Locally Developed Courses

Statistics

For the 2024-2025 School Year

Introduction to the Statistics Course Sequence

Subject: Mathematics - Discipline: Statistics

Statistics is the discipline concerned with the collection, analysis, interpretation and presentation of data. In Statistics, students have opportunities to engage in statistical thinking and analysis. This course emphasizes a multi-representational approach to statistics, with concepts, results, and problems being expressed graphically, numerically, analytically and verbally. The aim of Statistics 35 is to introduce students to the major concepts and tools for collecting, analyzing, and drawing conclusions from data. Learning outcomes in Statistics 35 are based on the *AP® Statistics Course and Exam Description* (College Board, 2020).

Student Need

In Statistics, students have the opportunity to learn about statistics beyond the scope of the Alberta Mathematics (10-12) Program of Studies. Statistics 35 is designed to prepare students to potentially write the Advanced Placement® (AP) Statistics exam, to ease students' transition to the first year of post-secondary study, and to prepare them for success in science, technology, engineering, mathematics and other programs. In this course, students develop and apply critical thinking and problem-solving skills as they delve into the themes of exploring data, sampling and experimentation, probability and simulation, and statistical inference. As well, students in Statistics 35 manage information from a variety of sources in order to effectively communicate their statistical findings.

Courses in the Statistics Course Sequence

Statistics 35 (LDC3195)

Statistics 35 provides opportunities for students to engage in statistical thinking and analysis. Statistics 35 is designed for high school students who wish to learn about statistics beyond the scope of the Alberta Mathematics (10-12) Program of Studies. This course is intended to prepare students to potentially write the Advanced Placement® (AP) Statistics exam, to ease students' transition to the first year of post-secondary study and to prepare them for success in science, technology, engineering, mathematics and other programs.

> No required facilities.

Prerequisites:

- All of the following:
  - Mathematics 20-1 (MAT2791)

Versions Available: (Each version must be locally approved by Board Motion prior to offering to students.)

Credit Level	First School Year	Last School Year
5	2024-2025	2027-2028

Curriculum Outline

Curriculum Elements		Statistics 35-5
1	**Topic** Data Analysis: Examining patterns, trends, associations, and relationships in data leads to understanding data in real-world contexts.	✓
1.1	**General Outcome** How can categorical data be examined numerically and graphically?	✓
1.1.1	**Specific Outcome** represent one-variable categorical data using frequency or relative frequency tables and bar graphs.	✓
1.1.2	**Specific Outcome** describe one-variable categorical data represented in frequency or relative frequency tables and bar graphs.	✓
1.1.3	**Specific Outcome** compare multiple sets of one-variable categorical data.	✓
1.1.4	**Specific Outcome** compare numerical and graphical representations for two categorical variables. • side-by-side bar graphs • segmented bar graphs • two-way tables	✓
1.1.5	**Specific Outcome** calculate statistics for two categorical variables. • joint relative frequency • marginal relative frequency • conditional relative frequency	✓
1.1.6	**Specific Outcome** compare statistics for two categorical variables. • compare distributions • determine if variables are associated	✓
1.2	**General Outcome** How can one-variable quantitative data be examined numerically and graphically?	✓

Curriculum Elements		Statistics 35-5
1.2.1	**Specific Outcome** represent quantitative data graphically. • histogram • stem and leaf • dot plot • cumulative graph	✓
1.2.2	**Specific Outcome** describe the characteristics of quantitative data distributions. • shape • centre • variability (spread) • unusual features, such as outliers, gaps, clusters or multiple peaks	✓
1.2.3	**Specific Outcome** calculate measures of center and position for quantitative data. • mean • median • quartiles • percentiles	✓
1.2.4	**Specific Outcome** calculate measures of variability for quantitative data. • range • interquartile range • standard deviation	✓
1.2.5	**Specific Outcome** explain the selection of a particular measure of center and/or variability for describing a set of quantitative data. • determining outliers • considering resistant or non-resistant measures	✓
1.2.6	**Specific Outcome** represent summary statistics for quantitative data graphically. • five-number summary • boxplot	✓
1.2.7	**Specific Outcome** describe summary statistics of quantitative data represented graphically.	✓

