Problem Set 2 — Political Science 599

Due Tuesday, 4 October 2005

Instructions: Please type this problem set single spaced. When presenting tables, do not cut and paste from statistical programs directly into your word processor. Make real tables with sensible significant digits. Embed any figures (i.e. graphics) or tables into the text. Make equations, when necessary, that look nice, and that are well explained in terms of the symbols and variables used. Use numbers for equations, figures, and tables. If you have questions about how this should work, look at a recent copy of the APSR. In responding to the questions use your own words rather than quoting from books. If you quote from books, explain the quotes in your own words. Include an appendix at the end of the problem set containing the code you used to read, manipulate, and analyze the datasets. The appendix should have separate sections for each question. Someone should be able to "run" a given segment of your appendix to produce the results for a given question. You may hand-write (neatly) the solutions to the math problems or use an equation editor or LATEX.

1. Generate 8 variables with values drawn randomly from a standard normal distribution. The first four variables should each have 10 observations, the 5th variable should have a sample size of 50 observations, and the 6th, 7th, and 8th variables should have sample sizes of 100, 1000, and 10000 respectively. Plot histograms for each of these variables and overlay on each histogram the curve for the probability density function that generated each variable. When you look across the plots, what do you see happening? If you use the same bin width for all of the plots, do your conclusions change? What bin widths do you prefer—the same for all plots, or different for each plot? If different for each plot, how would you change the bin width for each plot?

2. Use Table XII from Merriam & Gosnell (same excerpt from *Non-Voting* that you used in Problem Set 1). Is the reason given for non-voting statistically independent of rents in the area where the respondent lives? Give one example in which the probability of citing the reason is independent or nearly independent of rent. Give one example in which the probability of citing the reason is not statistically independent of rent.

3. Explain Pollock's 1944 *APSR* article, "An Areal study of the German Electorate, 1930-1933," in terms of statistical independence.

4. Do the following from Wonnacott and Wonnacott. Show your work.
2-34, 2-40, 3-10, 3-27, 3-35, 3-36, 3-46, 4-16, 4-24, 4-26, 4-42, 4-46

5. What is a random variable?

6. From the NES Cumulative File, select three variables — one you believe to be distributed Bernoulli, one Binomial, and one Normal. Pick a year in the period covered by this dataset before which you expect something different socio-politico-economically in the U.S. than you expect after that year, perhaps because of some big historical, political, or cultural change or trend. Divide the data into two parts — before that year and that year or later. Are your three variables statistically independent of time (measured in the way just specified)? What should we infer from this?

7. Evaluate the following limits:

$$\text{a. } \lim_{x \to 1} \frac{x(x-1)}{2(x-1)} \qquad \text{b. } \lim_{x \to 3} \frac{2x^2 - 6x}{x - 3} \qquad \text{c. } \lim_{x \to \infty} \frac{5x^2 - 3x + 1}{7x^2 + 9}$$

8. Find the slope of the following curves at the given points:

$$\text{a. } y = x^3 \text{ at } (2, 8) \qquad \text{b. } y = \frac{1}{x} \text{ at } (1, 1) \qquad \text{c. } y = \frac{1}{x} \text{ at } \left(2, \frac{1}{2}\right)$$

9. Conduct the following algebraic operations:

   - Multiply:

$$\text{a. } r^2 \times r^4 \qquad \text{b. } (3r^n)^2 \qquad \text{c. } (3a)^2 (5a)(a)^4$$

   - Find each product:

$$\text{a. } (x - 5)(2x + 7) \qquad \text{b. } (x^2 + y^2)(x - y) \qquad \text{c. } (x - 5)(x - 5) \qquad \text{d. } (x + 7)(x + 7)$$

   - Divide:

$$\text{a. } x^2 - 5x - 24 \text{ by } x + 3 \qquad \text{b. } 12x^2 - 3x \text{ by } 3x \qquad \text{c. } x^5 - 32 \text{ by } x - 2$$