

## Statistics

College of Science, Engineering, & Technology

Department of Mathematics & Statistics

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

Chair: Charles Waters

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Statistics is the mathematical science of studying and learning from data. Statisticians acquire, organize, analyze, present and draw inferences from data. Inferences about a population are communicated with measures of likelihood. Statistical analysis is used in a variety of disciplines to communicate uncertainties for the purpose of making informed decisions. Applications of statistics are all around us such as in weather forecasting, surveys, quality control, market demand, causality, and effectiveness of treatments, to name only a few.

The Department offers a major and minor in statistics. The major provides a sufficient 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.

### POLICIES/INFORMATION

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.

Contact the College of Science, Engineering and Technology Student Relations Office for application procedures.

**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.

**Course Application Policy.** Within each major or minor, no course may be applied to more than one requirement.

**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.** 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 or MATH 354 after completing MATH 455 or STAT 455.

### Placement Information for Mathematics and Statistics Course

**Enrollment.** Students seeking enrollment in MATH 112: College Algebra, MATH 113: Trigonometry, MATH 115: Precalculus Mathematics, MATH 121: Calculus I, MATH 130: Finite Mathematics and Introductory Calculus, MATH 201: Elements of Mathematics I, or STAT 154: Elementary Statistics must demonstrate readiness to succeed in the course by satisfying the corresponding requirement in the following table.

Course	Minimum ACT Math Subscore		Minimum Accuplacer Elementary Algebra Score		Minimum Accuplacer College Level Math Score		Minimum Accuplacer Calculus Readiness Score		Course Prerequisites
<b>Math 112</b>	<b>22</b>	Or	<b>76</b>	AND	<b>50</b>		<b>N/A</b>	Or	Successful Completion of Math 098
<b>Math 113</b>	<b>22</b>	Or	<b>N/A</b>		<b>63</b>	Or	<b>16</b>	Or	Math 112 with "C" or better
<b>Math 115</b>	<b>23</b>	Or	<b>N/A</b>		<b>86</b>	Or	<b>19</b>	Or	MATH 098 and Permission from dept. chair
<b>Math 121</b>	<b>24</b>	Or	<b>N/A</b>		<b>103</b>	Or	<b>22</b>	Or	Math 115 or both Math 112 and 113 with "C" or better
<b>Math 130</b>	<b>23</b>	Or	<b>N/A</b>		<b>86</b>	Or	<b>19</b>	Or	Math 112 or 115 with "C" or better
<b>Math 201</b>	<b>22</b>	Or	<b>76</b>	AND	<b>50</b>		<b>N/A</b>	Or	Successful completion of Math 098
<b>Stat 154</b>	<b>19</b>	Or	<b>76</b>	AND	<b>50</b>		<b>N/A</b>	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 and ACCUPLACER 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.

## STATISTICS CONTINUED

- 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

Degree completion = 120 credits

#### **Required General Education**

MATH 121 Calculus I (4)

#### **Major Common Core**

IT 210 Fundamentals of Programming (4)  
IT 214 Fundamentals of Software Development (4)  
IT 340 Introduction to Database 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: Applied Mathematics Track**

(choose a minimum of 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)

#### **Major Emphasis: Information Technology Track**

(choose a minimum of 16 credits from the following list)

IT 310 Data Structures & Algorithms (4)  
IT 320 Machine Structures and Operating Systems (4)  
IT 350 Information Security (4)  
IT 360 Introduction to Data Communication and Networking (4)  
IT 380 Systems Analysis and Design (4)  
MATH 470 Numerical Analysis I (4)  
MATH 471 Numerical Analysis II (4)

#### **Major Emphasis: Biological Science Track**

(choose a minimum of 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**

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**

An introduction to statistical concepts and methods that is applicable to all disciplines. Topics include descriptive measures of data, probability and probability distributions, statistical inference, tests of hypotheses, confidence intervals, correlation, linear regression, and analysis of variance. The use of statistical software will be emphasized.

Pre: ACT Math sub-score of 19 or higher, successful completion of MATH 098 or appropriate placement scores (see Placement Information under Statistics)

Fall, Spring, Summer

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, Summer

#### **STAT (3) 356 Introduction to Programming in SAS**

Introduction to basic programming techniques: creating DATA and PROC statements, libraries, functions, programming syntax, and formats. Descriptive and Inferential statistics in SAS. Emphasis is placed on using these tools for statistical analyses. Working with arrays, loop and SAS macro.

Pre: STAT 154 or instructor's approval

On-Demand

#### **STAT 398 (0) CPT: Co-Operative Experience**

Curricular Practical Training: Co-Operative Experience is a zero-credit full-time practical training experience for one summer and on adjacent fall or spring term. Special rules apply to preserve full-time student status. Please contact an advisor in your program for complete information.

Pre: At least 60 credits earned; in good standing; instructor permission; co-op contract; other prerequisites may also apply.

Fall, Spring, Summer

#### **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

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

Spring (Even Years)

#### **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

Spring

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## STATISTICS CONTINUED

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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  
Fall (Even Years)

### **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.