Curriculum Elements		Statistics 35-5
1.2.8	**Specific Outcome** compare multiple sets of quantitative data. • graphical representations • summary statistics	✓
1.3	**General Outcome** How can the relationship between quantitative bivariate data be determined?	✓
1.3.1	**Specific Outcome** represent bivariate quantitative data using scatter plots. • explanatory and response variables	✓
1.3.2	**Specific Outcome** describe the characteristics of a scatter plot, including direction, form (linear or non-linear), strength and unusual features.	✓
1.3.3	**Specific Outcome** determine the correlation for a linear relationship.	✓
1.3.4	**Specific Outcome** interpret the correlation for a linear relationship.	✓
1.3.5	**Specific Outcome** calculate a predicted response value using a linear regression model.	✓
1.3.6	**Specific Outcome** represent differences between measured and predicted responses using residual plots.	✓
1.3.7	**Specific Outcome** describe the form of association of bivariate data using residual plots.	✓
1.3.8	**Specific Outcome** estimate parameters for the least-squares regression line model. • slope • *y*-intercept • coefficient of determination	✓
1.3.9	**Specific Outcome** interpret coefficients for the least-squares regression line model.	✓
1.3.10	**Specific Outcome** identify influential points in regression. • outliers • high-leverage points	✓

Curriculum Elements		Statistics 35-5
1.3.11	**Specific Outcome** calculate a predicted response using a least squares regression line for a transformed data set.	✓
2	**Topic** Selecting Statistical Methods: Using appropriate observational studies and experiments informs the making of data-driven decisions.	✓
2.1	**General Outcome** How can observational studies aid in the collection of reliable data?	✓
2.1.1	**Specific Outcome** identify the type of a study.	✓
2.1.2	**Specific Outcome** identify appropriate generalizations and determinations based on observational studies.	✓
2.1.3	**Specific Outcome** identify a sampling method, given a description of a study. • simple random sample • stratified random sample • cluster sample • systematic random sample • census	✓
2.1.4	**Specific Outcome** explain why a particular sampling method is or is not appropriate for a given situation.	✓
2.1.5	**Specific Outcome** identify potential sources of bias in sampling methods. • voluntary response bias • undercoverage bias • question wording bias • non-random sampling methods	✓
2.2	**General Outcome** How can well-designed experiments aid in establishing causal relationships?	✓
2.2.1	**Specific Outcome** identify the components of an experiment. • explanatory and response variables • confounding variables	✓

Curriculum Elements		Statistics 35-5
2.2.2	**Specific Outcome** describe elements of a well-designed experiment, including: • comparisons of at least two treatment groups, one of which could be a placebo or control group. • random assignment/allocation of treatments to experimental units. • replication (more than one experimental unit in each treatment group). • control of potential confounding variables, where appropriate.	✓
2.2.3	**Specific Outcome** compare experimental designs and methods, including: • completely randomized design • single-blind and double-blind experiments • randomized block design • matched pairs design	✓
2.2.4	**Specific Outcome** explain why a particular experimental design is appropriate.	✓
2.2.5	**Specific Outcome** interpret the results of a well-designed experiment.	✓
3	**Topic** Using Probability and Simulation: Recognizing and accounting for statistical uncertainty and variation informs statistical inferences.	✓
3.1	**General Outcome** How can probability be calculated, interpreted and represented in order to explore random phenomena?	✓
3.1.1	**Specific Outcome** estimate probabilities using simulation.	✓
3.1.2	**Specific Outcome** calculate probabilities for events and their complements.	✓
3.1.3	**Specific Outcome** interpret probabilities for events.	✓
3.1.4	**Specific Outcome** explain why two events are, or are not, mutually exclusive.	✓
3.1.5	**Specific Outcome** calculate conditional probabilities.	✓
3.1.6	**Specific Outcome** calculate probabilities for independent events and for the union of two events.	✓

