

Statistics 431: Statistical Inference

Fall 2006

Problem Set 2

Due 2 Oct 2005

Devore Chapter 8: #6, 12, 22, 28, 32, 38, 39, 42.

Note: The wording in question 39 is not precise. The “random sample of 1,050” referred to in the question was actually chosen according to court-determined procedures. The issue here is whether these procedures actually produced a *random* sample, as intended, or merely a sample. Swain’s attorneys – and the solution in the back of the book – use a one-sided test. Suppose you were the defense lawyer, representing the state of Alabama. How would you argue that a two-sided test is more appropriate for this situation? Would it have made any substantive difference to the final evaluation if a two-sided test had been used?

Additionally:

A. In problem B of problem set 1, the intended octane rating of the gasoline produced by the company is 87.

- (a) Use the data of problem B, problem set 1 to test (at level $\alpha = 0.05$) whether the company’s mean octane rating for the day in question was different from 87.
- (b) Suppose the company does not claim that its “regular” grade gasoline has an octane rating of exactly 87. Instead, it claims the octane rating is at least 87. Perform a test (at level $\alpha = 0.05$) designed to verify that the company’s claim is correct.

B. While imprisoned by the Germans in World War II, the English mathematician John Kerrich tossed his only coin 10,000 times and obtained 5,076 heads. Let p denote the probability of a head on a single toss. We wish to check whether the data are consistent with the hypothesis that the coin was fair. Assume the outcomes of the tosses are mutually independent.

- (a) Set up the statistical hypotheses. Why should the alternative be two-sided even though Kerrich obtained more heads than tails on his 10,000 tosses?
- (b) Does your test reject the null hypothesis at $\alpha = 0.05$?
- (c) Find a 95% CI for the proportion of heads for Kerrich’s coin. Does this CI contain $p = 1/2$?
- (d) On his first 1,000 flips Kerrich obtained 574 heads. Does this information alter your conclusion in (b)?