Probability and Statistics Honors (#1210300) 2022 - 2023 Course Description

Course Title:	Probability and Statistics Honors
Course Number:	1210300
Course Information:	**In Probability and Statistics Honors, instructional time will emphasize four areas:** (1) creating and interpreting data displays for univariate and bivariate categorical and numerical data; (2) comparing and making observations about populations using statistical data, including confidence intervals and hypothesis testing; (3) extending understanding of probability and probability distributions and (4) developing an understanding of methods for collecting statistical data, including randomized trials. *All clarifications stated, whether general or specific to Probability and Statistics Honors, are expectations for instruction of that benchmark.* Curricular content for all subjects must integrate critical-thinking, problem-solving, and workforce-literacy skills; communication, reading, and writing skills; mathematics skills; collaboration skills; contextual and applied-learning skills; technology-literacy skills; information and media-literacy skills; and civic-engagement skills.
General Notes:	**Honors and Accelerated Level Course Note:** Accelerated courses require a greater demand on students through increased academic rigor. Academic rigor is obtained through the application, analysis, evaluation, and creation of complex ideas that are often abstract and multi-faceted. Students are challenged to think and collaborate critically on the content they are learning. Honors level rigor will be achieved by increasing text complexity through text selection, focus on high-level qualitative measures, and complexity of task. Instruction will be structured to give students a deeper understanding of conceptual themes and organization within and across disciplines. Academic rigor is more than simply assigning to students a greater quantity of work. **Florida's Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards** This course includes Florida's B.E.S.T. ELA Expectations (EE) and Mathematical Thinking and Reasoning Standards (MTRs) for students. Florida educators should intentionally embed these standards within the content and their instruction as applicable. For guidance on the implementation of the EEs and MTRs, please visit https://www.cpalms.org/Standards/BEST_Standards.aspx and select the appropriate B.E.S.T. Standards package. **English Language Development ELD Standards Special Notes Section:**

	Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate information, ideas and concepts for academic success in the content area of Mathematics. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: https://cpalmsmediaprod.blob.core.windows.net/uploads/docs/standards/eld/ma.pdf

Florida's Benchmarks for Excellent Student Thinking (B.E.S.T.) Standards: 7 Mathematical Thinking and Reasoning Standards, 46 Mathematics Benchmarks, 6 English Language Arts Benchmarks and 1 English Language Development Benchmark

7 Mathematical Thinking and Reasoning Standards		Textbook Section
MA.K12.MTR.1.1:	Mathematicians who participate in effortful learning both individually and with others: ● Analyze the problem in a way that makes sense given the task. ● Ask questions that will help with solving the task. ● Build perseverance by modifying methods as needed while solving a challenging task. ● Stay engaged and maintain a positive mindset when working to solve tasks. ● Help and support each other when attempting a new method or approach. Clarifications: Teachers who encourage students to participate actively in effortful learning both individually and with others: ● Cultivate a community of growth mindset learners. ● Foster perseverance in students by choosing tasks that are challenging. ● Develop students' ability to analyze and problem solve. ● Recognize students' effort when solving challenging problems.	Incorporated Throughout
MA.K12.MTR.2.1:	Demonstrate understanding by representing problems in multiple ways. Mathematicians who demonstrate understanding by representing problems in multiple ways: ● Build understanding through modeling and using manipulatives. ● Represent solutions to problems in multiple ways using objects, drawings, tables, graphs and equations. ● Progress from modeling problems with objects and drawings to using algorithms and equations. ● Express connections between concepts and representations. ● Choose a representation based on the given context or purpose. Clarifications: Teachers who encourage students to demonstrate understanding by representing problems in multiple ways:	Incorporated Throughout