Curriculum Elements		Statistics 35-5
3.1.7	**Specific Outcome** represent the probability distribution for a discrete random variable, using a graph, table or function.	✓
3.1.8	**Specific Outcome** interpret a probability distribution.	✓
3.1.9	**Specific Outcome** calculate parameters for a discrete random variable.	✓
3.1.10	**Specific Outcome** interpret parameters for a discrete random variable.	✓
3.1.11	**Specific Outcome** calculate parameters for linear combinations of random variables.	✓
3.1.12	**Specific Outcome** describe the effects of linear transformations of parameters of random variables.	✓
3.1.13	**Specific Outcome** compare a data distribution to the normal distribution model.	✓
3.1.14	**Specific Outcome** determine proportions and percentiles from a normal distribution.	✓
3.1.15	**Specific Outcome** compare measures of relative position in data sets.	✓
3.1.16	**Specific Outcome** calculate the probability that a particular value lies in a given interval of a normal distribution.	✓
3.1.17	**Specific Outcome** determine the interval associated with a given area in a normal distribution.	✓
3.1.18	**Specific Outcome** determine the appropriateness of using the normal distribution to approximate probabilities for unknown distributions.	✓
3.1.19	**Specific Outcome** estimate probabilities of binomial random variables using data from a simulation.	✓
3.1.20	**Specific Outcome** calculate probabilities for: • a binomial distribution • geometric random variables	✓

Curriculum Elements		Statistics 35-5
3.1.21	**Specific Outcome** calculate parameters for a: • binomial distribution • geometric distribution	✓
3.1.22	**Specific Outcome** interpret probabilities and parameters for a: • binomial distribution • geometric distribution	✓
4	**Topic** Statistical Argumentation: Applying statistical methods to make inferences develops critical thinking skills and facilitates the development of explanations or the justification of conclusions.	✓
4.1	**General Outcome** How can sampling distributions be used to determine characteristics of a population?	✓
4.1.1	**Specific Outcome** estimate sampling distributions using simulation.	✓
4.1.2	**Specific Outcome** determine parameters of a sampling distribution for: • sample proportions • difference in sample proportions • sample means • difference in sample means	✓
4.1.3	**Specific Outcome** determine whether a sampling distribution for a sample proportion can be described as approximately normal: • for a sample proportion • of a sample mean • for a difference of sample proportions • of a difference in sample means	✓
4.1.4	**Specific Outcome** interpret probabilities and parameters for a sampling distribution for: • a sample proportion • a sample mean • a difference in proportions • a difference in sample means	✓

Curriculum Elements		Statistics 35-5
4.2	**General Outcome** How can confidence intervals and margins of error be calculated and interpreted?	✓
4.2.1	**Specific Outcome** explain why an estimator is or is not unbiased.	✓
4.2.2	**Specific Outcome** calculate estimates for a population parameter.	✓
4.2.3	**Specific Outcome** identify an appropriate confidence interval procedure for a: • population proportion • comparison of population proportions • population mean, including the mean difference between values in matched pairs • difference of two population means • slope of a regression model	✓
4.2.4	**Specific Outcome** verify the conditions for calculating confidence intervals for: • a population proportion • a difference between population proportions • a population mean, including the mean differences between values in matched pairs • the difference of two populations • the slope of a regression model	✓
4.2.5	**Specific Outcome** determine the margin of error for: • a one-sample proportion, given a sample size • a one-sample *t*-interval, given a sample size • a difference of two population means, given a sample size • the slope of a regression model	✓
4.2.6	**Specific Outcome** determine an estimate for the sample size that will result in a given margin of error for a population proportion.	✓
4.2.7	**Specific Outcome** calculate an appropriate confidence interval for: • a population proportion • a comparison of population proportions • a population mean, including in matched pairs • a difference of two population means • the slope of a regression model	✓

Curriculum Elements		Statistics 35-5
4.2.8	**Specific Outcome** calculate an interval estimate based on a confidence interval for a: • population proportion • difference of proportions	✓
4.2.9	**Specific Outcome** interpret a confidence interval for: • a population proportion • a difference of population proportions • a population mean, including the mean difference between values in matched pairs • a difference of population means • the slope of a regression model	✓
4.2.10	**Specific Outcome** justify a claim based on a confidence interval for: • a population proportion • a difference of population proportions • a population mean, including the mean difference between values in matched pairs • a difference of population means • the slope of a regression model	✓
4.2.11	**Specific Outcome** identify the relationships between sample size, width of a confidence interval, confidence level, and margin of error for a: • population proportion • population mean	✓
4.2.12	**Specific Outcome** identify the effects of sample size on the width of a confidence interval for the slope of a regression model.	✓
4.3	**General Outcome** How can appropriate hypotheses tests for statistical significance be applied and interpreted?	✓
4.3.1	**Specific Outcome** describe chi-square distributions.	✓
4.3.2	**Specific Outcome** calculate expected counts for: • chi-square test for goodness of fit • two-way tables of categorical data	✓

