arbitrary value of the parameters. Make sure the standard deviation is large enough to show the noisy nature of the curve.

B. On the nature of noise

In all the simulations you've seen in class and the previous question, we've made a major assumption about the nature of noise around our deterministic mean values.

1. Look at the following two plots of some data around a deterministic linear model and explain how the nature of noise differs in the two models.



2. Write a function (call it myfunc_noisier) that takes in a vector of samples (say x), and four parameters a, b, c, and d. Then,

    a. It simulates the data for the sample x values, assuming that the data is normally distributed around a mean value (μ) with a standard deviation (σ), where μ and σ are calculated as,

$$\mu = ax + b$$

$$\sigma = cx + d$$

    b. Plot the output of this function for a random sample of 1000 values between 0 and 10 (against the random sample of values). Make sure to adjust the parameters in such a way that the plot captures the varying nature of the magnitude of noise.