	• Help students make connections between concepts and representations. • Provide opportunities for students to use manipulatives when investigating concepts. • Guide students from concrete to pictorial to abstract representations as understanding progresses. • Show students that various representations can have different purposes and can be useful in different situations.	
MA.K12.MTR.3.1:	Complete tasks with mathematical fluency. Mathematicians who complete tasks with mathematical fluency: • Select efficient and appropriate methods for solving problems within the given context. • Maintain flexibility and accuracy while performing procedures and mental calculations. • Complete tasks accurately and with confidence. • Adapt procedures to apply them to a new context. • Use feedback to improve efficiency when performing calculations. Clarifications: Teachers who encourage students to complete tasks with mathematical fluency: • Provide students with the flexibility to solve problems by selecting a procedure that allows them to solve efficiently and accurately. • Offer multiple opportunities for students to practice efficient and generalizable methods. • Provide opportunities for students to reflect on the method they used and determine if a more efficient method could have been used.	Incorporated Throughout
MA.K12.MTR.4.1:	Engage in discussions that reflect on the mathematical thinking of self and others. Mathematicians who engage in discussions that reflect on the mathematical thinking of self and others: • Communicate mathematical ideas, vocabulary and methods effectively. • Analyze the mathematical thinking of others. • Compare the efficiency of a method to those expressed by others. • Recognize errors and suggest how to correctly solve the task. • Justify results by explaining methods and processes. • Construct possible arguments based on evidence. Clarifications: Teachers who encourage students to engage in discussions that reflect on the mathematical thinking of self and others: • Establish a culture in which students ask questions of the teacher and their peers, and error is an opportunity for learning. • Create opportunities for students to discuss their thinking with peers. • Select, sequence and present student work to advance and deepen understanding of correct and increasingly efficient methods.	Incorporated Throughout

	• Develop students' ability to justify methods and compare their responses to the responses of their peers.	
MA.K12.MTR.5.1:	Use patterns and structure to help understand and connect mathematical concepts. Mathematicians who use patterns and structure to help understand and connect mathematical concepts: • Focus on relevant details within a problem. • Create plans and procedures to logically order events, steps or ideas to solve problems. • Decompose a complex problem into manageable parts. • Relate previously learned concepts to new concepts. • Look for similarities among problems. • Connect solutions of problems to more complicated large-scale situations. Clarifications: Teachers who encourage students to use patterns and structure to help understand and connect mathematical concepts: • Help students recognize the patterns in the world around them and connect these patterns to mathematical concepts. • Support students to develop generalizations based on the similarities found among problems. • Provide opportunities for students to create plans and procedures to solve problems. • Develop students' ability to construct relationships between their current understanding and more sophisticated ways of thinking.	Incorporated Throughout
MA.K12.MTR.6.1:	Assess the reasonableness of solutions. Mathematicians who assess the reasonableness of solutions: • Estimate to discover possible solutions. • Use benchmark quantities to determine if a solution makes sense. • Check calculations when solving problems. • Verify possible solutions by explaining the methods used. • Evaluate results based on the given context. Clarifications: Teachers who encourage students to assess the reasonableness of solutions: • Have students estimate or predict solutions prior to solving. • Prompt students to continually ask, "Does this solution make sense? How do you know?" • Reinforce that students check their work as they progress within and after a task. • Strengthen students' ability to verify solutions through justifications.	Incorporated Throughout
MA.K12.MTR.7.1:	Apply mathematics to real-world contexts. Mathematicians who apply mathematics to real-world contexts: • Connect mathematical concepts to everyday experiences. • Use models and methods to understand, represent and solve problems.	Incorporated Throughout

	• Perform investigations to gather data or determine if a method is appropriate. • Redesign models and methods to improve accuracy or efficiency. Clarifications: Teachers who encourage students to apply mathematics to real-world contexts: • Provide opportunities for students to create models, both concrete and abstract, and perform investigations. • Challenge students to question the accuracy of their models and methods. • Support students as they validate conclusions by comparing them to the given situation. • Indicate how various concepts can be applied to other disciplines.	
46 B.E.S.T. Mathematics Benchmarks		
MA.912.DP.1.1:	Given a set of data, select an appropriate method to represent the data, depending on whether it is numerical or categorical data and on whether it is univariate or bivariate. **Clarifications:** *Clarification 1:* Instruction includes discussions regarding the strengths and weaknesses of each data display. *Clarification 2:* Numerical univariate includes histograms, stem-and-leaf plots, box plots and line plots; numerical bivariate includes scatter plots and line graphs; categorical univariate includes bar charts, circle graphs, line plots, frequency tables and relative frequency tables; and categorical bivariate includes segmented bar charts, joint frequency tables and joint relative frequency tables. *Clarification 3:* Instruction includes the use of appropriate units and labels and, where appropriate, using technology to create data displays.	2.1, 2.2, 2.3, 2.4, 3.3, supplement segmented bar chart and joint frequency table
MA.912.DP.1.2:	Interpret data distributions represented in various ways. State whether the data is numerical or categorical, whether it is univariate or bivariate and interpret the different components and quantities in the display. **Clarifications:** *Clarification 1*: Within the Probability and Statistics course, instruction includes the use of spreadsheets and technology.	2.1, 2.2, 2.3, 2.4, 3.3, 6.1, 6.2, 6.3
MA.912.DP.1.3:	Explain the difference between correlation and causation in the contexts of both numerical and categorical data.	2.4
MA.912.DP.1.4:	Estimate a population total, mean or percentage using data from a sample survey; develop a margin of error through the use of simulation. **Clarifications:** *Clarification 1:* Within the Algebra 1 course, the margin of error will be given.	4.5, 7.1, 7.2
MA.912.DP.1.5:	Interpret the margin of error of a mean or percentage from a data set. Interpret the confidence level corresponding to the margin of error.	7.1, 7.2, 9.1, 9.2, 9.3

