

Show all work! Draw a normal distribution when needed.

Solve the problem.

- 1) Suppose that replacement times for washing machines are normally distributed with a mean of 9.3 years and a standard deviation of 2 years.
 - a) Draw this distribution showing an axes for the age of the machine and a z-axes.
 - b) What proportion of washing machines last more than 10 years?
 - c) If a store sells 100 washers how many do they expect to last more than 5 years?
 - d) Find the replacement time that separates the top 18% from the bottom 82%.
 - e) If you sell 9 washing machines and insure them for 10 years. What is the probability that the mean life of the 9 machines is more than 10 years? Find Mean and standard deviation of sampling distribution. Draw Sampling distribution.

Find the indicated probability. Show graphs with both x and z axis.

- 2) A bank's loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a standard deviation of 50.
- a) If an applicant is randomly selected, find the probability of a rating that is between 200 and 275.

b) In today's market the loan officer is only giving loans to the top 30% of applicants. What rating will separate the top 30% of applicants from the bottom 70%.

Solve the problem. Graph of the distribution of sample means is required.

- 3) A bank's loan officer rates applicants for credit. The ratings are normally distributed with a mean of 200 and a standard deviation of 50.
- If 40 different applicants are randomly selected, find the probability that their mean score is above 215.

- 4) The diameters of pencils produced by a certain machine are normally distributed with a mean of 0.30 inches and a standard deviation of 0.01 inches. In a random sample of 450 pencils, approximately HOW MANY would you expect to have a diameter less than 0.293 inches? (Hint: Find a proportion first.)

Provide an appropriate response.

5) Sampling without replacement involves dependent events, so this would not be considered a binomial experiment. Explain the circumstances under which sampling without replacement could be considered independent and, thus, binomial.

6) Under what conditions can we apply the results of the central limit theorem?

7) The typical computer random-number generator yields numbers in a uniform distribution between 0 and 1 with a mean of 0.500 and a standard deviation of 0.289. (a) Suppose a sample of size 50 is randomly generated. Find the probability that the mean is below 0.300. (b) Suppose a sample size of 15 is randomly generated. Find the probability that the mean is below 0.300. These two problems appear to be very similar. Only one can be solved by the central limit theorem. Which one and why?

8) SAT verbal scores are normally distributed with a mean of 430 and a standard deviation of 120 (based on the data from the College Board ATP). If a sample of 15 students is selected randomly, find the probability that the sample mean is above 500. Does the central limit theorem apply for this problem?

9) Which of the following notations represents the standard deviation of the population consisting of all sample means?

A) $\sigma_{\bar{x}}$

B) s

C) $\sqrt{npq}$

D) μ

Find the indicated value.

10) $z_{0.005}$

Provide an appropriate response.

- 11) A poll of 1100 randomly selected students in grades 6 through 8 was conducted and found that 54% enjoy playing sports.

Is the 54% result a statistic or a parameter? Explain.

Does the 54% refer to sample mean or a sample proportion?

- 12) Tell whether the following statistic is a biased or unbiased estimator of a population parameter:

Sample proportion used to estimate a population proportion.

Sample mean used to estimate a population mean.

Sample standard deviation used to estimate a population standard deviation.

Sample variance used to estimate a population variance.

- 13) Apply the Central Limit Theorem. Samples of size $n = 800$ are randomly selected from the population of numbers (0 through 9) produced by a random-number generator.

a) If the proportion of odd numbers is found for each sample what type of distribution is the distribution of the sample proportions? What is its mean and what is its standard deviation?

b) If the mean of the 800 values is found for each of the samples what type of distribution is the distribution of sample mean? What is the mean and what is the standard deviation of the distribution of sample means? (please use correct notation.)

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion p .