Curriculum Elements		Statistics 35-5
4.3.3	**Specific Outcome** identify the null and alternative hypotheses for a: • population proportion • difference of two population proportions • population mean with unknown σ, including the mean difference between values in matched pairs • difference of two population means • test for a distribution of proportions in a set of categorical data • chi-square test for homogeneity or independence • slope of a regression model	✓
4.3.4	**Specific Outcome** identify an appropriate testing method for: • a population proportion • the difference of two population proportions • a population mean with unknown σ, including the mean difference between values in matched pairs • a difference of two population means • a distribution of proportions in a set of categorical data • comparing distributions in two-way tables of categorical data • slope of a regression model	✓
4.3.5	**Specific Outcome** verify the conditions for making statistical inferences when testing: • a population proportion • a difference of two population proportions • a population mean, including the mean difference between values in matched pairs • the difference of two population means • goodness of fit for a chi-square distribution • a chi-square distribution for independence or homogeneity • the slope of a regression model	✓
4.3.6	**Specific Outcome** calculate an appropriate test statistic for: • a population proportion, including *p*-value • the difference of two population proportions • a population mean, including the mean difference between values in matched pairs • a difference of two means • a chi-square test for goodness of fit, including p-value • a chi-square test for homogeneity or independence, including p-value • the slope of a regression model	✓

Curriculum Elements		Statistics 35-5
4.3.7	**Specific Outcome** interpret the p-value of a: • significance test for a population proportion • significance test for a difference of population proportions • significance test for a population mean, including the mean difference between values in matched pairs • significance test for a difference of population means • chi-square test for goodness of fit • chi-square test for homogeneity or independence • the slope of a regression model	✓
4.3.8	**Specific Outcome** justify a claim about the population based on the results of a: • significance test for a population proportion • significance test for a difference of population proportions • significance test for a population mean • significance test for a difference of two population means in context • chi-square test for goodness of fit • chi-square test for homogeneity or independence • significance test for the slope of a regression model	✓
4.4	**General Outcome** To what extent can Type I and Type II errors influence inference?	✓
4.4.1	**Specific Outcome** identify Type I and Type II errors.	✓
4.4.2	**Specific Outcome** calculate the probability of a Type I and Type II errors.	✓
4.4.3	**Specific Outcome** identify factors that affect the probability of errors in significance testing.	✓
4.4.4	**Specific Outcome** interpret Type I and Type II errors.	✓

Statement of Overlap with Existing Programs

Similar / Overlapping Courses	Description of Similarity / Overlap - Rationale
Mathematics 20-2	Both Mathematics 20-2 and Statistics 35 address z-scores, standard deviation, confidence intervals and margins of error.
	The overlapping content is covered in much greater depth in Statistics 35 than is required in Mathematics 20-2.
Mathematics 20-3	Both Mathematics 20-3 and Statistics 35 address graphical display of categorical data.
	The overlapping content is covered in much greater depth in Statistics 35 than is required in Mathematics 20-3.
Mathematics 30-2	Both Mathematics 30-2 and Statistics 35 address probability and mutually exclusive events.
	The overlapping content is covered in much greater depth in Statistics 35 than is required in Mathematics 30-2.
Mathematics 30-3	Both Mathematics 30-3 and Statistics 35 address median, mean, range, percentiles and probability.
	The overlapping content is covered in much greater depth in Statistics 35 than is required in Mathematics 30-3.
Mathematics 9	Both Mathematics 9 and Statistics 35 address bias.
	The overlapping content is covered in much greater depth in Statistics 35 than is required in Mathematics 9.