MA.912.DP.2.1:	For two or more sets of numerical univariate data, calculate and compare the appropriate measures of center and measures of variability, accounting for possible effects of outliers. Interpret any notable features of the shape of the data distribution. **Clarifications:** *Clarification 1*: The measure of center is limited to mean and median. The measure of variation is limited to range, interquartile range, and standard deviation. *Clarification 2*: Shape features include symmetry or skewness and clustering. *Clarification 3*: Within the Probability and Statistics course, instruction includes the use of spreadsheets and technology.	3.1, 3.2, 3.3
MA.912.DP.2.2:	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. **Clarifications:** *Clarification 1*: Instruction includes the connection to the binomial distribution and surveys.	6.1, 6.2, 6.3, 6.4
MA.912.DP.2.3:	Estimate population percentages from data that has been fit to the normal distribution. **Clarifications:** *Clarification 1*: Instruction includes using technology, empirical rules or tables to estimate areas under the normal curve.	6.1, 6.2, 6.3, 6.4
MA.912.DP.2.4:	Fit a linear function to bivariate numerical data that suggests a linear association and interpret the slope and y-intercept of the model. Use the model to solve real-world problems in terms of the context of the data. **Clarifications:** *Clarification 1*: Instruction includes fitting a linear function both informally and formally with the use of technology. *Clarification 2*: Problems include making a prediction or extrapolation, inside and outside the range of the data, based on the equation of the line of fit.	2.4, 10.2, 10.3
MA.912.DP.2.5:	Given a scatter plot that represents bivariate numerical data, assess the fit of a given linear function by plotting and analyzing residuals. **Clarifications:** *Clarification 1*: Within the Algebra 1 course, instruction includes determining the number of positive and negative residuals; the largest and smallest residuals; and the connection between outliers in the data set and the corresponding residuals.	10.2, 10.3
MA.912.DP.2.6:	Given a scatter plot with a line of fit and residuals, determine the strength and direction of the correlation. Interpret strength and direction within a real-world context. **Clarifications:** *Clarification 1*: Instruction focuses on determining the direction by analyzing the slope and informally determining the strength by analyzing the residuals.	10.1, 10.2, 10.3

