Program Cover Document – **STA 216/Statistical Inference and Probability**

I. Learning goals

This course addresses three main learning goals for the Mathematics Education programs. Future teachers need to 1) "master the content knowledge needed to teach in the secondary schools," and furthermore, have 2) "background in higher level mathematics that allow them to teach competently and confidently." In particular, this course introduces future mathematics educators to statistical ideas and concepts with an emphasis on methods of statistical inference (notably confidence intervals and hypothesis tests) and probability (notably conditional probability, the binomial distribution, and concepts relating to independence and disjoint probabilities). The course covers all of the PRAXIS II exam (licensure exam) topics in Statistics and Probability, as well as the topics in the Core Curriculum Content Standards (CCSS) relating to Statistics and Probability. Furthermore, future teachers need to 3) "effectively utilize technology and determine how to meaningfully integrate technology in teaching mathematics." In this course, all topics and learning outcomes will be integrated with technology most commonly found in the high school classroom. Future teachers will learn how to use technology while learning statistics and probability and later, in their methods courses, will learn how to teach these topics using technology.

II. Student assessment

A combination of homework problems and exams throughout the course will be given to provide valuable information both for the instructor and the individual students.as to how well they are doing. Student performance on these assessment instruments and the performance of students in their future professional courses, such as MTT 380, MTT 390 and MTT 490 (Student teaching), will be used to assess the success of STA 216 in achieving its learning goals and its contribution to the fulfillment of the Mathematics Education program goals.

III. Learning activities

Students must experience standards-based teaching and learning in order to understand how to implement it. At the discretion of the instructor, learning activities will include any or all of the following: attendance at lectures, in-class activities, reading assignments, graded homework assignments, and using graphing calculators and Excel spreadsheets to solve probability problems, calculate inference test outcomes and confidence intervals, and compute basic descriptive statistical summary information. By completing these learning activities, and in particular, using the technology to learn these concepts, students will be better prepared for learning how to teach statistics and probability in their methods courses, MTT 380 and 390.

STA "216": Statistical Inference & Probability **1 unit**

Class Meetings: M & W 5:30-6:50 (section) and 7:00 – 8:20 (section)
Instructor: Adam Shrager
Office: Math adjunct office (room 109 or 108)
Email – shragera@tcnj.edu
Office Hours – Usually Weds 4pm – 5:20pm. Additional times as announced.

Description: This course introduces future mathematics educators to statistical ideas and concepts with an emphasis on methods of statistical inference (notably confidence intervals and hypothesis tests) and probability (notably conditional probability, the binomial distribution, and concepts relating to independence and disjoint probabilities).
Prerequisite: MAT 127

Purpose of the Course: Provide an integrated introduction to basic descriptive statistics, probability, and statistical inference. The syllabus covers all of the PRAXIS II exam topics in Statistics and Probability, as well as the topics in the Common Core State Standards (CCSS) relating to Statistics and Probability.

Technology: All course topics and learning outcomes will be integrated with technology most commonly found in the high school classroom. Those who enroll in the course are expected to bring a graphing calculator to every class session. They are also expected to have regular access to Microsoft Excel (the data analysis functions) or Google Sheets. Students will also be exposed to a statistical software package, in the college's computer labs.

Fourth Hour Requirements: During the fourth hour devoted to course learning, students are expected to spend time working with the technology they are exposed to during the class and overcoming the learning curve associated with any new software. During the fourth hour students will:

- Spend time in TCNJ mathematics computer labs building skills in large-scale data analysis in minitab, SPSS, and other popular statistical software.
- Learning the data analysis functionality associated with popular spreadsheet programs accessible and available to all students and future educators, including Microsoft Excel and Google Sheets
- Mastering the statistics functionality, including simulation, probability functions, and inferential statistical tests and confidence intervals, on the workhorse of the high school statistics classroom: the graphing calculator. Particularly those produced by Texas Instruments.

Learning Outcomes: On completion of the course, the student will be able to

Recognize and apply the most appropriate probability techniques in particular circumstances.

Understand, interpret, and communicate statistical reasoning from data using basic statistical terms, descriptive statistics, charts and graphs when appropriate.

Recognize and evaluate the relationship between two quantitative variables through simple linear regression and correlation and be able to explain why correlation does not imply causation.

Understand, analyze and interpret relationships in two-way tables using chi-square tests.

Understand the relationship between sample statistics and population parameters, make appropriate point and interval estimates of selected population parameters and interpret confidence intervals.

Understand and be able to describe basic principles of probability, including the application of the normal curve to social and physical phenomena.

