MATH 183 General Education Proposal

1. A sample syllabus for this course.

2. Statement of how your course meets the Colonnade Plan's learning objectives.

MATH 183: Introductory Statistics (3 hours) meets the five learning objectives included in the Quantitative Reasoning section of the Colonnade Plan. MATH 183 students will learn to interpret, illustrate, and communicate mathematical and statistical ideas. Further, students will learn to model and solve problems. Students with a Math ACT of 26 or higher will receive 3 hours credit for this requirement.

MATH 183 specifically meets the five learning objectives as detailed below:

Learning Objective 1: Interpret information presented in mathematical and/or statistical forms.

Students in MATH 183 learn to interpret information presented in mathematical and statistical forms by learning to interpret both graphical and numerical summaries of data.

Specifically, students learn to:
- Interpret qualitative data presented in pie charts and bar graphs.
- Interpret quantitative data presented in dotplots, boxplots, stem-and-leaf plots, and histograms.
- Identify the shape of a distribution based on dotplots, boxplots, stem-and-leaf plots, and histograms.
- Be aware of misleading graphs (and how to avoid creating them) by critiquing real graphs used in the media.
- Interpret measures of center, spread, and position.
- Recognize the relationship between quantitative variables via a scatterplot.
- Interpret the value of the correlation coefficient.
- Interpret the intercept and slope of a regression equation in the context of the problem (and recognize when it is not appropriate to do so).
- Interpret the mean and standard deviation of a probability distribution.
- Draw statistical conclusions about populations based on sample data.
- Interpret the results of hypothesis tests and confidence intervals for population parameters.

Learning Objective 2: Students will illustrate and communicate mathematical and/or statistical information symbolically, visually and/or numerically.

Students in MATH 183 learn to illustrate and communicate mathematical information symbolically by learning the correct notation for various parameters and statistics. There are many symbols used for notating specific statistics (such as $\bar{x}$ for the sample mean); students learn and use these in MATH 183. Students also learn how to symbolically represent the linear relationship between quantitative variables.

Students in MATH 183 learn to illustrate and communicate statistical information visually by learning when and how to use appropriate graphs to display both qualitative and quantitative data. Students also learn to present information in probability experiments via contingency tables and tree diagrams.

Students in MATH 183 learn to illustrate and communicate statistical information numerically by learning how to summarize a dataset via the calculation of various descriptive statistics.

Learning Objective 3: Students will determine when computations are needed and execute the appropriate computations.

Students in MATH 183 learn to determine when computations are needed and execute the appropriate computations through exercises that develop skill in carrying out statistical procedures accurately and efficiently to solve real-world problems.

Students in MATH 183 are presented with real-world scenarios (via word problems) where statistical analysis is required. Students must read the problem carefully, determine the appropriate statistical method to use, carry out that method via the appropriate computations, and draw conclusions from those calculations (when appropriate).

Specifically, students learn techniques and develop skill in executing the following computations:
- Computing measures of center (mean, median, and mode).
- Computing measures of spread (range, variance, and standard deviation).
- Computing measures of position (percentiles and quartiles).
- Computing the Pearson correlation coefficient.
- Computing estimates of the regression parameters in simple linear regression.
- Computing basic, compound, and conditional probabilities.
- Using the counting rules to compute the number of ways certain events can occur.
- Computing the mean, standard deviation, and variance of a discrete probability distribution.

- Computing probabilities associated with the binomial probability distribution.
- Computing probabilities associated with the normal probability distribution.
- Computing quantiles from the normal probability distribution.
- Computing the mean and standard deviation of the sampling distributions of the sample mean and proportion.
- Computing one-sample confidence intervals for the population mean and proportion.
- Computing the test statistic and p-value (or critical value) for one-sample hypothesis tests for the population mean and proportion.

Learning Objective 4: Students will apply an appropriate model to the problem to be solved.

Students in MATH 183 learn to apply an appropriate model to the problem to be solved via exercises designed to teach recognition of which statistical method is appropriate to analyze a given dataset. Students learn various statistical techniques for both qualitative and quantitative data. When given a problem, students must determine what type of data is being presented and how to analyze that data via the appropriate statistical model. This includes (among others) using simple linear regression for analyzing bivariate quantitative data and using various probability distributions to model real-world phenomena.

Learning Objective 5: Students will make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis.

Students in MATH 183 learn to make inferences, evaluate assumptions and assess limitations in estimation modeling via hypothesis testing and confidence intervals. Students must evaluate whether or not the assumptions are met for an inferential statistical method; they also learn the implications of violating necessary assumptions. Students learn that through inferential statistics, they are drawing conclusions about a population based on sample data, so errors in conclusions can occur. They learn to limit that error through the choices of their confidence level and significance level.

3. Brief description of how your department will assess this course's effectiveness.

For MATH 183, assessment will occur at the end of the semester. To assess the course objectives, each student will complete a problem that addresses the five learning objectives. A committee of at least three faculty members will select a sample and evaluate the common assessment problem that addresses the skills and concepts as stated in the learning outcomes. The committee will randomly collect 25% to 30% of

the sample across all sections of MATH 183 to help assess students' mastery of the learning outcomes. The following criterion will be used to assess student learning outcomes:

Each test question will be scored on scale of 0 to 5, using a scoring guide developed by the committee in conjunction with the department. A common rubric (5 -Excellent ; 4 - Good; 3 - Satisfactory; 2 - Poor; 0 and 1- Fail).

The goals will be as follows:

Satisfactory = at least 70% of students scored 3 or better

Unsatisfactory = under 70% of students scored 3 or better

4. If necessary, a list of any proposed revisions needed to bring you course in line with the Colonnade Plan.

MATH 183 will be re-evaluated at the end of each academic year to determine if the learning objectives are being met and will be updated accordingly.

Sample Syllabus Statement

MATH 183: Introductory Statistics

The following items will be included in all MATH 183 syllabi.

Course Description:

MATH 183 is an introduction to the theory and application of statistics. This course provides students with the ability to understand and apply statistical skills and concepts. MATH 183 students will be able to: use fundamental reasoning principles; interpret information presented in tables or graphical displays; use graphical, symbolic, and numeric methods to solve practical problems; apply an appropriate statistical model to the problem to be solved; and become critical consumers of statistics.

Topics include: introduction to elementary probability theory; the analysis of data by means of graphs and frequency distributions and the statistics which describe them; the binomial and normal probability distributions; and statistical inference. Emphasis is on applied real-world problems.

Learning Objectives:

This course fulfills the Quantitative Reasoning requirement in the Foundations category of WKU's Colonnade program. As part of that program, MATH 183 has the following learning objectives:

Students will demonstrate the ability to:

1. Interpret information presented in mathematical and/or statistical forms.
2. Illustrate and communicate mathematical and/or statistical information symbolically, visually and/or numerically.
3. Determine when computations are needed and execute the appropriate computations.
4. Apply an appropriate model to the problem to be solved.
5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis.

Types of Assessments:

The following assessments are used in this course: Exams, quizzes, homework assignments (may include projects), and in-class activities.

Rubric for MATH 183: Introductory Statistics

Score	Scoring Criteria
0	Student gives no response or response is completely irrelevant
1	Student gives two correct responses, with appropriate work shown (if applicable)
2	Student gives four correct responses, with appropriate work shown (if applicable)
3	Student gives six correct responses, with appropriate work shown (if applicable)
4	Student gives eight correct responses, with appropriate work shown (if applicable)
5	Student gives ten correct responses, with appropriate work shown (if applicable)