AAEC 3401—Agricultural Statistics

CATALOG DESCRIPTION

(4 credit hours) Principles and procedures involved in the analysis of agricultural data including indices of central tendency and dispersion; probability; sampling; significance tests; analysis of variance; and simple linear correlation. Partially fulfills core Mathematics requirement (in conjunction with a mathematics course). F, S, SS.

CURRENT TEXTBOOK

Fundamentals of Statistics & *MML Gen & MyStat Pkg*, 3rd edition, by Michael Sullivan, III. Pearson Prentice Hall, 2011.

PURPOSE OF COURSE

This course is designed for students interested in the application of statistics in agriculture, social science, and business. This is an introductory (first) course in statistics and assumes no prior knowledge of statistics. AAEC 3401 fulfills a set of learning objectives as established by the Texas Higher Education Coordinating Board. In this course, students will learn about statistical inference and how it is used in scientific inquiry to generalize (infer) from a sample to a population. Students will use technology (word processing and spreadsheet application software) to perform statistical analyses and create tables, graphs, and written answers to questions.

CORE CURRICULUM/GRADUATION REQUIREMENTS SATISFIED BY AAEC 3401

AAEC 3401 satisfies the Texas Tech University Core Curriculum requirement in Mathematics or Logic. The course is designed for a range of majors interested in application of statistics in agriculture and social science. Statistics plays an important role in scientific inquiry because it is used to test the validity of scientific hypotheses.

GENERAL COURSE OBJECTIVES (as specified by the Coordinating Board):

1. Critical Thinking Skills: to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information.

Students will use mathematical/logical thinking, visualization (graphs), and written expression to analyze a statistical problem. Students will read a real-world problem and then identify and apply a statistical technique to solve the problem and prepare a written interpretation of the statistical conclusion. In particular, students will develop skills to: (1) construct tables and graphs to represent important features of a dataset; (2) calculate and interpret measures of central tendency and dispersion (e.g., mean and standard deviation); (3) compute and interpret probabilities for discrete and continuous random variables; (4) apply the Central Limit Theorem; (5) calculate and interpret confidence intervals; (6) conduct and interpret a hypothesis test; (7) compute and interpret a correlation coefficient using real-world data; (8) calculate a regression model and describe the relationships among variables and predict; (9) conduct and interpret an analysis of variance; and (10) apply a chi-square test and explain the association between variables. Critical thinking is assessed when students are asked to provide written and verbal answers to statistical questions that require creative thinking, analysis, and evaluation of information in numerical data.

Assessment Strategies: Critical thinking skills will be assessed using specific questions embedded in homework problem sets, in-class quizzes, take-home problem sets, and tests/exam. Additional assessments will come from active-learning group exercises, re-tests of missed concepts, class polling, and from instructor provided feedback to students about their learning (or lack thereof).

2. Communication Skills: to include effective development, interpretation and expression of ideas through written, oral and visual communication.

Upon completion of this course, students will be able to communicate statistical results in mathematical formulas and symbols using written and oral communication. Students will use technology (word processing and spreadsheet application software) to create tables, graphs, and written answers for take-home assignments. Quiz and tests/exam questions will require long and short written answers and students will demonstrate oral communication through class discussion. In AAEC 3401, each student will be a member of a team that applies a statistical technique (learned in class) to a statistical problem. The team will: (a) identify the statistical question and collect real-world data to address the question; (b) organize and summarize the data using formulas, tables, and graphs; and (c) draw and interpret a conclusion using written and verbal communication. In AAEC 3401, students attend a three-hour lab session each week where they solve computer-generated problems. Students are expected to interact with their classmates and answer questions posed by a classmate. In this process, the student—now teacher—will use visual, oral, and written communication to formulate and deliver information to the classmate; digest and interpret feedback questions from the classmate; and iterate through this cycle until the classmate demonstrates ability to solve the problem. Active learning in pairs allows students to practice communication skills in an informal (no pressure) setting.

Assessment Strategies: Specific problems will be included in homework problem sets, quizzes, class tests/exam to assess communication skills. Additional assessments will come from the team project (that includes a written report and oral presentation) and from evaluation of active-learning in small groups.

3. Empirical and Quantitative Skills: to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions.

This course introduces students to basic statistical methods used in practice to validate scientific theories and reach informed conclusions, and to answer business and economic questions so informed decisions are possible. Students will develop empirical and quantitative skills through application of mathematical formulas/reasoning to analyze numerical data. In particular, students will develop skills to: (1) construct tables and graphs to represent important features of a dataset; (2) calculate and interpret measures of central tendency and dispersion (e.g., mean and standard deviation); (3) compute and interpret probabilities for discrete and continuous random variables; (4) apply the Central Limit Theorem; (5) calculate and interpret confidence intervals; (6) conduct and interpret a hypothesis test; (7) compute and interpret a correlation coefficient using real-world data; (8) calculate a regression model and describe the relationships among variables and predict; (9) conduct and interpret an analysis of variance; and (10) apply a chi-square test and explain the association between variables. After completion of this course, students will be able to outline and explain the process of statistical inference, and apply this process to generalize from observable sample data to the population of interest to the sample collector.

