***Twin Cities Campus***

# Statistical Practice B.A.

*Statistics, School of*

**College of Liberal Arts**

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2018
- Required credits to graduate with this degree: 120
- Required credits within the major: 53 to 54
- Degree: Bachelor of Arts

Statistics is the science of learning from data, measuring, controlling, and communicating uncertainty. It provides the navigation essential for controlling the course of scientific and societal advances.

The statistical practice BA is intended for students who want to use their education as certification for work requiring statistical skills or as a basis for further education in another area like medicine, psychology, law or others. Compared to the BS degree, this program reduces the number of required mathematics courses and increases the number of applied statistics courses, or courses in a supporting quantitative area. Students who complete this program using statistics electives will have applied statistics training equivalent to most masters programs in statistics.

## Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

## Admission Requirements

Students must complete 1 courses before admission to the program.

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

**Required prerequisites**

**Preparatory Course**

Complete STAT 3011 or STAT 3021 with a grade of C- or better in order to declare the statistical practice BA major.
Take exactly 1 course(s) totaling 3 - 4 credit(s) from the following:

- STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
  *or* STAT 3021 - Introduction to Probability and Statistics (3.0 cr)

## General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

## Program Requirements

Students are required to take 4 semester(s) of any second language.

All CLA BA degrees require 18 upper-division (3xxx-level or higher) credits outside the major designator. These credits must be taken in designators different from the major designator and cannot include courses that are cross-listed with the major designator. The major designator for the Statistical Practice BA is STAT.

At least 17 upper-division credits in the major must be taken at the University of Minnesota - Twin Cities campus.

Students may earn no more than one degree from the statistics program: a BA or a BS or a minor.

All incoming CLA freshmen must complete the First-Year Experience course sequence.

**Calculus**

Take exactly 2 course(s) totaling exactly 8 credit(s) from the following:

- MATH 1271 - Calculus I [MATH] (4.0 cr)
  *or* MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
  *or* MATH 1571H - Honors Calculus I [MATH] (4.0 cr)

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•MATH 1272 - Calculus II (4.0 cr)
*or* MATH 1372 - CSE Calculus II (4.0 cr)
*or* MATH 1572H - Honors Calculus II (4.0 cr)

**Programming for Statisticians**
Take exactly 1 course(s) totaling exactly 4 credit(s) from the following:
•CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
*or* CSCI 2021 - Machine Architecture and Organization (4.0 cr)

**Core Courses**
Take exactly 6 course(s) totaling exactly 24 credit(s) from the following:
•STAT 3032 - Regression and Correlated Data (4.0 cr)
•STAT 3701 - Introduction to Statistical Computing (4.0 cr)
•STAT 4051 - Statistical Machine Learning I (4.0 cr)
•STAT 4052 - Statistical Machine Learning II (4.0 cr)
•Choose one Theory of Statistics two-course sequence. Note: Students interested in the BA/MS in biostatistics sub-plan should complete STAT 4101/4102 or STAT 5101/5102. In order to apply for admission to the sub-plan, these courses should be completed with a B or higher by the end of a student's 3rd year in the BA degree.
**Option 1**
STAT 4101 - Theory of Statistics I (4.0 cr)
STAT 4102 - Theory of Statistics II (4.0 cr)
*or* **Option 2**
Note: These courses require MATH 2263 or MATH 2374 as a prerequisite.
STAT 5101 - Theory of Statistics I (4.0 cr)
STAT 5102 - Theory of Statistics II (4.0 cr)
*or* **Option 3**
Note: These courses require MATH 2263 or MATH 2374 as a prerequisite.
MATH 5651 - Basic Theory of Probability and Statistics (4.0 cr)
STAT 5102 - Theory of Statistics II (4.0 cr)

