Homework 12

S320/520

Due at the beginning of class, Thursday 10th December.

Please write "S320" or "S520" at the top of your homework.
Show working and include all graphs you are asked to draw (in R.)

1. The psychologists Daniel Kahneman and Amos Tversky described the following situation:

   > The instructors in a flight school adopted a policy of consistent positive reinforce-
   > ment recommended by psychologists. They verbally reinforced each successful exe-
   > cution of a flight maneuver. After some experience with this training approach, the
   > instructors claimed that contrary to psychological doctrine, high praise for good
   > execution of complex maneuvers typically results in a decrement of performance on
   > the next try.[1]

   Is there a simpler explanation for the decreased performance following praise? What does
   this have to do with chapter 15?

2. Let $(x_1, \ldots, x_5) = (-0.2, -0.9, -0.4, 0.6, 0.4)$. Let $(y_1, \ldots, y_5) = (0.4, -0.3, -0.3, 0.5, 1.1)$.

   (a) Find Pearson's correlation coefficient for x and y.
   (b) Estimate the regression line to predict y from x.
   (c) Estimate the regression line to predict x from y.
   (d) In R, draw a scatterplot of the data and add the two regression lines *on the same graph.*
       (This will require rearranging the line you got in (c) to make y the subject.) Are the
       lines the same?

3. Trosset chapter 15.7 exercise 5

4. Trosset chapter 15.7 exercise 8

5. The file `examanxiety.txt` on Canvas contains information on a number of variables:

   - `Exam`: score on a math exam
   - `Revise`: hours spend revising for the math exam
   - `Anxiety`: "math anxiety" on a scale from 0 to 100 (100 is most anxious)

   (a) Find the regression line to predict exam score from anxiety. Write down your answer as
       an equation (do not just paste R output.)

---

[1] Reprinted in *Judgement Under Uncertainty: Heuristics and Biases* (1982).

(b) Which of the following regression assumptions are met?

    i. Linearity

    ii. Independence

    iii. Equal variance (homoskedasticity)

    iv. Normality of errors

(c) Suppose we want to make probabilistic predictions of a student's exam score given their math anxiety. Should we use the bivariate normal? Why or why not?

6. (3 points of extra credit for everyone.) Fit a multiple regression model to predict exam score using more than one x-variable. Write down the model you chose, and explain why you chose that model.