Assessment Strategies: Specific problems will be included in homework problem sets, in-class quizzes, take-home problem sets, and class tests/exam to assess empirical and quantitative skills.

COURSE-SPECIFIC LEARNING OBJECTIVES AND CORRESPONDING OUTCOMES

1. Apply arithmetic, algebraic, geometric, statistical and/or logical reasoning to solve problems.

Upon completion of this course, students will be able to solve statistical problems using mathematical/logical reasoning expressed with mathematical formulas and graphs. In particular, students will develop statistical skills to: (1) construct tables and graphs to represent important features of a dataset; (2) calculate and interpret measures of central tendency and dispersion (e.g., mean and standard deviation); (3) compute and interpret probabilities for discrete and continuous random variables; (4) apply the Central Limit Theorem; (5) calculate and interpret confidence intervals; (6) conduct and interpret a hypothesis test; (7) compute and interpret a correlation coefficient using real-world data; (8) calculate a regression model and describe the relationships among variables and predict; (9) conduct and interpret an analysis of variance; and (10) apply a chi-square test and explain the association between variables. Assessment of student problem solving skills will be conducted using homework problem sets, quizzes and class tests/exam.

Assessment Strategies: Mastery of student problem solving skills will be assessed using homework problem sets, in-class quizzes, take-home problem sets, and tests/exam created to address this specific objective. Additional assessments will come from observation of active-learning in small groups and from in-class discussion.

2. Represent and evaluate basic mathematical and/or logical information numerically, graphically, and symbolically.

Students will evaluate and analyze data from real-world datasets using mathematical symbols, algebraic formulas, graphs/diagrams, and verbal and written expression. Students will complete exercises to: (a) create a frequency distribution table with appropriate graphs, and explain and interpret important features of a dataset; (b) calculate correlation and regression coefficients using mathematical formulas, interpret (in writing) the numerical coefficients, and predict with the regression model; and (c) calculate an analysis of variance and a means-separation and interpret statistical differences in sample means for real-world experimental trials. On exams, quizzes, and lab assignments, students will be required to interpret mathematical information using graphs, numerical measures, mathematical expressions, and logical sentences.

Assessment Strategies: Specific problems will be included in homework problem sets, quizzes, class tests/exam to address this objective.

3. Use mathematical and logical reasoning to evaluate the validity of an argument.

Students will use mathematical and logical reasoning to identify and apply a selected statistical technique to evaluate a statistical hypothesis. Students will learn to: express a statistical hypothesis using a mathematical formula; apply mathematical/logical reasoning to test the validity of the hypothesis; and explain and interpret the conclusion with logical sentences. In this course, students will distinguish between a sample and a population and be able to apply statistical inference to generalize from information in a sample to the population of interest to the sample collector.

Assessment Strategies: Specific problems will be included in homework problem sets, quizzes, class tests/exam to address this objective.

4. Interpret mathematical and/or logical models such as formulas, graphs, tables and schematics, and draw inference from them.

Students will design, evaluate, and use mathematical formulas, tables, and graphs to interpret data and draw inferences from data in assigned problem sets. Students will: (a) calculate and interpret numerical measures of central tendency and dispersion; (b) calculate confidence intervals and conduct hypothesis tests and interpret the results; and (c) calculate and interpret quantitative measures of association between variables (including correlation, regression, and chi-square statistics).

Assessment Strategies: Student interpretative and inference skills will be assessed using specific questions included in homework problem sets, in-class quizzes, take-home problem sets, and tests/exam. Class discussion and class polling will be used as added assessments.

College-Level Competency: Students graduating from Texas Tech University should be able to demonstrate the ability to apply quantitative and logical skills to solve problems. In particular, students who successfully complete AAEC 3401 will be able to apply the skills in (1)-(10) of Course-Specific Learning Objective 1 to solve mathematical/statistical problems and to interpret the results using logical/mathematical reasoning expressed with mathematical formulas, graphs/diagrams, and in writing and verbally. Student learning outcomes will be assessed through graded homework problem sets, in-class and take-home quizzes, and imbedded questions in tests/exam. A rubric rating system using UNACCEPTABLE, ADEQUATE, AND SUPERIOR classifications will be used to assess achievement of learning outcomes. The overall goal in this course is for the average of the class sample to achieve an ADEQUATE rubric rating in each of the knowledge learning outcomes.