**Electives**
Take a total of 11 credits, at least 5 of which must be listed below as STAT Electives. Students planning to pursue a minor in mathematics, or an advanced degree in statistics or biostatistics should consult the undergraduate advisor for suggested coursework.
Take 11 or more credit(s) from the following:
**STAT Electives**
Take 5 or more credit(s) from the following:
•STAT 3501 *{Inactive}*(1.0 cr)
•STAT 5031 *{Inactive}*(4.0 cr)
•STAT 5201 - Sampling Methodology in Finite Populations (3.0 cr)
•STAT 5303 - Designing Experiments (4.0 cr)
•STAT 5401 - Applied Multivariate Methods (3.0 cr)
•STAT 5421 - Analysis of Categorical Data (3.0 cr)
•STAT 5511 - Time Series Analysis (3.0 cr)
•STAT 5601 - Nonparametric Methods (3.0 cr)
•STAT 5931 - Topics in Statistics (3.0 cr)
•**Other Electives**
Take at most 6 credit(s) from the following:
•CSCI 2011 - Discrete Structures of Computer Science (4.0 cr)
•CSCI 2011H - Honors Discrete Structures of Computer Science (4.0 cr)
•CSCI 2021 - Machine Architecture and Organization (4.0 cr)
•CSCI 2041 - Advanced Programming Principles (4.0 cr)
•CSCI 3003 - Introduction to Computing in Biology (3.0 cr)
•CSCI 3081W - Program Design and Development [WI] (4.0 cr)
•CSCI 4011 - Formal Languages and Automata Theory (4.0 cr)
•CSCI 4041 - Algorithms and Data Structures (4.0 cr)
•CSCI 4041H *{Inactive}*(4.0 cr)
•CSCI 4061 - Introduction to Operating Systems (4.0 cr)
•CSCI 4131 - Internet Programming (3.0 cr)
•CSCI 4211 - Introduction to Computer Networks (3.0 cr)
•CSCI 4511W - Introduction to Artificial Intelligence [WI] (4.0 cr)
•CSCI 4611 - Programming Interactive Computer Graphics and Games (3.0 cr)
•CSCI 4707 - Practice of Database Systems (3.0 cr)
•CSCI 4950 - Senior Software Project (3.0 cr)
•CSCI 4970W - Advanced Project Laboratory [WI] (3.0 cr)
•CSCI 5103 - Operating Systems (3.0 cr)
•CSCI 5105 - Introduction to Distributed Systems (3.0 cr)

