RARITAN VALLEY COMMUNITY COLLEGE
ACADEMIC COURSE OUTLINE

MATH 117H STATISTICS HONORS

I. Basic Course Information

A. Course Number and Title: MATH 117H Statistics Honors

B. New or Modified Course: Modified

C. Date of Proposal: Semester: Fall Year: 2025

D. Effective Term: Fall 2026

E. Sponsoring Department: Mathematics & Computer Science

F. Semester Credit Hours: 4

G. Weekly Contact Hours: 5 Lecture: 4
Laboratory: 1
Out of class student work per week: 8.5

H. ☐ Prerequisite (s): GPA of 3.5 or permission of the instructor,
MATH 030 Intermediate Algebra
☐ Corequisite (s):

I. Additional Fees: None

II. Catalog Description

Prerequisites: GPA of 3.5 or permission of the instructor and MATH 030 Intermediate Algebra. This is an honors course combining the material in both Math 110 Statistics I and Math 111 Statistics II, as well as topics of Experimental Design. This course introduces the student to the methods and uses of statistical research. Topics include descriptive displays and analysis, classical probability, the normal distribution, the sampling distribution of the mean, inferences concerning means, critical values, and *p*-values (Statistics I). Other topics include description and analysis of bivariate data, regression and correlation, inferences in regression, chi-square procedures, inferences in two means and proportions, simple experimental design, analysis of variance, and optional non-parametric tests (Statistics II). Experimental Design topics include randomized block designs, two-way factorial experiments, repeated measures, relationship between ANOVA and regression, two-stage nested designs, and estimation based on nested sampling.

III. Statement of Course Need

A. This course combines the two-semester sequence of Stats I and II to provide mathematically talented students the opportunity to obtain a level of rigor not currently available in general Statistics courses.

B. A one-hour lab component would benefit Statistics Honors because four hours a week is tight for course content that is more than double that of Statistics I or II alone. The extra lab hour would allow spiraling the content to be implemented as well as time to apply and incorporate the content with its use for statistical analysis.

C. This course will generally transfer as a mathematics general elective requirement or a mathematics program elective dependent on the transfer institution.

IV. Place of Course in College Curriculum

A. This course serves as a free elective.
B. This course serves as a General Education course in Mathematics.
C. This course meets a program requirement for various A.S. and A.A. degree programs.
D. To see course transferability: a) for New Jersey schools, go to the NJ Transfer website, www.njtransfer.org; b) for all other colleges and universities, go to the individual websites.

V. Outline of Course Content

A. The Nature of Statistics

B. Organizing Data
   1. Sampling Techniques
   2. Grouping Data
   3. Histograms and Other Graphs
   4. Stem and Leaf Diagrams

C. Descriptive Measures for Univariate Data
   1. Summation Notation
   2. Measures of Central Tendency
   3. Measures of Dispersion
   4. Interpretation of Standard Deviation
   5. Grouped Data Formulas
   6. Quartiles and Box-and-Whisker Diagrams
   7. Parameters and Statistics

D. Probability
   1. Classical Probability
   2. Rules of Probability
   3. Mutually Exclusive Events
   4. Conditional Probability
   5. Independent Events

E. Discrete Random Variables
   1. Probability Distributions
   2. The Mean and Standard Deviation of Discrete Random Variables
   3. Bernoulli Trials and Binomial Coefficients
   4. The Binomial Distribution

F. The Normal Distribution
   1. From Discrete to Continuous Random Variables
   2. The Standard Normal Curve
   3. Finding Areas Under the Normal Curve
   4. Normally Distributed Random Variables

G. The Sampling Distribution of the Mean
   1. Random Sample and Sampling Error
   2. The Mean and Standard Deviation of the Sample Mean
   3. The Central Limit Theorem

H. Estimation
   1. Point and Interval Estimation of a Parameter
   2. Constructing Confidence Intervals for Population Means
   3. The *t*-Distribution
   4. Sample Size Considerations