LEARNING ASSESSMENT:

Assessment of the expected learning outcomes will be measured using homework problem sets, in-class quizzes, take-home problem sets, tests/exam, active-learning group exercises, re-tests of missed concepts, and class polling. Benchmark: 70% of students will achieve a score of 70% or better on all graded assignments.

Tests and Exam—Three tests plus a comprehensive final exam will be given during the semester. Tests and exam questions will require hand calculations, tabular and graphical representation, and interpretation using short and long written answers.

Lab Assignments—Students are required to attend a three-hour lab session each week where they solve computer-generated problems (lab assignments will be available on *CourseCompass/MyMathLab)*. A total of 15 labs will be graded and discussed in class.

Quizzes—Quizzes will be given during class or lab periods. A total of 12 quizzes will be graded and discussed in class.

Take-Home Assignments—Take-home assignments will be assigned on four selected statistical topics during the semester and will require extensive use of technology (word processing and spreadsheet application software) to create tables, graphs, and written answers to questions. Students will apply mathematical calculations and interpret and evaluate mathematical formulas and use written and visual expression to explain their answers.

Oral Presentation—Each student will be assigned to a team that applies a statistical technique (learned in the course) to a real-world problem. The team will make an oral presentation of their results using

technology (word processing and spreadsheet application software) to create tables, graphs, visual slides, and written explanation.

The minimum percentage required to achieve a given letter grade will be:

A=90%
B=80%
C=70%
D=60%
F= lower than 60%

ABSENCE DUE TO RELIGIOUS OBSERVANCE:
A student who is absent from classes for the observance of a religious holy day will be allowed to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence (*University Catalog*). Notification must be made in writing and delivered in person no later than the 15th class day of the semester.

ABSENCE DUE TO OFFICIALLY APPROVED TRIPS:
A student who is absent due to an official trip should obtain a letter to that effect from the person responsible for the student missing class. The student will not be penalized and is responsible for the material missed (*University Catalog*).

ACCOMODATION OF STUDENS WITH DISABILITIES:
Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.

ACADEMIC HONESTY STATEMENT:
The TTU "Code of Student Conduct", which you should have received when you enrolled in the university, contains a lengthy list of prohibited behaviors, among which is "Academic Dishonesty". Please note that cheating and plagiarism (a form of cheating) are included among the actions that are subject to disciplinary action. Cheating will not be tolerated in this course. A student who is caught cheating will receive a grade of 0 on the exam, paper, or exercise. Awarding of a grade of F for the course is also a possible penalty. In addition, the incident of academic dishonesty will be reported to the Dean of the appropriate academic college for such disciplinary action as they see fit to administer.

Plagiarism:
"The appropriation or imitation of the language, ideas, and thoughts of another author, and representation of them as one's original work." *The Random House College Dictionary*, revised edition. New York: Random House, 1975, p. 1014. "1. The use, by paraphrase or direct quotation, of the published or unpublished work of another person without full and clear acknowledgement; 2. the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials." *Student Affairs Handbook*, Texas Tech University, Lubbock, Texas, 1998-99, p. 22. Plagiarism and cheating are not

tolerated and will result in a grade of 0 on work that contains plagiarized material. In addition, a grade of F may be awarded for the course. Any cases of cheating will be reported to the Honors College and the responsible academic dean (i.e., Arts &Sciences, Business Administration, Engineering, etc.)

CLASSROOM RULES AND BEHAVIOR:

Students are expected to show respect to classmates, instructors, and especially guest speakers. Consistent with the stated assumptions and beliefs of Texas Tech University, the department has composed and the department undergraduate association has endorsed the following set of rules for appropriate student classroom behavior.

- Do not talk during class meetings. Talking is disruptive to the instructor and to your fellow classmates.
- Do not arrive late to class and do not leave the classroom during class meetings. Exceptions may occur for medical emergency, physiological urgency or situations where prior instructor approval has been granted.
- Do not use (including viewing of) communication devices (phones, etc) during class meetings. All electronic devices should be silenced during class meetings.
- Do not read/view other unassigned materials (newspapers, magazines, etc,) during class meetings.
- Do not exhibit disruptive posture during class meetings. e.g. sleeping, slouching, laying, resting feet/head on furniture, etc.
- Do not use notebook computers during class meetings unless prior instructor approval has been granted.

COURSE OUTLINE:

Week	Text Material	E-book Material
1	1.1-1.5	
2	2.1-2.3, 3.1	2.3 Additional Displays of Quantitative Data
3	3.2-3.5	
4	4.1; **Test #1**	
5	4.2-4.3	
6	5.1, 6.1	
7	7.1-7.4	
8	8.1**; Test #2**	
9	8.2, 9.1	
10	9.2-9.4, 10.1	
11	10.2-10.4	
12	11.1; **Test #3**	
13	11.2-11.3, 12.3	
14		13.1-13.2—One-way ANOVA & Tukey test
15	12.1-12.2	