**COURSE OUTLINE, TIMELINE AND LEARNING OBJECTIVES**

**Graphical and Numeric Representations of Data**  (independent summer work through mid Sept.)

**Learning Objective:** Students will be able to choose the best method of graphical display and make the appropriate graphs. Students will be able to analyze and extract needed information from graphs and describe central tendency, spread and outliers, using appropriate terminology. Students will be able to graph side-by-side boxplots, find standard deviation, mean and the 5-number summary on their calculators.

- Activity: Graph dotplot. Draw intervals from the mean and calculate the standard deviation
- Calculator Activity: *Guess the String Length and the hoop-Parallel Boxplots, mean standard deviation, 5-number summary*  JL (MA learning standard10.D.1)
- Linear Transformations- *Red Sox players’ salaries*
- Activity: *Guessing Famous Ages- Standard Deviations*  JL
- Activity: *Physicians’ Reactions to Patient Size*  RIC  Parallel boxplots with discussion. Can you answer the question “Is there a statistically significant difference in the time a physician spends with average weight patients and with an overweight patients?”  DR (Yes, with inference -2 sample t-test in chap. 11)
- Side by side stem and leaf graphs
- Uniform distributions
- Discussions of distributions and best methods of display with Fathom lab*
- Outliers

**Normal Distributions** (completed by late Sept.)

**Learning Objective:** Students will understand the concept of standardizing a value within a normal distribution and be able to calculate a z-score. Students will be able to calculate the value’s percentile.

- Properties of a Density Curve (10.D.3)
- Calculating z and finding the area* under a curve first by hand and then with a calculator
- Standard Deviation with Fathom lab* (10.N.4)

**Regression** (completed by mid October)

**Learning Objective:** Students will be able to recognize bivariate data, be able to identify the explanatory and response variable and calculate the least squares regression line. Students will analyze scatterplots and residual plots to describe the relationship and pattern between the variables and be able to communicate pertinent information. Students
will be able to predict how influential and outlier values will affect that line. Students will understand various aspects of correlation. Students will be able to extract the necessary information from a computer print-out to write the equation of a line, identify the $r^2$ value and describe what it represents with appropriate terminology.

- Scatterplots (10.D.1)
- Correlation
- Least Squares Line of Regression and manipulation of formulas (10.D.2)
- Activity: Distance v. Airfare: Predict the Line w/a Toothpick  JL
- Residual plots

**Power Transformations and Additional Topics of Regression** (completed by late Oct.)

**Learning Objective:** Students will understand how to transform curved data to create a least squares regression line and to convert that equation to an equation of an exponential or power function. Students will also be able to set up a two-way table and find conditional frequencies.

- Review of natural and base 10 logarithms (10.N.1)
- Exponential and Power Transformations (10.P.2)
- Two-way Tables

**Planning Sample Collection and Designing Experiments** (completed by mid Nov.)

**Learning Objective:** Students will be able to identify observational and experimental data. Students will learn to recognize potential sources of bias in data and will learn techniques of data collection to reduce the possibility bias and to collect data that is approximately representative of the population. Students will understand the differences between sampling and experimentation. Students will learn techniques of blocking and simulation. Students will be able to communicate all aspects of sampling and experimentation with appropriate terminology.

- Types of Sampling: Clustered, stratified and a simple random sample
  Activity: Random Rectangles  JL
- Designing Experiments- Matched Pair and Block Design
  Activity: A River Runs Through It – Blocking  JL
- Simulation
  Project: Students will design an experiment to study bias. They will choose one type of bias to study, then create a question and ask it two different ways to two different randomly selected groups, one with the bias factor to the experimental group and one without the bias to the control group. They will collect 50 samples of each group. Students will describe the design of the question and the design of the data collection. Students will present their data in table form and graph form, analyze their results, draw conclusions and explain them. Students will describe observations of the process, including any pitfalls they encountered and any changes they would make.
**Probability** (completed by early Dec.)

**Learning Objective:** Students will learn how to use the multiplication and addition rule to calculate probabilities. Students will learn how to calculate conditional probabilities. Students will learn how to describe probabilities using the terms mutually exclusive, independent and complementary.

