

## STATISTICS

### Statistics

College of Science, Engineering, & Technology

Department of Mathematics & Statistics

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Website: [www.mnsu.edu/dept/mathstat/](http://www.mnsu.edu/dept/mathstat/)

Chair: Brian Martensen

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Statistics in this department is designed to provide a basic theoretical background for statistical inference and some techniques and practice in applying the theory. Courses in statistics would be useful for anyone as a tool in another area of study or as preparation for more advanced study of statistics. Many students choose statistics as an option in their general education or take statistics as a requirement for their major. The Department of Statistics also offers both a major and a minor in statistics.

The major provides a background in statistics, mathematics, and computer science to enable students to pursue a career in business, industry, or actuarial science as well as to pursue advanced study in statistics. The major is organized into 3 tracks to allow an emphasis in applied mathematics, computer science, or biological science. A well prepared student can expect to complete the major in four years. The minor gives students a basic core of statistics that would compliment majors in many areas by providing a thorough grounding in basic statistical principles, methods of data analysis, and a knowledge base to assist in understanding statistical procedures applied to a variety of disciplines.

A student must be admitted to a major to be permitted to take 300- and 400-level courses. Admission is granted by the department. In addition to minimum university admission requirements of: a minimum of 32 earned semester credit hours and a minimum cumulative GPA of 2.00, students must complete 10 credits in mathematics and statistics counting towards the Major with a 2.5 GPA.

#### POLICIES/INFORMATION

**GPA Policy.** Statistics major and minors must earn a grade of 2.00 ("C") or better in all courses applied to the major or minor.

**P/N Grading Policy.** All 300- and 400-level courses are offered for grade only with the exception of STAT 498 and STAT 499 which are available for both P/N and letter grade.

**Credit by examination.** Will not be approved for courses in which a student has already received a grade.

**Credit Limitation.** A student may not receive credit for STAT 354 after completing MATH 455 or STAT 455.

Students seeking enrollment in MATH 112: College Algebra, MATH 201: Elements of Mathematics I, or STAT 154: Elementary Statistics must demonstrate readiness to succeed in the course through one of the following means:

1. ACT mathematics sub-score of 19 or higher, or
2. ACCUPLACER Elementary Algebra Test score of 75.5 or higher AND ACCUPLACER College-Level Math Test score of 49.50 or higher.

Students not meeting one of these requirements are placed in Math 098: Intermediate Algebra.

Students seeking enrollment in courses beyond those listed above must demonstrate readiness to succeed in the course through one of the following means: ACT score, ACCUPLACER score, Descriptive Test of Mathematical Skills (DTMS) placement test score, or satisfactory completion (i.e. grade of "C" or better) of pre-requisite coursework, according to the chart below.

Course	Minimum ACT Math Subscore		Minimum Accuplacer Elementary Algebra Score		Minimum Accuplacer College Level Math Score		Minimum Accuplacer Calculus Readiness Score		Course Prerequisites
Math 112	19	Or	75.5	AND	49.5		N/A	Or	Successful Completion of Math 098
Math 113	19	Or	N/A		63	Or	16	Or	Math 112 with "C" or better
Math 115	20	Or	N/A		86	Or	19	Or	Permission from dept. chair
Math 121	22	Or	N/A		103	Or	22	Or	Math 115 or both Math 112 and 113 with "C" or better
Math 130	20	Or	N/A		86	Or	19	Or	Math 112 or 115 with "C" or better
Math 201	19	Or	75.5	AND	49.5		N/A	Or	Successful completion of Math 098
Stat 154	19	Or	75.5	AND	49.5		N/A	Or	Successful completion of Math 098

NOTE 1: The Calculus Readiness test may be taken in addition to the ACCUPLACER instrument by students seeking to enroll in courses above MATH 112.

NOTE 2: Documented ACCUPLACER scores from any Minnesota State Colleges and Universities (MNSCU) institution taken within two calendar years will be accepted.

NOTE 3: ACT scores, ACCUPLACER scores and DTMS scores that are more than two years old will not be accepted for mathematics placement.

**Procedures.** Students may substitute for the above requirements based on documentation of:

1. equivalent or higher scores on standardized college admissions tests, such as SAT quantitative scores, that report a separate mathematics sub-score within two calendar years;
2. successful completion of equivalent prior post-secondary education, such as course transfer evaluations or Cambridge International Examinations; or
3. enrollment exclusively in non-credit courses or programs. Students requesting such substitutions should submit the documentation to the Chair of the Department of Mathematics and Statistics for evaluation. The evaluation will be based on nationally accepted concordances between the testing instruments and/or courses. The Chair of the Department of Mathematics and Statistics or designee should respond in writing to student requests within three weeks of receiving them.

