

1. DESCRIPTIVE STATISTICS

- (a) Scales of Measurement
- (b) Graphical Summaries
- (c) Numerical Summaries
- (d) Center of Data
- (e) Spread of Data

2. BASIC PROBABILITY

- (a) Probability Rules
- (b) Conditional Probability
- (c) Bayes Theorem

3. PROPERTIES OF RANDOM VARIABLES

- (a) Discrete random variables
- (b) Continuous random variables
- (c) Mean and variance of random variables

4. BINOMIAL AND NORMAL DISTRIBUTION

- (a) Binomial distribution
- (b) Normal distribution

5. SAMPLING DISTRIBUTIONS

- (a) Sampling variability
- (b) Distribution of the sample mean
- (c) Normal approximation to the Binomial

6. ESTIMATION AND CONFIDENCE INTERVALS

- (a) Point estimates for parameters
- (b) Confidence intervals for mean with know and unknown standard deviation
- (c) Confidence intervals for the standard deviation
- (d) Confidence intervals for the proportion of a binomial
- (e) Choosing a sample size

7. TESTING HYPOTHESIS FOR A SINGLE SAMPLE

- (a) P-value approach –observed significance level
- (b) Fixed level of significance approach
- (c) One sample t-test for the mean
- (d) Tests for the variance
- (e) Large sample tests for proportions

8. COMPARING TWO SAMPLES

- (a) Paired t-test
- (b) Comparing the means for two independent samples
- (c) Confidence intervals for the difference of two means
- (d) Comparing two proportions in large samples

9. BIVARIATE DATA

- (a) Correlation
- (b) Regression and inference

PERFORMANCE STANDARDS

APPROACHES STANDARDS:

Student knows definitions of concepts and executes computations in simple cases.

MEETS STANDARDS:

Student understands definitions and concepts, executes computations, and applies concepts to practical situations.

EXCEEDS STANDARDS:

Student understands definitions and concepts, executes complex computations, applies concepts to practical situations, and uses concepts to make informed decisions.

1. DESCRIPTIVE STATISTICS

- Scales of Measurement
- Graphical Summaries
- Numerical Summaries
- Center of Data
- Spread of Data

Sample assessment questions:

- In a field there are 7 trees and their mean height is 25ft and their median height is 20ft. If the tallest tree is the only one that grows next year and it grows 3ft, what will be the new mean and median?
- Find the mean, median, mode and standard deviation of a data set.

2. BASIC PROBABILITY

- Probability Rules
- Conditional Probability
- Bayes Theorem

Sample assessment questions:

- The likelihood of a cat developing Feline Leukemia is 1.1%. The National Veterinary Association has developed a test that if a cat has leukemia it will show a positive result 98% of the time, whereas if a cat doesn't have leukemia the test will show a positive result 2% of the time. If your cat is tested and the result is positive what is the probability that it has leukemia?
- Tom and Ray hike independently from each other in the Sequoia National Park. The probability that Tom will hike the Alta peak on is 0.3 and the probability that Ray will hike Alta peak is 0.6. What is the probability that a) neither Tom nor Ray will hike Alta peak; b) at least one of them will hike Alta peak?

3. PROPERTIES OF RANDOM VARIABLES

- Discrete random variables
- Continuous random variables
- Mean and variance of random variables

Sample assessment questions:

- The number of calls X , to a 911 number in a small city has the following probability distribution: Find the probability that there will be 4 or more calls on a given day. What is the expected number of calls on a given day?

x	0	1	2	3	4	5	6
$P(X=x)$	0.1	0.1	0.2	0.25	0.15	?	0.15

4. BINOMIAL AND NORMAL DISTRIBUTION

- Binomial distribution
- Normal distribution

Sample assessment questions:

- The Centers for Disease Control has determined that when a person is given a vaccine, the probability that the person will develop immunity to a virus is 0.95. If 10 people are given the vaccine what is the probability that at least 8 of them will develop immunity to the virus?
- A test was conducted regarding the reading skills of fourths graders. The resulting data is normally distributed with a mean of 75 and a standard deviation of 8.5. The lowest 6.3% of the students are required to retake the exam before the end of the school year. If a random student is chosen what is the probability that he or she scores less than 59? What score indicates that the student has to retake the exam?