- Classic Probability
- Probability Rules
- Counting Probability
- Tree Diagrams

**Random Variables** (completed late Dec.)

**Learning Objective:** Students will learn the rules of variance and how to discern discrete from continuous variables.

- Discrete v. Continuous
- Means and Variance

*Activity: Xavier and Yotam's Race- X + Y as a Random Variable*  
JL

**Binomial and Geometric Distributions** (completed mid Jan.)

**Learning Objective:** Students will learn how to identify binomial and geometric probabilities and how to calculate them.

- Binomial probabilities
- Geometric probabilities

**Sampling Distributions**

**Learning Objective:** Students will understand the concept of sampling distributions for means and proportions. Students will understand the Central Limit Theorem and be able to describe the concepts involved.

- Sample means and Proportions
- Central Limit Theorem
- Pennies Activity

**Inference** (completed early Feb.)

**Learning Objective:** Students will learn and apply the techniques of confidence intervals and Hypothesis Testing. Students will be able to write hypotheses, calculate a test statistic and p-value and draw appropriate conclusions and communicate them with appropriate terminology. Students will be able to graphically describe and calculate Type I and II error, and Power. Students will be able to use a calculator to check their calculations.

- Confidence Intervals
Hypothesis Testing
- Type I and II error and Power

**t- Distributions** (completed late Feb.)
**Learning Objective:** Students will learn when a t-distribution should be used and how confidence intervals and hypothesis tests differ for a t-distribution. Students will also be able to identify when data should be pooled and how to check for conditions when a t-distribution is appropriate.

- read the t-chart
- Calculate Confidence Intervals and Hypothesis Testing for t-distributions
- two-sample t-tests
- Activity: Physicians’ Reactions to Patient Size Part II from chapter 1. Now students will use inference to answer the question “Is there a difference in the time physicians spend with average weight patients and overweight patients beyond random variation?” DR

**Inference for Proportions** (completed early March)
**Learning Objective:** Students will learn when a proportion should be used and how confidence intervals and hypothesis tests differ for a proportion.

- Confidence Intervals
- Hypothesis Testing
- Comparing Two Proportions

**Chi-Squared Distribution** (completed late March)
**Learning Objective:** Students will learn to identify when a Test for Homogeneity, Independence or a Goodness of Fit test should be used and how to perform it and the appropriate conclusions that can be drawn from the tests. Students will learn how to check for conditions when a chi-squared distribution is appropriate. Students will learn how to calculate expected values and what they represent, write them as a two-way table and input the data into their calculators to check their chi-squared calculations. Students will learn how to write appropriate conclusions from their findings.

- Activity: M&M’s Test for Homogeneity
- Test for Goodness of Fit

**Inference for Regression** (completed late March)
**Learning Objective:** Students will learn how to test if the slope of a least squares regression line is appropriate and to find the confidence interval of the slope.

- Inference about the model
- Predictions and conditions

**Review for AP Exam** (completed late April)
**Learning Objective:** Students will thoroughly review the content of this course and be accountable for what they learned.

- Review three to five chapters per day with a study packet each day of AP practice questions followed by three tests
- Cumulative Exam of AP multiple choice questions

**Post Exam Project** (completed June 4th for Seniors and June 15th for Juniors)

**Learning Objective:** Students will be able to see a different perspective of learning and experience what it is like to "be the teacher."

- Students will prepare multimedia lessons from material learned in this course to teach to 4th grade students in the Duxbury schools.

Massachusetts learning strands are included in the first few topics of the course. But since the course content goes into significantly more depth than math courses mandated by the Commonwealth, there are no pertinent learning strands for the remainder of the course.

**Use of old AP Exam questions:**
Practice multiple choice questions and actual open response questions are used throughout the course. Open response questions are done in class and timed and then answers are discussed.

**Homework**
Significant portions of the student text are assigned as reading, often followed the next day by a reading quiz.

Homework questions are assigned from the student text, from AP practice books and from many other sources to coincide with the topic discussed that day. Many assigned questions ask for explanations to support students’ conclusions. These explanations are often discussed in class.

**Assessment**
Tests are given after each topic. Questions are multiple choice, short answer and open response to reflect the AP exam. Many questions require explanations and support for the conclusions that have been reached. Students may use their calculators and the AP exam formula sheets and tables on all tests. Extra credit packets of additional questions are offered for further practice of each topic.