Understand the concept of statistical significance and that it does not always imply importance.

Understand the concept of a confidence interval and be able to construct and interpret an interval, as well as to calculate minimum sample size for a given margin of error.

Understand the concept of a hypothesis test and be able to interpret observed significance levels and p-values.

Compare statistics and make statistically valid conclusions about true parameters regarding their differences.

Utilize technology to solve probability problems, calculate inference test outcomes and confidence intervals, and compute basic descriptive statistical summary information.

Expectations: All students are expected to…

Attend class regularly and participate in in-class activities.

Read the portions of the text as assigned.

Make serious attempts at all of the assigned weekly problem sets and in preparation for exams.

Use the resource of their fellow students, the tutoring center, and their instructor to seek answers to questions that arise in class, in the readings, and on the homework

Textbook and Required Class Materials

***TEXTBOOK: Introduction to the Practice of Statistics* (7th Edition)** by Moore, McCabe, & Craig. W. H. Freeman and Company, 2012

IDEALLY, THIS BOOK WILL BE READ BEFORE THE START OF THE SEMESTER: Bringing Down the House: The Inside Story of Six M.I.T. Students Who Took Vegas for Millions by Ben Mezrich. Free Press, 2003.

Calculator and Computer: Each student is required to bring a graphing calculator to class every class session. The Texas Instruments TI-83 or 84 series are recommended. Each student will need access to the internet to complete homework assignments and print off notes and readings. Each student will also need occasional access to Microsoft Excel spreadsheet program.

Classroom Policies

Attendance: ***All students are expected to attend all classes***. It is assumed that any information given out during class has been delivered to all students. A student who is absent for a test **will not** be permitted to make up the test unless some arrangement has been made with me in advance. Approval for missing a test will be rare and based on truly exceptional circumstances. In the case of illness, a doctor's note will be required. Please view TCNJ's attendance policy **http://www.tcnj.edu/~recreg/policies/attendance.html**

Academic Honesty: Please make sure you are familiar with TCNJ's academic honesty policy. Any suspected violation of this policy will be confronted in strict accordance with the policy. **http://www.tcnj.edu/~academic/policy/integrity.html**

Students with Disabilities: See TCNJ's Americans with Disabilities Act (ADA) policy available on the web: http://www.tcnj.edu/~affirm/ada.html .

Graded Assignments

Exams (20%, 20%, 10% each): Three in-class exams will be given on or about **February XX, March XX, and April XX**. Your lowest exam grade will count 10% towards your final course grade. The other two exams will count 20% each towards your course grade. All work on the exams must be independent. Make-up exams will not be considered.

Problem Sets & Class Participation (20%): Problem sets will cover the concepts taught in the class. They will usually be distributed each Weds and are due AT THE START OF CLASS THE FOLLOWING Weds (see attached calendar). Students who will miss class may submit the assignments electronically via e-mail, **NOT** VIA DROPBOX UNLESS OTHERWISE INSTRUCTED. **No late assignments will be accepted**. You are encouraged to work with others on your problem sets, but each student must submit their assignment independently. If you work with someone else. You must simply write: I WORKED WITH _____ on the top of your assignment. Again, working in study group is encouraged.

There will be NINE graded problem sets distributed. They will be due Wednesdays EXCEPT on Wednesdays in which we have an exam. Your best EIGHT problem set grades will count toward your final course grade. Essentially, this means you can drop your lowest grade…or skip one assignment.

Problem Sets will be graded on completeness, accuracy, and effort. I will not appreciate submitted work that is not college-quality. GRADED assignments will be returned to you the Wednesday after you submit them (maybe the Monday, if I grade them quickly).

Final Exam (30%): The final exam for this course will be a comprehensive exam. See TCNJs Final Exam policy at http://www.tcnj.edu/~academic/policy/finalevaluations.htm

Extra Credit. My grading policy is generous and is designed for students to succeed. There will be absolutely no extra credit issued or assigned. Don't ask, unless you enjoy rejection and awkward moments.

