



Statistics - Unit D - Inference

Unit Focus

Unit D deals with the reasoning of statistical inference. It presents methods for estimating and testing claims about a population proportion. Discussion about confidence intervals builds on foundations laid in previous learning about normal distributions and sampling. Extensions are made to testing for an association between two categorical variables, and estimating and testing claims about a population mean.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Common Core Mathematics: 9-12 - Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). (CCSS.MATH.CONTENT.HSS.MD.B.7) - Make sense of problems and persevere in solving them. (CCSS.MATH.MP.1) - Construct viable arguments and critique the reasoning of others. (CCSS.MATH.MP.3) - Use appropriate tools strategically. (CCSS.MATH.MP.5) Madison Public Schools Profile of a Graduate - Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)	<i>Students will be able to independently use their learning to...</i> T1 model relationships among quantities. T2 make sense of a problem, initiate a plan, execute it, and evaluate the reasonableness of the solution. T3 apply familiar mathematical concepts to a new problem or apply a new concept to rework a familiar problem. T4 justify reasoning using clear and appropriate mathematical language.	
	Meaning	
	Understanding(s)	Essential Question(s)
	<i>Students will understand that...</i> U1 Mathematicians identify relevant tools, strategies, relationships, and/or information in order to draw conclusions. U2 Mathematicians create or use models to examine, describe, solve and/or make predictions. U3 Mathematicians select and use appropriate statistical methods and tools to analyze data, show trends, and describe or make predictions. U4 Mathematicians analyze data to evaluate inferences, make predictions and/or communicate a decision.	<i>Students will keep considering...</i> Q1 What beliefs are worth testing scientifically? Q2 As consumers of information, how do we question the information we are presented as facts? Q3 How is inference used to shape our world?
	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
	<i>Students will know...</i> K1 statistical inference draws conclusions about a population based on data from a sample K2 parameters describe the population	<i>Students will be skilled at...</i> S1 identifying topics that can be tested with inference S2 creating null and alternate hypotheses

Stage 1: Desired Results - Key Understandings

K3 statistics estimate the parameter based on a sample
K4 if the sample is large enough: the sampling distribution of p is approximately normal, the mean of the sampling distribution is p , the formula for standard deviation of a sampling distribution
K5 as we increase the number of samples, the distribution becomes normal, and 95% of samples approach the true parameter.
K6 significance tests assess the evidence provided by data about some claim concerning a population.
K7 significance tests try to prove that a claim is so unlikely to be true that it must not be true.
K8 the smaller the P-value is, the stronger is the evidence against H_0 provided the data.
K9 if the P-value is smaller than α (alpha), we say that the data are statistically significant.
K10 significant does not mean important, it means not likely to happen by chance.
K11 a significance test answers only 1 question: How strong is the evidence that the null hypothesis is not true?
K12 the P-value of a significance test depends strongly on the size of the sample, as well as on the truth about the population.
K13 there is no sharp border between "significant" and "insignificant," only increasingly strong evidence as the P-value decreases.
K14 95% confidence interval is guaranteed to capture the true population parameter in 95% of all samples
K15 the sampling distribution of a statistic is the distribution of values taken by the statistic in all possible samples of the same size from the same population
K16 confidence interval for a parameter has two parts: an interval calculated from the data and a confidence level C which gives the probability that the interval will capture the true parameter value in repeated samples.
K17 to create survey results with a desired margin of error, like ± 3 pts for gallup polls, solve for the margin of error algebraically.
K18 the null hypothesis (H_0 pronounced hought), is the claim which you will try to disprove
K19 the alternate hypothesis (H_A), is the claim you will support by disproving H_0 .

S3 creating a random sample
S4 calculating a sample parameter
S5 calculating a standard deviation
S6 drawing P-values on a normal curve
S7 stating a 95% confidence interval as a confidence statement
S8 calculating and interpreting P-values at various degrees of confidence
S9 making a statement about the outcomes of hypothesis tests in the context of an experiment

Stage 1: Desired Results - Key Understandings

K20 the probability, computed assuming that H_0 is true, that the sample outcome would be as extreme or more extreme than the actually observed outcome is called the Pvalue of the test.

K21 good data is the foundation of good research

K22 questionable data creates weakness in any inference

K23 randomness of data sources must be addressed

K24 bias must be eliminated from samples and surveys

K25 confidence intervals estimate the unknown value of a parameter and also tell us how uncertain the estimate is, and *

Even 99% confidence leaves 1% room for a false negative * High confidence comes at the cost of a wider confidence interval * If you want a higher confidence level and lower interval range, increase sample size.

K26 our methods require that the proportion (p) is significantly larger than the sample and that the sample is large enough so that the distribution of the sample proportion is close to normal

K27 always report a P-value with the sample size and statistics about the sample outcome.

K28 Vocabulary: statistical inference, confidence interval, confidence level, sampling distribution, critical values, significance test, P-value, null hypothesis, alternative hypothesis, statistically significance at the 5% level