#### Procedure for Waiver.

1. Students not meeting the requirements for enrollment in MATH 112, MATH 201 or STAT 154 may request a waiver to this policy.
2. Written requests for waivers to the policy must be submitted to the Chair of the Department of Mathematics and Statistics, and should include evidence of alternate means of demonstrating readiness for college algebra including but not limited to:
  - a. High school or recent post-secondary coursework which would indicate adequate preparation (transcripts or other records which include course titles, levels and grades are acceptable), or
  - b. Verification of extenuating circumstances which may have affected performance on previous exams.
3. Requests for waivers should be submitted by the following deadlines:
  - a. August 5th for fall semester enrollment,
  - b. December 1st for spring semester enrollment, and
  - c. May 1st for summer session enrollment.
4. The Chair of the Department of Mathematics and Statistics or designee should respond in writing to student requests within three weeks of receiving them.

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- Students whose initial requests are denied may submit a written appeal to the Dean of the College of Science, Engineering and Technology. The Dean should respond in writing, with a copy to the Chair of the Department of Mathematics and Statistics.
- The Dean's decision is the final step in this appeal process

**Policy Rationale.** The purpose of the policy is to place students in a course that is developmentally appropriate to help ensure their long term success. Data suggests students not meeting these guidelines have a higher likelihood of having to repeat a course.

### STATISTICS BS

#### **Required General Education**

MATH 121 Calculus I (4)

#### **Required for Major (76 credits)**

CS 110 Computer Science I (4)  
CS 111 Computer Science II (4)  
CS 230 Intelligent Systems (4)  
MATH 122 Calculus II (4)  
MATH 223 Calculus III (4)  
MATH 247 Linear Algebra I (4)  
STAT 154 Elementary Statistics (3)  
STAT 354 Concepts of Probability and Statistics (3)  
STAT 450 Regression Analysis (3)  
STAT 451 Experimental Designs (3)  
STAT 455 Theory of Statistics I (4)  
STAT 456 Theory of Statistics II (4)  
STAT 457 Sample Survey, Design and Analysis (3)  
STAT 458 Categorical Data Analysis (3)  
STAT 459 Nonparametric Methods (3)  
STAT 492 Statistics Capstone Experience (3 )

Major Emphasis: Select one of the following three tracks.

#### **Applied Mathematics Track (minimum 16 credits from the following list)**

MATH 290 Foundations of Mathematics (4)  
MATH 321 Ordinary Differential Equations (4)  
MATH 375 Introduction to Discrete Mathematics (4)  
MATH 422 Partial Differential Equations (4)  
MATH 425 Mathematical Modeling (4)  
MATH 470 Numerical Analysis I (4)  
MATH 471 Numerical Analysis II (4)

#### **Computer Science Track (minimum 16 credits from the following list)**

CS 210 Data Structures (4)  
CS 220 Machine Structures and Programming (3)  
CS 320 Computer Architecture (3)  
CS 340 Concepts of Database Management Systems (3 )  
CS 350 Network Architectures (3)  
CS 370 Concepts of Programming Language (3)  
CS 433 Data Mining/Machine Learning (3)  
MATH 470 Numerical Analysis I (4)  
MATH 471 Numerical Analysis II (4)

#### **Biological Science Track (minimum 16 credits from the following list)**

BIOL 105 General Biology I (4)  
BIOL 211 Genetics (4)  
BIOL 320 Cell Biology (4)  
BIOL 479 Molecular Biology (4)

**Required Minor: None**

### STATISTICS MINOR

#### **Required for Minor (20-21 credits)**

MATH 121 Calculus I (4)  
MATH 122 Calculus II (4)  
STAT 354 Concepts of Probability and Statistics (3)  
STAT 450 Regression Analysis (3)  
STAT 451 Experimental Designs (3)  
(Choose one course from the following)  
STAT 455 Theory of Statistics I (4)  
STAT 457 Sample Survey, Design and Analysis (3)  
STAT 458 Categorical Data Analysis (3)  
STAT 459 Nonparametric Methods (3)

#### **COURSE DESCRIPTIONS**

##### **STAT 154 (3) Elementary Statistics**

Basic descriptive measures of data, elementary probability concepts and their relation to statistical inference, tests of hypotheses and confidence intervals. An appropriate preparation for more advanced statistics courses in any area.