- 14) Of 367 randomly selected medical students, 30 said that they planned to work in a rural community. Find a 95% confidence interval for the true proportion of all medical students who plan to work in a rural community.

d) (2 Points) What is the critical value needed to calculate a 90% confidence interval? _____

e) (2 Points) What is the point estimate for the population proportion? _____

f) (2 Points) Show the formula and the values used to calculate the margin of error

E= _____

g) (2 Points) Find a 90 percent confidence interval for the proportion of doctors who plan to work in rural communities. _____

h) (4 Points) State the meaning of this confidence interval.

Use the given data to find the minimum sample size required to estimate the population proportion.

15) Margin of error: 0.044; confidence level: 95%; $\hat{p}$ and $\hat{q}$ unknown

16) Margin of error: 0.005; confidence level: 99%; from a prior study, $\hat{p}$ is estimated by 0.166.

Solve the problem.

- 17) A newspaper article about the results of a poll states: "In theory, the results of such a poll, in 99 cases out of 100 should differ by no more than 5 percentage points in either direction from what would have been obtained by interviewing all voters in the United States." Find the sample size suggested by this statement.

Use the given data to find the minimum sample size required to estimate the population proportion.

18) (5 points) Margin of error: 0.008; confidence level: 99%; from a prior study, $\hat{p}$ is estimated by 0.139.

b) Does the size of the population effect the size of the sample needed to make this confidence interval?

19) a) (2 Points) Define confidence interval.

b) (2 Points) Define margin of error.

b) (2 Points) Suppose a confidence interval is $0.12 < p < 0.20$. Find the sample proportion $\hat{p}$ and the error estimate E.

Solve the problem.

20) The sample data below consists of the heights of 30 randomly selected adults.

You wish to use the data to obtain a confidence interval estimate of the population mean.

a) Does the data set include any outliers?

b) How could you handle the outlier in this case? Explain your answer.

d) Calculate the confidence interval with and without the outlier.

e) Are confidence interval limits sensitive to outliers?

60.1	66.9	70.4	73.2	65.2	64.1
68.5	69.2	64.0	62.4	66.9	71.2
68.2	61.4	65.7	72.5	74.0	70.0
65.8	69.3	60.4	72.4	58.1	68.3
60.5	66.4	60.5	71.3	67.8	73.2

f) Find the confidence interval for the standard deviation of the heights of men.

Use the given degree of confidence and sample data to construct a confidence interval for the population mean μ .

- 21) A laboratory tested 80 chicken eggs and found that the mean amount of cholesterol was 213 milligrams with $s = 12.8$ milligrams. Construct a 95 percent confidence interval for the true mean cholesterol content, μ , of all such eggs.

Provide an appropriate response.

- 22) What assumption about the parent population is needed to use the t distribution to compute the margin of error when $n < 30$?

- 23) (21 Points) A machine in a saw mill cuts pieces of lumber to an average width of $\mu = 4$ inches with a standard deviation $\sigma = .05$ inches

a) (3 Points) Graph the distribution with both an x-axes and a z-axes. Show mean and standard deviation. Calculate the z-score of a 4.08 width for a piece of lumber and label on your graph.

b) (3 Points) What is the probability that width is at least 4.08 for a piece of lumber? Show all work. Use proper probability notation, calculator inputs and shade region with equal area on the graph above.

c) (3 Points) What width separates the widest 10% of cuts? Show on a new graph.

d) (3 Points) On a given day the inspector samples 16 boards, and finds the sample mean. Find the mean $\mu_{\bar{x}}$ and standard deviation $\sigma_{\bar{x}}$ of the population of sample means for samples of size $n = 16$.

e) (3 Points) Find the z-score of a sample mean that is at least $\bar{x} = 4.08$ inches in the distribution of sample means.

f) (6 Points) For a sample of size 16, what is the probability that the **mean** at least $\bar{x} = 4.08$ inches in the distribution of sample means? Graph the distribution of sample means when the sample size is 16 with both an $\bar{x}$ -axes and a z-axes. Does the data indicate that the machine is working properly.