

**Instructions:** Do your work and record your results on separate paper. You can work on the problems in any order. Clearly number your work for each problem.. You do not need to write answers on the question sheet.

This exam is a tool to help me (and you) assess how well you are learning the course material. As such, you should report enough written detail for me to understand how you are thinking about each problem. If you use your calculator, write down enough details of the arithmetic to make clear what calculation you are doing. (100 points total)

---

1. You and a friend are debating whether women favor universal health insurance more than men (in the U.S.). Your friend finds the results of a sample survey study in which the proportion of women who favor universal health insurance is 56% and the proportion of men who favor universal health insurance is 52%. (The survey was done with appropriately selected random samples.) Your friend claims that these values from the sample survey give conclusive evidence that the proportion who favor universal health insurance is greater for women than for men. Explain to your friend what essential element is missing here and what additional information from the study is needed to give a meaningful interpretation of the survey results. Use language your friend can understand assuming that your friend has never had a statistics course. (8 points)
  
2. The Department of Transportation wants to provide commuters with information on the morning commute time from Tacoma to Seattle. The DOT chooses a SRS of 50 weekdays from a one-year period and measures the time to commute from Tacoma to Seattle starting at 8 am. The average time for these 50 days is 63 minutes and the standard deviation is 37 minutes.
  - (a) Compute a 95% confidence interval for the time to commute from Tacoma to Seattle starting at 8 am. (12 points)
  - (b) The DOT wants to list this confidence interval on its traffic website. Write a brief description (a sentence or two) to help commuters understand how to think about this confidence interval in their planning. (4 points)
  - (c) Explain why it might be important for the DOT to periodically gather new data and compute a new confidence interval. (4 points)
  
3. You want to do a survey sample to determine the proportion of college students who think every college student should take a statistics course. Determine a sample size that will give you a 90% confidence interval with a margin of error no bigger than 2%. (8 points)

4. To determine whether glaucoma affects cornea thickness, measurements were made in 8 people who were affected by glaucoma in one eye but not in the other. The cornea thicknesses (in microns) and the differences are given in the following table along with the means and standard deviations.

Subject	1	2	3	4	5	6	7	8	$\bar{x}$	$s$
Unaffected eye	484	478	492	444	436	398	464	476	459.0	31.3
Affected eye	488	478	480	426	440	410	458	460	455.0	27.7
Difference	-4	0	12	18	-4	-12	6	16	4.0	10.7

- (a) Determine whether it is better to treat these samples as independent or to treat these as matched pairs. Explain how you reach your conclusion. (5 points)
- (b) Carry out appropriate statistical analysis based on this data about to address the question of whether glaucoma affects cornea thickness. (15 points)
5. A researcher wants to determine the proportion of public zoos in the United States that employ at least one education specialist. The researcher selects a simple random sample of 25 zoos and contacts each. The researcher determines that 20 of these zoos employ at least one education specialist. The researcher wants to compute a 95% confidence interval for the proportion of zoos that employ an education specialist.
- (a) Explain why the large-sample method is not appropriate for this situation. (3 points)
- (b) Explain why the “plus four” method is appropriate for this situation. (3 points)
- (c) Compute a 95% confidence interval for the population proportion using the “plus four” method. (12 points)
- (d) A report on this study concludes “More than half of the public zoos in the U.S. employ an education specialist.” Is this a reasonable conclusion? Explain your reasoning. (4 points)
6. To what extent do syntax textbooks, which analyze the structure of sentences, illustrate gender bias? A study of this question sampled sentences from one syntax textbook. One part of the study examined the use of the words “girl,” “boy,” “man,” and “woman.” We will call the first two words *juvenile* and the last two words *adult*. Is the proportion of female references that are juvenile (girl) equal to the proportion of male references that are juvenile (boy)?

- (a) Identify the populations and parameters of interest here. (4 points)
- (b) Set up hypotheses (null and alternative) for this situation. (4 points)
- (c) Here are the data from the sampled sentences in the text (with  $X$  giving the count of juvenile references):

Gender	$n$	$X$
Female	60	48
Male	132	52

- Use this data to carry out a significance test for your hypotheses from (b). (10 points)
- (d) Write a conclusion based on the results of your significance test. (4 points)