STAT 216

Date	Day	Topics
M, x	1	Chapter 1: Introduction, definitions, frequency distributions & shapes.
W, x	2	Chapter 1: Histograms, charts, graphs, stem & leaf, boxplots.
M, x	3	Chapter 1: Measures of center & spread (dispersion)
W, x	4	Chapter 1: Normal Distribution ***PS#1 Due***
M, x	5	Chapter 1: Normal Distribution
W, x	6	Chapter 2: Regression and Correlation ***PS#2 Due***
M, x	7	Chapter 2: Regression and Correlation
W, x	8	TEST 1
		Bringing Down the House should be read by this day.
M, x	9	Chapter 4: Probability I – The basics
W, x	10	Chapter 4: Probability II & The Law of Large Numbers ***PS#3 Due***
M, x	11	Chapter 4: Conditional Probability / Bayes's Rule
W, x	12	Chapter 5: Binomial & geometric distributions ***PS#4 Due***
M,x	13	Chapter 5: The Central Limit Theorem
W,x	14	TEST 2 – ***THEN SPRING BREAK!***
M,x	15	Chapter 6: Estimating with Confidence
W, x	16	Chapter 6 & 8: Interpreting confidence intervals for means and proportions
M,x	17	Chapter 6: The basics of significance tests ***PS#5 Due***
W,x	18	Chapter 6: Errors & Power in significance testing
M,x	19	Chapter 7: Hypothesis testing and the t-distribution ***PS#6 Due***
W,x	20	Chapter 7: Hypothesis testing, comparing two means
M, x	21	Chapter 7: Hypothesis testing, matched pairs ***PS#7 Due***
W,x	22	TEST 3
M, x	23	Chapter 8: Inference for proportions
W, x	24	Chapter 8: Comparing two proportions ***PS#8 Due***
M, x	25	Chapter 9: Two-way tables & the chi-square test for association
W, x	26	Chapter 9: Chi-square test for goodness of fit ***PS#9 Due***
M, x	27	Review For Final Exam
W, x	28	Review For Final Exam

SELECTED TCNJ POLICIES

Attendance

Every student is expected to participate in each of his/her courses through regular attendance at lecture and laboratory sessions. It is further expected that every student will be present, on time, and prepared to participate when scheduled class sessions begin. At the first class meeting of a semester, instructors are expected to distribute in writing the attendance policies which apply to their courses. While attendance itself is not used as a criterion for academic evaluations, grading

is frequently based on participation in class discussion, laboratory work, performance, studio practice, field experience, or other activities which may take place during class sessions. If these areas for evaluation make class attendance essential, the student may be penalized for failure to perform satisfactorily in the required activities. Students who must miss classes due to participation in a field trip, athletic event, or other official college function should arrange with their instructors for such class absences well in advance. The Office of Academic Affairs will verify, upon request, the dates of and participation in such college functions. In every instance, however, the student has the responsibility to initiate arrangements for make-up work.

Students are expected to attend class and complete assignments as scheduled, to avoid outside conflicts (if possible), and to enroll only in those classes that they can expect to attend on a regular basis. Absences from class are handled between students and instructors. The instructor may require documentation to substantiate the reason for the absence. The instructor should provide make-up opportunities for student absences caused by illness, injury, death in the family, observance of religious holidays, and similarly compelling personal reasons including physical disabilities. For lengthy absences, make-up opportunities might not be feasible and are at the discretion of the instructor. The Office of Academic Affairs will notify the faculty of the dates of religious holidays on which large numbers of students are likely to be absent and are, therefore, unsuitable for the scheduling of examinations. Students have the responsibility of notifying the instructors in advance of expected absences. In cases of absence for a week or more, students are to notify their instructors immediately. If they are unable to do so they may contact the Office of Records and Registration. The Office of Records and Registration will notify the instructor of the student's absence. The notification is not an excuse but simply a service provided by the Office of Records and Registration. Notifications cannot be acted upon if received after an absence. In every instance the student has the responsibility to initiate arrangements for make-up work. TCNJ's attendance policy is available on the web:
http://www.tcnj.edu/~recreg/policies/attendance.html

Academic Integrity Policy
Academic dishonesty is any attempt by the student to gain academic advantage through dishonest means, to submit, as his or her own, work which has not been done by him/her or to give improper aid to another student in the completion of an assignment. Such dishonesty would include, but is not limited to: submitting as his/her own a project, paper, report, test, or speech copied from, partially copied, or paraphrased from the work of another (whether the source is printed, under copyright, or in manuscript form). Credit must be given for words quoted or paraphrased. The rules apply to any academic dishonesty, whether the work is graded or ungraded, group or individual, written or oral.

TCNJ's academic integrity policy is available on the web:
http://www.tcnj.edu/~academic/policy/integrity.html.

Americans with Disabilities Act (ADA) Policy
Any student who has a documented disability and is in need of academic accommodations should notify the professor of this course and contact the Office of Differing Abilities Services (609-771-2571). Accommodations are individualized and in accordance with Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1992.

TCNJ's Americans with Disabilities Act (ADA) policy is available on the web:
http://www.tcnj.edu/~affirm/ada.html