

Math 214 Statistics Fall 13 Sample Midterm 2

- (1) A certain gas tank is designed to hold 20 gallons. Suppose the volumes of randomly selected gas tanks are approximately normal with mean 20.0 gallons and standard deviation 0.15 gallons.
 - (a) The manufacturer will exclude the largest 2% of gas tanks. How large does a tank need to be before it is excluded?
 - (b) What proportion of gas tanks hold between 19.75 and 20.10 gallons?
 - (c) If a sample of 16 gas tanks is randomly selected, what is the probability that the sample mean will be between 14.75 and 15.10 gallons?
- (2) A drug is found to be 90% effective at curing a particular disease.
 - (a) If 500 people are treated with the drug, what is the expected number of people who will be cured?
 - (b) What is the standard deviation of the number of patients cured if the sample size is 100?
 - (c) If 100 people are given the drug, what is the probability that exactly 99 will be cured?
 - (d) If 500 are treated, find the probability that more than 440 will be cured. (Use the normal approximation.)
- (3) Scores on an physical aptitude test are normally distributed with standard deviation $\sigma = 10$. In a simple random sample of 36 people, the mean score is 104.
 - (a) Based on this sample, what is the 95% confidence interval for the overall population mean?
 - (b) How many people should be tested to reduce the margin of error by half?
- (4) A statistician in a new city tests a realtors claim that the average rent μ is more than \$650. Based on available data, he finds that a 95% confidence interval for μ is (\$630, \$674).

- (a) State the hypotheses H_0 and H_a .
- (b) Would he reject or fail to reject H_0 at the 95% confidence level? Explain why.
- (5) On a snowy road, the mean stopping distance for cars is 215m, with standard deviation $\sigma = 2.5$ m. A tire company claims that its new snow tires can give better performance. A random sample of 9 of the new tires has mean stopping distance of 213m. We aim to decide if the improvement is statistically significant at the 0.05 confidence level.
- (a) State the hypotheses H_0 and H_a .
- (b) Specify your test statistic and its sampling distribution.
- (c) Compute the test statistic.
- (d) Estimate or compute the P -value as accurately as possible using the tables, or your calculator, or R .
- (e) Would you reject or fail to reject H_0 at the given significance level? State your conclusion.
- (6) A double-blind, randomized trial compared blue pills and green pills for the treatment of arterial disease. The change in the thickness of arterial walls was measured, and the following data was obtained.

	n	\bar{x}	s
blue pills	20	11.1	5.04
green pills	15	5.8	5.00

Perform a two-sided test for equality of population means using a 0.05 significance level, as follows.

- (a) State the hypotheses H_0 and H_a .
- (b) Specify your test statistic and its sampling distribution. For the t -distribution, specify the degrees of freedom.
- (c) Compute the test statistic.

- (d) Estimate or compute the P -value as accurately as possible using the tables, or your calculator, or R .
- (e) Would you reject or fail to reject H_0 at the given significance level? State your conclusion.
- (7) A machine is supposed to fill jugs with 120 ounces of detergent. Below is a summary of random sample of quality control measurements.

n	\bar{x}	s
25	126	4.2

- (a) Find the 90% confidence interval for the mean amount of detergent.
- (b) Is the machine working to specification at this confidence level?
- (8) In 2006 the EPA revised how it computed MPG ratings on new cars, as the old test was felt to favour cars with good gas milage at low speeds. Under the old standard, a Toyota Prius had a rating of 60 MPG. Under the new standard it had a rating of 48 MPG.

Ten Prius owners decide to test their cars, and record the following data.

Car:	1	2	3	4	5	6	7	8	9	10		n	xbar	s
MPG:	51	50	46	51	51	58	48	55	52	53		10	51.5	3.37

Perform a two sided significance test with the null hypothesis that the new standards are accurate. Use $\alpha = 0.05$.

- (a) State the hypotheses H_0 and H_a .
- (b) Specify your test statistic and its sample distribution. For the t -distribution, specify the degrees of freedom.
- (c) Compute the test statistic.
- (d) Estimate or compute the P -value as accurately as possible using the tables, or your calculator, or R .
- (e) Would you reject or fail to reject H_0 at the given significance level? State your conclusion.

- (9) An SRS of 85 students is taken from a large university to estimate the proportion of students whose parents bought them a car. In the sample, the parents of 51 students had bought them a car.
- (a) What is a 95% confidence interval for the proportion p of students whose parents bought them a car?
 - (b) Suppose you want to test whether more than half of all students have parents buy them cars. State the hypotheses H_0 and H_a .
 - (c) Specify the statistic and compute the value of the statistic.
 - (d) Estimate the P-value for this hypothesis test.
 - (e) At the 5% confidence level, what is the conclusion?
- (10) Are parents of female students more likely to buy them cars than parents of male students? An SRS of 40 female students and 45 male students is taken. In the samples, 20 female students and 21 male students indicated that their parents had bought them cars.
- (a) What is an estimate of the *difference* between the proportions for female and male students.
 - (b) Suppose you want to test whether or not the proportions are the same. State the hypotheses H_0 and H_a .
 - (c) Specify the statistic and compute the value of the statistic.
 - (d) Estimate the P-value for this hypothesis test.
 - (e) At the 5% confidence level, what is the conclusion?