Problem Set 1

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Photo by Howard Jackman

Format

- The submission is:
  - A write-up as a PDF document, which includes any plots, diagrams, tables, pictures, and explanations
  - In a separate “file”, submit all code used to derive the results
    - Tarball, zipped directory, lots of individual files w/ self-explanatory titles, etc.
    - Include any original data files or how the data was accessed
      - If you use a internet scraping tool, note the date when you retrieved the data
      - If you can save the data to a file, do so and submit the data file. There is no need to change the format, e.g. HTML, XML, JSON, etc.
  - Cover page
    - On the cover page include your name, the date of submission, a facial image of yourself, the name of the course, and the title of the submission
  - Submit the assignment (both the write-up and code) via Absalon

Example Cover Page

Problem Set #1

David “Jason” Koskinen (XDN365)

Advanced Methods in Applied Statistics
Day Month Year

Software and Data Handling

- As a precursor to doing computer aided statistics, the first problem set will focus on data handling, parsing text, writing code, and simple presentation
- Exercises will focus on USA college basketball statistics from the 2014 and 2009 Ken Pomeroy Basketball pages at https://kenpom.com/
  - The content is unimportant and was chosen due to some *interesting* features
  - There are many, many, many different ways to use the data from the 2014 and 2009 webpages, and I will note that some webscraping software and tools are blocked by the KenPom.com website. For those who experience web scraping blocking, I have received permission from Ken Pomeroy to host a static and minimal version of the relevant webpages at:
    - https://www.nbi.dk/~koskinen/Teaching/AdvancedMethodsInAppliedStatistics2024/data/2014KenPomeroy.html
    - https://www.nbi.dk/~koskinen/Teaching/AdvancedMethodsInAppliedStatistics2024/data/2009KenPomeroy.html

Time

- This will be *potentially* time-consuming
  - Took me 4 hours to do the first time and 2 hours to redo
  - Could be done in ~20 minutes if you've already mastered: regular expressions, HTML/XML parser, class declaration, plotting commands, etc…

Assignment Overview

- Conceptually this is a simple assignment
  - No advanced statistical methods or analyses are needed
- The goal of the first assignment is to assess how well people can load, analyze, and plot data
  - Essentially a plotting and data throughput exercise
  - But, there are some interesting data features
- Words of advice for the following problem set
  - Don’t be overly reliant on spreadsheets
  - Don’t assume that the input data (or format) is stable between years for exercises 2 and 3
- There are some known (at least by me) ambiguities in the exercises. If you come across what you perceive is an ambiguity, detail it in your write-up.

Exercise 1 (3pts.)