MA.912.DP.2.7:	Compute the correlation coefficient of a linear model using technology. Interpret the strength and direction of the correlation coefficient.	10.1, 10.3
MA.912.DP.2.9:	Fit an exponential function to bivariate numerical data that suggests an exponential association. Use the model to solve real-world problems in terms of the context of the data. **Clarifications:** *Clarification 1*: Instruction focuses on determining whether an exponential model is appropriate by taking the logarithm of the dependent variable using spreadsheets and other technology. *Clarification 2*: Instruction includes determining whether the transformed scatterplot has an appropriate line of best fit, and interpreting the y-intercept and slope of the line of best fit. *Clarification 3*: Problems include making a prediction or extrapolation, inside and outside the range of the data, based on the equation of the line of fit.	10.5
MA.912.DP.3.1:	Construct a two-way frequency table summarizing bivariate categorical data. Interpret joint and marginal frequencies and determine possible associations in terms of a real-world context.	4.2, 4.3 and supplement
MA.912.DP.3.2:	Given marginal and conditional relative frequencies, construct a two-way relative frequency table summarizing categorical bivariate data. **Clarifications:** *Clarification 1:* Construction includes cases where not all frequencies are given but enough are provided to be able to construct a two-way relative frequency table. *Clarification 2:* Instruction includes the use of a tree diagram when calculating relative frequencies to construct tables.	4.2, 4.3 and supplement
MA.912.DP.3.3:	Given a two-way relative frequency table or segmented bar graph summarizing categorical bivariate data, interpret joint, marginal and conditional relative frequencies in terms of a real-world context. **Clarifications:** *Clarification 1:* Instruction includes problems involving false positive and false negatives.	supplement
MA.912.DP.3.4:	Given a relative frequency table, construct and interpret a segmented bar graph.	supplement
MA.912.DP.3.5:	Solve real-world problems involving univariate and bivariate categorical data. **Clarifications:** *Clarification 1:* Instruction focuses on the connection to probability. *Clarification 2:* Instruction includes calculating joint relative frequencies or conditional relative frequencies using tree diagrams. *Clarification 3*: Graphical representations include frequency tables, relative frequency tables, circle graphs and segmented bar graphs.	supplement
MA.912.DP.4.1:	Describe events as subsets of a sample space using characteristics, or categories, of the outcomes, or as unions, intersections or complements of other events.	4.1, 4.2, 4.3
MA.912.DP.4.2:	Determine if events A and B are independent by calculating the product of their probabilities.	4.2

MA.912.DP.4.3:	Calculate the conditional probability of two events and interpret the result in terms of its context.	4.3
MA.912.DP.4.4:	Interpret the independence of two events using conditional probability.	4.2, 4.3, supplement
MA.912.DP.4.5:	Given a two-way table containing data from a population, interpret the joint and marginal relative frequencies as empirical probabilities and the conditional relative frequencies as empirical conditional probabilities. Use those probabilities to determine whether characteristics in the population are approximately independent. **Clarifications:** *Clarification 1*: Instruction includes the connection between mathematical probability and applied statistics.	supplement
MA.912.DP.4.6:	Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.	supplement
MA.912.DP.4.7:	Apply the addition rule for probability, taking into consideration whether the events are mutually exclusive, and interpret the result in terms of the model and its context.	4.2
MA.912.DP.4.8:	Apply the general multiplication rule for probability, taking into consideration whether the events are independent, and interpret the result in terms of the context.	4.2
MA.912.DP.4.9:	Apply the addition and multiplication rules for counting to solve mathematical and real-world problems, including problems involving probability.	4.4
MA.912.DP.4.10:	Given a mathematical or real-world situation, calculate the appropriate permutation or combination.	4.4
MA.912.DP.5.1:	Distinguish between a population parameter and a sample statistic.	1.2, 7.1, 7.2
MA.912.DP.5.2:	Explain how random sampling produces data that is representative of a population.	1.3, 7.1, 7.2
MA.912.DP.5.3:	Compare and contrast sampling methods. **Clarifications:** *Clarification 1*: Instruction includes understanding the connection between probability and sampling methods. *Clarification 2*: Sampling methods include simple random, stratified, cluster, systematic, judgement, quota and convenience.	1.3 and supplement (judgement and quota)
MA.912.DP.5.4:	Generate multiple samples or simulated samples of the same size to measure the variation in estimates or predictions.	4.5, 6.3, 8.1
MA.912.DP.5.5:	Determine if a specific model is consistent within a given process by analyzing the data distribution from a data-generating process.	4.5, 5.1, 5.2, 6.1, 6.2, 7.2
MA.912.DP.5.6:	Determine the appropriate design, survey, experiment or observational study, based on the purpose. Articulate the types of questions appropriate for each type of design.	1.1, 1.3, 8.1, 8.2, 8.3
MA.912.DP.5.7:	Compare and contrast surveys, experiments and observational studies.	1.1, 1.3, 8.1

