

1. (5 points) **Substance M** In an experiment to learn if substance M can help restore memory, the brains of 20 rats were treated to damage their memories. The rats were trained to run a maze. After a day, 10 rats were given M and 7 of them succeeded in the maze; only 2 of the 10 control rats were successful. The z test

- A. is reasonably accurate because the conditions for inference are met.
- B. may be inaccurate because some counts of successes and failures are too small.
- C. may be inaccurate because the populations are too small.

2. (5 points) **Job Prospects** An opinion poll asks an SRS of 100 college seniors how they view their job prospects. In all, 53 say "Good." Does the poll give reason to conclude that more than half of all seniors think their job prospects are good? The hypotheses for a test to answer this question are

- A. $H_0 : p = 0.5, H_a : p > 0.5$.
- B. $H_0 : p > 0.5, H_a : p = 0.5$.
- C. $H_0 : p = 0.5, H_a : p \neq 0.5$.

3. (5 points) The alternative hypothesis for the ANOVA F test is

- A. all the means are equal.
- B. not all the means are equal.
- C. all the means are not equal.

4. (5 points) The data in a two-sample problem are

- A. an SRS of matched pairs of observations drawn from a population.
- B. two independent SRSs, each drawn from a separate population.
- C. robust against non-normality.

5. (20 points) Can active learning improve knowledge retention? Two undergraduate calculus-based engineering statistics courses were taught in different academic quarters, with one employing active-learning methods and another using traditional learning methods. The traditional class was taught lecture-style with relatively little in-class interaction between peers and with the instructor. The active-learning course integrated four group projects into the curriculum, with in-class time devoted to group work on the projects and fewer homework assignments. To assess knowledge retention, two five-question versions of a test were created. They had similar but not identical questions covering core statistics topics, worth a total of 18 possible points. All students in both sections were randomly given one version of the test as part of their final exam. Then, eight months later, a volunteer subset of the original students were given the version that they had not taken previously. To encourage students to take the second version of the exam, a ten-dollar gift card to the university bookstore was given to each participant. The change in the score from the first version to the second is used to measure a student's long-term ability to retain the course material. Here are the changes in exam scores for the 15 students in the Active group:

0 5 7 8 0 3 6 2 5 1
3 2 4 3 5

The changes in exam scores for the 23 students in the Traditional group are

7 0 8 2 4 3 1 2 5 8
5 6 3 12 1 6 3 6 7 7
5 6 2

Is there good evidence that active learning is superior to traditional lecturing?

6. (20 points) Subjects with preexisting cardiovascular symptoms who were receiving subitramine, an appetite suppressant, were found to be at increased risk of cardiovascular events while taking the drug. The study included 9804 overweight or obese subjects with preexisting cardiovascular disease and/or type 2 diabetes. The subjects were randomly assigned to subitramine (4906 subjects) or a placebo (4898 subjects) in a double-blind fashion. The primary outcome measured was the occurrence of any of the following events: nonfatal myocardial infarction or stroke, resuscitation after cardiac arrest, or cardiovascular death. The primary outcome was observed in 561 subjects in the subitramine group and 490 subjects in the placebo group. Do the data give good reason to think that there is a difference between the proportions of treatment and placebo subjects who experienced the primary outcome? (Note that subitramine is no longer available in the United States due to the manufacturer's concerns over increased risk of heart attack or stroke.)

(a) State hypotheses, find the test statistic, and use either software or the bottom row of Table C for the P-value. Be sure to state your conclusion.

(b) Explain simply why it was important to have a placebo group in this study.

7. (20 points) Many birds are injured or killed by flying into windows. It appears that birds don't see windows. Can tilting windows down so that they reflect earth rather than sky reduce bird strikes? Place six windows at the edge of a woods: two vertical, two tilted 20 degrees, and two tilted 40 degrees. During the next four months, there were 53 bird strikes, 31 on the vertical windows, 14 on the 20-degree windows, and 8 on the 40-degree windows. If the tilt has no effect, we expect strikes on windows with all three tilts to have equal probability. Test this null hypothesis. What do you conclude? (Use the chi-square [goodness-of-fit test](#).)

8. (20 points) The data in another exercise show that durable press treatment greatly reduces the breaking strength of cotton fabric. Of course, durable press treatment also reduces wrinkling. How much? "Wrinkle recovery angle" measures how well a fabric recovers from wrinkles. Higher is better. Here are data on the wrinkle

Untreated	79	80	78	80	78
Permafresh 55	136	135	132	137	134
Permafresh 48	125	131	125	145	145
Hylite HF	143	141	146	141	145

The untreated fabric once again stands out, this time as inferior to the treated fabrics in wrinkle resistance. Examine the data for the three durable press processes and summarize your findings.

Explain why we can't trust the ANOVA F test in this situation.