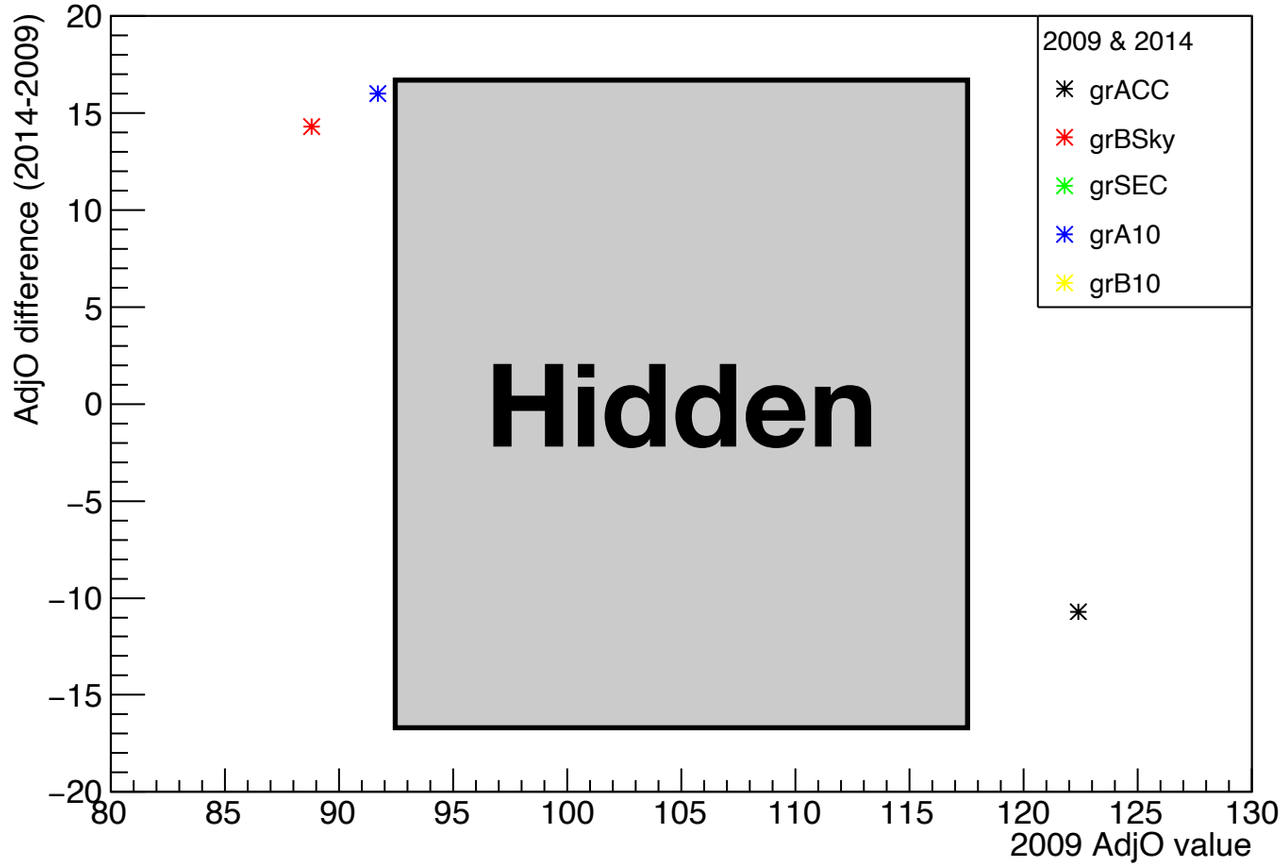
- Take the 2014 Ken Pomeroy data related to NCAA College Basketball analytics from http://kenpom.com/index.php?y=2014
- On a single plot, produce histograms of:
  - The Adjusted Defense "AdjD" for all the teams in the 5 conferences (ACC, SEC, B10, BSky, and A10)
- Different colors for each conference and add a legend
- The plot must be visually understandable.
  - E.g. keep bin widths constant for all the data if you plot a histogram.

Exercise 2 (4pts.)

- Take the 2014 and 2009 Ken Pomeroy data related to NCAA College Basketball analytics
- Calculate the difference in "AdjO" for all the teams in the 5 conferences from Exercise 1:
  - 2014 minus 2009 as a function of the 2009 AdjO value
    - Plot the data as a graph with a data point for each team entry being the same conference color as for the previous histogram in Exercise 1
- Calculate the median and mean of the difference in "AdjO" between 2009 and 2014:
  - For each of the 5 conferences (there should be a median and a mean for each conference)
  - For all teams that were not in the 5 conferences

Exercise 2 cont. (Example)

- Calculate the difference in "AdjO" for all the teams in the 5 conferences from Exercise 1:
  - Between 2014 and 2009 as a function of the 2009 AdjO value
  - Plot the data as a graph with a data point for each team entry being the same conference color as for the previous histograms



*Be mindful that this plot is an example and is not guaranteed to be accurate

**Each team should have its own data point. There are many more points beneath the 'Hidden' box

Exercise 3 (3pts.)

- Take the 2014 and 2009 Ken Pomeroy data related to NCAA College Basketball analytics
- Redo Exercises 1 and 2, while now adding the "BE" conference to the previous list of 5 conferences
  - For those who have written robust code for the earlier exercises, this should be fast and easy
- It is likely to be much harder for those who…
  - Parse some data in "by hand"
  - Only wrote code that requires the exact data format specific to the team names, conferences, AdjO/AdjD position, etc.

Problem Set Submission

- Submit the results, plots, numbers, text, etc. in a **single** PDF document
  - The submitted PDF document should not contain any code
- In a separate file include the code, however terrible, broken, crashing, unpretty, or uncommented in the submission
- Unless you parse directly from the internet HTML, also include the data files you actually used. Sometimes files can change, so please supply the one you are actually using.

Exercise 4 (Extra 1pt.)

- One of the most important observations in astronomy was made in 2018 with the coincident observation of gravitational waves in addition to photons across a wide range of wavelengths from a binary neutron star merger
- There is an author list at http://www.nbi.dk/~koskinen/Teaching/AdvancedMethodsInAppliedStatistics2018/data/authors-acknowledgements-v5.pdf
  - How many unique authors are there in that list?
  - If there was one single author list in alphabetical order (instead of being grouped by experimental collaboration), what author is the mid-point.
    - What is author at the location (total authors)/2? Potentially there are two authors depending on whether the total number of authors is an odd or even number.
    - Sort by last name and then first initial(s).