



UTICA COMMUNITY SCHOOLS

Course Title: Statistics

Course Content Expectations:

This course is a one-semester class designed to teach the basics of statistics and probability. Students will gain an understanding of descriptive and inferential statistics, as well as the vocabulary and computations that pertain to the subject. The basics of probability and counting techniques will also be discussed. **Students should know and be able to apply the following concepts to various situations.**

Topics to be covered

Students are introduced to the subject of statistics by exploring key concepts such as:

- data sources, including:
 - surveys, observational studies and experiments
 - the importance of a data source
 - population, sample, census
- data sets, including:
 - categorical or quantitative
 - describing distributions using simple graphs
- role of probability and simulation
- the limitations of statistical inference

Part 1: Descriptive statistics

Students further their introduction to descriptive statistics by learning or reviewing (examples of how graphing calculators are integrated into the course are included):

- graphical displays of data, including:
 - stemplots, histograms, and boxplots
 - creating displays on the TI-83
- measures of center, including:
 - mean, median and IQR
- measures of spread, including:
 - variance and standard deviation
 - effects of outliers or other individual data points
- comparison of distributions, including:
 - side-by-side graph comparisons
 - center and spread comparisons

- measures of relative standing, including:
 - z-scores and percentiles
- density curves, including:
 - means and medians in density curves
 - the normal curve
- Normal Distributions, including:
 - 68-95-99.7 Rule
 - standard normal distribution and table
 - calculations based on the standard normal curve
- correlation, including:
 - explanatory, response and lurking variables
 - positive, negative and weak associations
 - scatterplots
- least squares regression, including:
 - calculations
 - role of slope and intercept of the line
 - predictions
 - residuals and residual plots
 - the coefficient of determination
- relationships between categorical variables
 - two-way tables
 - Simpson's Paradox
- establishment of causation, including:
 - confounding, common response and causation
 - recognizing lurking variables

Part 2: Producing Data

Students further their introduction to descriptive statistics by learning or reviewing:

- designs of samples, including:
 - voluntary response, convenience
 - the role of bias in sampling and other cautions
 - simple random sample, systematic random sampling and stratified random sampling
- designs of experiments, including:
 - randomized comparative experiments
 - control, placebo effect and double-blind studies
 - simple random, block and matched pairs design

Part 3: Probability and Random Variables

Students develop the necessary foundations for statistical inference by exploring:

- simulations, including:
 - basics steps
 - assigning digits
 - using the random digit table or TI-83 to create assignments

- probability, including:
 - randomness
 - sample space
 - addition rule
 - the multiplication principle with or without replacement
- probability rules, including:
 - disjoint events
 - complement events
 - independent vs. dependent events
 - conditional probability
 - tree and Venn diagrams
 - law of large numbers
- binomial distributions, including:
 - binomial random variables
 - binomial coefficients
 - formula for binomial probability
- geometric distributions, including:
 - calculating geometric probabilities
 - expected value
- sample means, including:
 - calculating the mean and standard deviation of a sample mean
 - sampling distribution of a sample mean from a normal population
 - central limit theorem

Part 4: Statistical Inference

Students investigate statistical inference by exploring:

- confidence intervals, including:
 - calculating one-sample t intervals
 - confidence intervals for a population proportion
- basics of significance tests, including:
 - null and alternative hypothesis
 - test statistics
 - P-value of the test
 - significance levels
 - interpreting results of the test
 - Type I and Type II errors
- tests about a population mean, including:
 - one sample t tests
- tests about a population proportion, including:
 - one-proportion z tests
- chi-square distributions, including:
 - calculating the expected count and the chi-square statistic
 - tests for goodness of fit in relation to genetics