I. Hypothesis Testing – Statistics Inference
   1. Nature and Design of Hypothesis Tests – classical and *p*-value methods
   2. Tests for Single Means and Single Proportions
   3. Interpretation of Results
   4. Type I and Type II Errors
   5. Power Analysis

J. Inferences About Two Population Means
   1. Independent and Dependent Samples
   2. Tests for Differences between Two Means
   3. Tests for Differences between Two Proportions
   4. Tests for Standard Deviations
   5. Chi-Square Procedures

K. Inferences About More Than Two Population Means
   1. The *F*-Distribution
   2. The Logic behind Analysis of Variance
   3. One-Way ANOVA
   4. Two-Way ANOVA
   5. Randomized Blocks
   6. Two-way Factorial Experiments
   7. Repeated Measures

L. Descriptive Measures for Bivariate Data
   1. Scatter Plots
   2. Linear Equations with One Independent Variable
   3. The Regression Equation
   4. The Correlation Coefficient
   5. The Coefficient of Determination

M. Inferences for Regression and Correlation
   1. Standard Error of the Estimate
   2. Inferences for Regression and Correlation Coefficients
   3. The Model for Multiple Regression
   4. The Relationship between ANOVA and Regression

N. Nested Sampling
   1. Two-stage Nested Designs
   2. Estimating a Population Mean Based on Nested Sampling

VI. A. <u>Course Learning Outcomes</u>:

At the completion of this course, students will be able to:

1. Synthesize descriptive methods of statistics for the purpose of organizing and summarizing data. (GE-2)
2. Interpret the meaning of summary measures (mean, median, mode, standard deviation, variance, quartile, percentile, range, minimum, maximum, outlier, etc.) within the context of problem. (GE-2)
3. Calculate the probability of an event using both discrete and normal distribution methods. (GE 2)
4. Construct and interpret a confidence interval for a population mean. (GE-2)
5. Conduct a hypothesis test for a population mean using the *p*-value or critical-value approach. (GE-2)
6. Choose an appropriate method of inferential statistics. (GE-2)
7. Conduct and interpret methods of inferential statistics for difference of two means or two proportions. (GE-2)
8. Conduct and interpret Chi-square tests for goodness of fit, independence or homogeneity. (GE-2)
9. Conduct and interpret one-way ANOVA and two-way ANOVA. (GE-2)
10. Conduct and interpret methods of statistical inference for linear regression including prediction intervals, confidence intervals and slope parameter. (GE-2)
11. Conduct a simple statistical study (experimental or observational), including the sampling design, interpretation of computer results from their collected data, and inference from these results to a conclusion consistent with their design. (GE 2)

12. Explain and present (written and verbal) statistical results from own experimental design study. (GE 1)

B. Assessment Instruments

1. Case studies (required)
2. Research papers (required)
3. Student oral presentations (required)
4. Computer programs

VII. Grade Determinants

A. Research paper (required)
B. Case studies (required)
C. Tests (required)
D. Presentations (required)
E. Homework (required)
F. Cumulative final exam (required)

VIII. Texts and Materials

A. Suggested textbook: *Statistics: Informed Decisions Using Data* by Sullivan
B. Graphing calculator
C. Statistical package: Choices include but are not limited to:
    1. R
    2. StatCrunch
    3. Excel/Google Sheets
    4. MINITAB

Please Note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

IX. Resources

Because of the technology used in the course, classes should be held in a computer laboratory.

X. Check One: ☒Honors Course ☐ N/A

In addition to combining content from Math 110 Stats I and Math 111 Stats II, Stats Honors contains:

1. Additional explorations of the theory behind Statistical Formulas.
2. Additional opportunity for students to explore statistical applications through case studies and a semester project. Since Stats I and II are combined, this allows for a

more comprehensive and robust project than would otherwise be possible in the separated courses.