

Show your work clearly, neatly, systematically and understandably. Round the decimal for probability to 5-decimal place and round the percentage to 3-decimal. Use proper notation. 107 points available.

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1. (7) A random sample of 175 households receiving the free sample of cereal showed that 45 of them purchased the cereal after. Construct a 97%-CI for the true proportion of households receiving free samples which later purchase the cereal.
2. (5) To estimate the president's approval rating, how many people should be sampled so that the margin of error is 3% with 95% confidence level?
3. (5) Suppose you want to estimate the average number of songs college students store on their portable devices with margin of error to be no more than 10 songs. At 94% confidence level, how many students should you sample?

4. (22:8,7,9) A random sample of 15 obituary notices in the Hawaiian newspapers gave the following information about life span in years of Hawaii residents:

72 68 81 93 56 19 7 94 83 84 97 75 71 86 47

- a. Find the sample mean and sample deviation.
- b. Assuming that the population life span is normally distributed, construct a 95%-CI for the true standard deviation of the life span of Hawaiian residents?
- c. Assuming that the population life span is normally distributed, does this sample indicate that the population mean life span for Hawaii residents is less than 77 years?

5. (9) Let the age of a Quebec resident at the time of the first marriage be normally distributed. Suppose that a recent study of age at first marriage for a random sample of 41 residents in Quebec gave a variance of 3.3 years. Test the claim that the current variance is less than 5.1. Use  $\alpha = 0.05$
6. (9) "If you could start your career all over again, would you still choose to be a college professor?" About 76% of all US college professors responded "yes" to this question. A random sample of 59 college professors in Colorado showed that 47 claim they would choose college teaching again. Does this indicate that the proportion of professors in Colorado who choose the career again is different from 76%. Use  $\alpha = 0.01$

7. (21:7,7,7) A mean arsenic level of 8.0 parts per billion (ppb) is considered safe for agricultural use. A well in Texas is used to water cotton crops and is tested on a regular basis for arsenic. A random sample of 36 tests gave a mean of 7.2 ppb arsenic with a standard deviation of 1.9 ppb. Assume that arsenic concentration is normally distributed. Does this information indicate that the mean level of arsenic in this well is less than 8.0 ppb?
- a. Find the 95% confidence interval for the mean arsenic level of that well.
- b. If the actual standard deviation of the arsenic level of that well is 2.0 ppb. Find the 95% confidence interval for the mean arsenic level of that well using the above data and this value of  $\sigma$ .
- c. Suppose the Margin of Error needed is half of Margin of Error in part (b), how many more tests data needed?



9. (9) The Congressional Budget Office reports that 36% of federal civilian employees have a bachelor's degree. A random sample of 120 employees in the private sector showed that 34 have a bachelor's degree. Does this indicate that the percentage of employees holding bachelor's degrees in the private sector is different from the proportion in the federal civilian sector? Use  $\alpha = 0.05$ .
10. (2) For the same data,  $H_0$ , and significance level, is it possible that a one-tailed test results in the decision to reject  $H_0$  while a two-tailed test results in the decision to fail to reject  $H_0$ ? Explain.
11. (2) For the same data,  $H_0$ , and significance level, if the decision is to reject  $H_0$  based on a two-tailed test, do you also reject  $H_0$  based on a one-tailed test? Explain.