5. SAMPLING DISTRIBUTIONS

- Sampling variability
- Distribution of the sample mean
- Normal approximation to the Binomial

Sample assessment questions:

- A certain private university knows that if an offer of enrollment is sent to an applicant there is a 0.75 probability that the potential student will accept the offer. If 1000 offers are sent out, what is the probability that more than 780 students will accept the offer?
- Suppose that the time spent waiting for a bus is a random variable with mean 6 minutes and standard deviation 0.89 minutes. If 25 people are selected, what is the probability that their average wait time is more than 6.4min?

6. ESTIMATION AND CONFIDENCE INTERVALS

- Point estimates for parameters
- Confidence intervals for mean with know and unknown standard deviation
- Confidence intervals for the standard deviation
- Confidence intervals for the proportion of a binomial
- Choosing a sample size

Sample assessment questions:

- A large company is trying to find out if consumers are interested in buying new flavor of cereal. They want to be accurate enough so that at a 95% level of confidence that the sample proportion doesn't differ from the true population proportion by more than 0.03. How many people should be surveyed in order to do this?

- The National Feline Association states that the mean age of domestic cats is 12 years. A local vet believes that the true mean is less than 12 years. A sample of 15 cats yields a sample mean of 10.5 years and a sample variance of 4. Using a level of significance of 0.05, determine if the vet is correct.

7. TESTING HYPOTHESIS FOR A SINGLE SAMPLE

- P-value approach –observed significance level
- Fixed level of significance approach
- One sample t-test for the mean
- Tests for the variance
- Large sample tests for proportions

Sample assessment questions:

- A machine at a food production company fills 64oz boxes with cereal. A sample of 51 boxes yields a sample mean of $\bar{x} = 63.5\text{oz}$ and a sample variance of $s^2 = 64$. The machine needs to be fixed if the true standard deviation is greater than 6oz. Use hypothesis testing to find out if the machine needs to be adjusted using $\alpha = 0.05$. Write 2-3 sentences interpreting your results. What does a Type I error represent in this example?
- The package on a can of GoodSoups claims that the true mean salt content is 567mg. A consumer advocacy group worries that the salt content is higher. The group recorded the results of 20 cans and found a sample mean of 575mg and a sample variance of 15mg. Test if the consumer group is right using a level $\alpha = 0.01$.

8. COMPARING TWO SAMPLES

- Paired t-test
- Comparing the means for two independent samples
- Confidence intervals for the difference of two means
- Comparing two proportions in large samples

Sample assessment questions:

- In order to determine driving habits, an auto insurance company surveyed 30 male and 25 female drivers. Each was asked how many miles he or she had driven in the past year. The mean number of miles for males was 9,117. The mean number of miles for the women was 10,014. Suppose it is assumed that the standard deviations are known to be $\sigma_1 = 3,249$ and $\sigma_2 = 3,960$ respectively. Can we conclude at the 5% significance level that the male and female drivers differ in the number of miles driven per year?
- CompanyA and CompanyB both make computer components. The lifetimes for samples of the components from both companies are summarized here: Using a 5% level of significance, test if these two companies' components have the same lifetimes. Find a 99% confidence interval for the difference of the two means.

CompanyA: Mean = 4.98 Variance = 1.13

CompanyB: Mean = 5.35 Variance = 1.84

9. BIVARIATE DATA

- Correlation
- Regression and inference

Sample assessment questions:

- Word Problem Scenarios: Given a data set on x and y, find the regression line $y = a + bx$; test if the regression line is statistically significant; predict values of y for a stated value of x.