ST 413/513: Homework 1

Please **type** or **write** your answers **neatly** and be sure to show **all** of your work (including any `R` code you used to get your answers). Points will be deducted for answers without explanation or interpretation and for poorly organized and presented submissions. Please cut and paste any computer output (i.e., summaries or plots) into your homework so that all plots and output appear with the corresponding exercise solution. Your write-up must be submitted as a PDF via Gradescope. Please label questions (e.g. Q1) and their subparts (e.g. (a), (b),(c)) in Gradescope.

- Work through Ch 17 Conceptual Exercise 2. You do not have to turn anything in for this, but I *strongly* recommend that you spend some time on it.

Q1. Ch 17 Exercise 7.

Q2. Ch 17 Exercise 9.
Note: The data are available as `ex1708` in the `Sleuth3` R package.

Q3. Ch 17 Exercise 15.
Note: The data are available as `ex1715` in the `Sleuth3` R package.
Additional instructions: Read the description of the data and disregard the questions in the final paragraph (the wording is confusing). Instead, do and answer the following:

(a) Perform PCA on the final four variables in the data— *Attendance*, *Nonchurch*, *Strong*, and *Income*. (*Hint:* Be mindful of the fact that these responses are on different scales.)

(b) What percent of the variability in the four responses is explained by the first principal component (PC1)?

(c) Identify a meaningful linear combination suggested by the first principal component (PC1). Compute the correlation between your chosen linear combination and PC1 and plot the two variables against each other. Does your chosen linear combination appear to be a reasonable proxy for PC1?

(d) Fit a linear regression model with your chosen linear combination as the response and the *Distinctiveness* variable as a predictor. Is *Distinctiveness* a statistically significant predictor of your chosen linear combination at the 0.05 significance level? Interpret the estimated regression coefficient for *Distinctiveness*.