	Clarifications: *Clarification 1*: Instruction includes understanding how randomization relates to sample surveys, experiments and observational studies.	
MA.912.DP.5.8:	Draw inferences about two populations using data and statistical analysis from two random samples.	9.1, 9.2
MA.912.DP.5.9:	Compare two treatments using data from an experiment in which the treatments are assigned randomly. **Clarifications:** *Clarification 1*: Instruction includes the understanding that if one wants to validate a causal relationship, then randomized assignment of treatment groups must occur.	9.1, 9.2
MA.912.DP.5.10:	Determine whether differences between parameters are significant using simulations.	9.1, 9.2
MA.912.DP.5.11:	Evaluate reports based on data from diverse media, print and digital resources by interpreting graphs and tables; evaluating data-based arguments; determining whether a valid sampling method was used; or interpreting provided statistics. **Clarifications:** *Clarification 1*: Instruction includes determining whether or not data displays could be misleading.	1.1, 2.4, 4.1, 4.5, 5.2, 7.1, 9.1, 9.2
MA.912.DP.6.1:	Define a random variable for a quantity of interest by assigning a numerical value to each individual outcome in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.	5.1
MA.912.DP.6.2:	Develop a probability distribution for a discrete random variable using theoretical probabilities. Find the expected value and interpret it as the mean of the discrete distribution.	5.1
MA.912.DP.6.3:	Develop a probability distribution for a discrete random variable using empirical probabilities. Find the expected value and interpret it as the mean of the discrete distribution.	5.1
MA.912.DP.6.4:	Given a binomial distribution, calculate and interpret the expected value. Solve real-world problems involving binomial distributions. **Clarifications:** *Clarification 1*: Instruction focuses on the connection between binomial distributions and coin tossing and the connection to one-question surveys in which the question has two possible responses.	5.2
MA.912.DP.6.5:	Solve real-world problems involving geometric distributions. **Clarifications:** *Clarification 1*: Instruction focuses on the connection between geometric distributions and tossing a coin until the first heads appears and the connection to making repeated attempts at a task until it is successfully completed.	supplement
MA.912.DP.6.7:	Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values and standard deviations. Evaluate and compare strategies on the basis of the calculated expected values and standard deviations.	4.1, 5.1

	Clarifications: *Clarification 1*: Instruction includes the relationship between expected values and standard deviations on one hand and the rewards and risks on the other hand. *Clarification 2*: Instruction includes reducing risk through diversification.	
MA.912.DP.6.8:	Apply probabilities to make fair decisions, such as drawing from lots or using a random number generator.	4.2, 4.3

6 English Language Arts Benchmarks and 1 English Language Development Benchmark		**Textbook Section**
ELA.K12.EE.1.1:	Cite evidence to explain and justify reasoning. **Clarifications:** 9-12 Students continue with previous skills and should be aware of existing style guides and the ways in which they differ.	Incorporated Throughout
ELA.K12.EE.2.1:	Read and comprehend grade-level complex texts proficiently. **Clarifications:** See Text Complexity for grade-level complexity bands and a text complexity rubric.	Incorporated Throughout
ELA.K12.EE.3.1:	Make inferences to support comprehension. **Clarifications:** Students will make inferences before the words infer or inference are introduced. Kindergarten students will answer questions like "Why is the girl smiling?" or make predictions about what will happen based on the title page. Students will use the terms and apply them in 2nd grade and beyond.	Incorporated Throughout
ELA.K12.EE.4.1:	Use appropriate collaborative techniques and active listening skills when engaging in discussions in a variety of situations. **Clarifications:** In grades 3-12, students engage in academic conversations discussing claims and justifying their reasoning, refining and applying skills. Students build on ideas, propel the conversation, and support claims and counterclaims with evidence.	Incorporated Throughout
ELA.K12.EE.5.1:	Use the accepted rules governing a specific format to create quality work. **Clarifications:** Students will incorporate skills learned into work products to produce quality work. For students to incorporate these skills appropriately, they must receive instruction. A 3rd grade student creating a poster board display must have instruction in how to effectively present information to do quality work.	Incorporated Throughout
ELA.K12.EE.6.1:	Use appropriate voice and tone when speaking or writing. **Clarifications:** In kindergarten and 1st grade, students learn the difference between formal and informal language. For example, the way we talk to our friends differs from the way we speak to adults. In 2nd grade and beyond, students practice appropriate social and academic language to discuss texts.	Incorporated Throughout
ELD.K12.ELL.MA.1:	English language learners communicate information, ideas and concepts necessary for academic success in the content area of Mathematics.	Incorporated Throughout