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: 2017

D. Effective Term: Fall 2018

E. Sponsoring Department: Mathematics

F. Semester Credit Hours: 4

G. Weekly Contact Hours: 5 Lecture: 3
Laboratory: 2
Out of class student work per week: 7 hours

H. Prerequisites: GPA of 3.5 or permission of the instructor,
MATH 030 Intermediate Algebra, or MATH 030R: Intermediate Algebra with Review or appropriate score on math placement test

I. Laboratory Fees: No

J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval: Lynne E. Kowski, Lynne.Kowski@raritanval.edu (Chair); Sarah Imbriglio, Sarah.Imbriglio@raritanval.edu (Divisional Dean)

II. Catalog Description

Prerequisites: GPA of 3.5 or permission of the instructor and MATH 030 Intermediate Algebra, or MATH 030R: Intermediate Algebra with Review or appropriate score on math placement test. 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 is a general education mathematics course and serves as a math requirement for various A.S. and A.A. programs. Honors courses in mathematics have been developed to provide mathematically talented students the opportunity to obtain a level of rigor not currently available in existing 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 education elective or a mathematics program elective.

IV. Place of Course in College Curriculum

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

The course outline provides an overview of the subject content to be covered in the course. It contains sufficient detail so that the scope and depth of the course may be easily inferred and that someone unfamiliar with the subject area will be able to understand what the course entails. The outline order may be either hierarchical or chronological and include activities as well as topical areas. For example:

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. Measure of Dispersion
4. Interpretation of Standard Deviation ~~and Chebychev's theorem~~
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 – Statistical 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. General Education and Course Learning Outcomes

A. General Education Learning Outcomes:

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-NJ 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-NJ 2)
3. Calculate the probability of an event using both discrete and normal distribution methods. (GE-NJ 2)
4. ~~Interpret results from inferential statistics to interpret data for the purposes of interval estimation in means and proportions~~. Conduct and interpret a confidence interval for the purpose of decision making for population means or hypothesis test. (GE-NJ 2)
5. ~~Interpret results from inferential statistics to interpret data for the purposes of decision making in hypothesis testing, including independent and or dependent means, and one or two proportions.~~ Conduct a hypothesis test on one or two means using the p-value or critical-value approach. (GE-NJ 2)
6. Conduct a hypothesis test on one or two proportions using the p-value or critical-value approach. (GE-NJ 2)

7. Interpret p-value results from a hypothesis test for decision making using the p-value approach. (GE-NJ 2)
8. ~~Interpret results from inferential statistics to interpret data for the purposes of decision-making in Chi-Square tests for independence or goodness-of fit.~~ Conduct a hypothesis test using Chi-Square for independence or goodness of fit using the p-value or critical-value approach. (GE-NJ 2)
9. ~~Interpret results from inferential statistics to interpret data for the purposes of decision-making for a one-way ANOVA analysis~~. Conduct a hypothesis test using one-way ANOVA using the p-value or critical-value approach. (GE-NJ 2)
10. ~~Use linear regression techniques for purposes of analysis and prediction for slope or correlation~~. Conduct a hypothesis test for a population linear correlation coefficient and slope using the p-value or critical-value approach. (GE-NJ 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-NJ 2; ~~GE-NJ IL~~)
12. Explain and present (written and verbal) statistical results from own experimental design study. (GE-NJ 1)

B. Course Learning Outcomes:

1. See above.

C. Assessment Instruments

1. Embedded questions in the Final Exam.
2. Semester research project

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)

Given the goals and outcomes described above, LIST the primary formats, modes, and methods for teaching and learning that may be used in the course:

A. lecture/discussion
B. small-group work
C. computer-assisted instruction
D. student oral presentations
E. student collaboration

F. independent study

VIII. Texts and Materials

LIST which of the following types of course materials will be used. Specify title and publication information about textbooks and any other major text sources or other materials.

A. suggested textbook: Introductory Statistics, 10th edition, N. A. Weiss, Pearson-Addison Wesley, 2016
B. graphing calculator
C. statistical package: Choices include but are not limited to:
   - StatCrunch
   - EXCEL
   - 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

A. Instructor access to internet and MINITAB for all class days
B. Student computer lab with internet and MINITAB access for lab days

X. Honors Option

This course is already an honors course, and thus doesn't need a separate honors option.