Pre: Must achieve a score of 18 or better on the MnSCU Math Readiness Test, or have achieved an ACT Math subscore of 19 or higher, or successful completion of MATH 098.

Pre: MATH 098, MATH 112, MATH 115, MATH121 or appropriate score on the placement exam(see Placement Information under Mathematics.)

Fall, Spring

GE-4

##### **STAT 354 (3) Concepts of Probability & Statistics**

This is a calculus-based course covering introductory level topics of probability and statistics. It is designed to meet the needs of both the practitioner and the person who plans further in-depth study. Topics include probability, random variables and probability distributions, joint probability distributions, statistical inference (both estimation and hypothesis testing), analysis of variance, regression, and correlation. Same as MATH 354.

Pre: MATH 122 with "C" (2.0) or better or consent

Fall, Spring

##### **STAT 450 (3) Regression Analysis**

Simple and multiple regression, correlation, analysis of variance and covariance.

Pre: MATH 354 / STAT 354 or STAT 455 with "C" (2.0) or better or consent

ALT-Spring

##### **STAT 451 (3) Experimental Designs**

Completely randomized, block, fractional factorial, incomplete block, split-plot, Latin squares, expected mean squares, response surfaces, confounding, fixed effects and random effects models.

Pre: MATH 354 / STAT 354 or STAT 455 with "C" (2.0) or better or consent

ALT-Spring

##### **STAT 455 (4) Theory of Statistics I**

A mathematical approach to statistics with derivation of theoretical results and of basic techniques used in applications. Includes probability, continuous probability distributions, multivariate distributions, functions of random variables, central limit theorem and statistical inference. Same as MATH 455.

Pre: MATH 223 with "C" (2.0) or better or consent

Fall

##### **STAT 456 (4) Theory of Statistics II**

A mathematical approach to statistics with derivation of theoretical results and of basic techniques used in applications, including sufficient statistics, additional statistical inference, theory of statistical tests, inferences about normal models and nonparametric methods. Same as MATH 456.

Pre: MATH 455 / STAT 455 with "C" (2.0) or better or consent

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### **STAT 457 (3) Sample Survey, Design and Analysis**

Sampling distributions: means and variances. Bias, robustness and efficiency. Random sampling, systematic sampling methods including stratified random sampling, cluster sampling and two-stage sampling, ratio, regression, and population size estimation. Suitable statistical software is introduced, for example, MATLAB, R, SAS, etc.

Pre: MATH 354 / STAT 354 or STAT 154 with “C” (2.0) or better or consent  
ALT-Fall

### **STAT 458 (3) Categorical Data Analysis**

Forms of multivariate analysis for discrete data, two dimensional tables, models of independence, log linear models, estimation of expected values, model selection, higher dimensional tables, logistic models and incompleteness. Logistic regression. Suitable statistical software is introduced, for example, MATLAB, R, SAS, etc.

Pre: MATH 354 / STAT 354 or STAT 154 with “C” (2.0) or better or consent  
ALT-Fall

### **STAT 459 (3) Nonparametric Methods**

Derivation and usage of nonparametric statistical methods in univariate, bivariate, and multivariate data. Applications in count, score, and rank data, analysis of variance for ranked data. Nonparametric regression estimation. Suitable statistical software is introduced, for example, MATLAB, R, SAS, etc.

Pre: MATH 354 / STAT 354 or STAT 154 with “C” (2.0) or better or consent  
Alt-Spring

### **STAT 488 (1-3) Seminar**

The study of a particular topic primarily based upon recent literature. May be repeated for credit on each new topic.

### **STAT 491 (1-4) In-Service**

A course designed to upgrade the qualifications of persons on-the-job. May be repeated for credit on each new topic.

### **STAT 492 (3) Statistics Capstone Experience**

This course is designed to allow undergraduate students an opportunity to integrate their statistics experiences by engaging each student in working on problems in applied or theoretical statistics.

Pre: STAT 457, STAT 458, STAT 459, STAT 450 (at least two of these)  
Spring

### **STAT 495 (1-4) Selected Topics**

A course in an area of statistics not regularly offered. May be repeated for credit on each new topic.

### **STAT 498 (1-12) Internship**

Provides a student the opportunity to gain expertise and experience in a special field under the supervision of a qualified person.

### **STAT 499 (1-4) Individual Study**

Independent individual study under the guidance and direction of a faculty member. Special arrangements must be made with an appropriate faculty member. May be repeated for credit of each new topic.