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- CSCI 5106 - Programming Languages (3.0 cr)
- CSCI 5115 - User Interface Design, Implementation and Evaluation (3.0 cr)
- CSCI 5117 - Developing the Interactive Web (3.0 cr)
- CSCI 5125 - Collaborative and Social Computing (3.0 cr)
- CSCI 5143 - Real-Time and Embedded Systems (3.0 cr)
- CSCI 5161 - Introduction to Compilers (3.0 cr)
- CSCI 5211 - Data Communications and Computer Networks (3.0 cr)
- CSCI 5221 - Foundations of Advanced Networking (3.0 cr)
- CSCI 5231 *{Inactive}*(3.0 cr)
- CSCI 5271 - Introduction to Computer Security (3.0 cr)
- CSCI 5302 - Analysis of Numerical Algorithms (3.0 cr)
- CSCI 5304 - Computational Aspects of Matrix Theory (3.0 cr)
- CSCI 5403 *{Inactive}*(3.0 cr)
- CSCI 5421 - Advanced Algorithms and Data Structures (3.0 cr)
- CSCI 5451 - Introduction to Parallel Computing: Architectures, Algorithms, and Programming (3.0 cr)
- CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- CSCI 5471 - Modern Cryptography (3.0 cr)
- CSCI 5481 - Computational Techniques for Genomics (3.0 cr)
- CSCI 5511 - Artificial Intelligence I (3.0 cr)
- CSCI 5512 - Artificial Intelligence II (3.0 cr)
- CSCI 5521 - Machine Learning Fundamentals (3.0 cr)
- CSCI 5523 - Introduction to Data Mining (3.0 cr)
- CSCI 5525 - Machine Learning: Analysis and Methods (3.0 cr)
- CSCI 5551 - Introduction to Intelligent Robotic Systems (3.0 cr)
- CSCI 5552 - Sensing and Estimation in Robotics (3.0 cr)
- CSCI 5561 - Computer Vision (3.0 cr)
- CSCI 5607 - Fundamentals of Computer Graphics 1 (3.0 cr)
- CSCI 5608 - Fundamentals of Computer Graphics II (3.0 cr)
- CSCI 5609 - Visualization (3.0 cr)
- CSCI 5611 - Animation & Planning in Games (3.0 cr)
- CSCI 5707 - Principles of Database Systems (3.0 cr)
- CSCI 5708 - Architecture and Implementation of Database Management Systems (3.0 cr)
- CSCI 5715 - From GPS, Google Maps, and Uber to Spatial Data Science (3.0 cr)
- CSCI 5801 - Software Engineering I (3.0 cr)
- CSCI 5802 - Software Engineering II (3.0 cr)
- MATH 2283 *{Inactive}*(3.0 cr)
- MATH 3283W - Sequences, Series, and Foundations: Writing Intensive [WI] (4.0 cr)
- MATH 4065 - Theory of Interest (4.0 cr)
- MATH 4067W - Actuarial Mathematics in Practice [WI] (3.0 cr)
- MATH 4151 *{Inactive}*(3.0 cr)
- MATH 4152 - Elementary Mathematical Logic (3.0 cr)
- MATH 4281 - Introduction to Modern Algebra (4.0 cr)
- MATH 4428 - Mathematical Modeling (4.0 cr)
- MATH 4512 - Differential Equations with Applications (3.0 cr)
- MATH 4567 - Applied Fourier Analysis (4.0 cr)
- MATH 4603 - Advanced Calculus I (4.0 cr)
- MATH 4604 - Advanced Calculus II (4.0 cr)
- MATH 4707 - Introduction to Combinatorics and Graph Theory (4.0 cr)
- MATH 5067 - Actuarial Mathematics I (4.0 cr)
- MATH 5068 - Actuarial Mathematics II (4.0 cr)
- MATH 5075 - Mathematics of Options, Futures, and Derivative Securities I (4.0 cr)
- MATH 5076 - Mathematics of Options, Futures, and Derivative Securities II (4.0 cr)
- MATH 5165 - Mathematical Logic I (4.0 cr)
- MATH 5166 *{Inactive}*(4.0 cr)
- MATH 5248 - Cryptology and Number Theory (4.0 cr)
- MATH 5251 - Error-Correcting Codes, Finite Fields, Algebraic Curves (4.0 cr)
- MATH 5285H - Honors: Fundamental Structures of Algebra I (4.0 cr)
- MATH 5286H - Honors: Fundamental Structures of Algebra II (4.0 cr)
- MATH 5335 - Geometry I (4.0 cr)
- MATH 5336 *{Inactive}*(4.0 cr)
- MATH 5345H - Honors: Introduction to Topology (4.0 cr)
- MATH 5378 - Differential Geometry (4.0 cr)
- MATH 5385 - Introduction to Computational Algebraic Geometry (4.0 cr)
- MATH 5445 - Mathematical Analysis of Biological Networks (4.0 cr)
- MATH 5447 - Theoretical Neuroscience (4.0 cr)
- MATH 5467 - Introduction to the Mathematics of Image and Data Analysis (4.0 cr)

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- MATH 5485 - Introduction to Numerical Methods I (4.0 cr)
- MATH 5486 - Introduction To Numerical Methods II (4.0 cr)
- MATH 5525 - Introduction to Ordinary Differential Equations (4.0 cr)
- MATH 5535 - Dynamical Systems and Chaos (4.0 cr)
- MATH 5583 - Complex Analysis (4.0 cr)
- MATH 5587 - Elementary Partial Differential Equations I (4.0 cr)
- MATH 5588 - Elementary Partial Differential Equations II (4.0 cr)
- MATH 5615H - Honors: Introduction to Analysis I (4.0 cr)
- MATH 5616H - Honors: Introduction to Analysis II (4.0 cr)
- MATH 5652 - Introduction to Stochastic Processes (4.0 cr)
- MATH 5654 - Prediction and Filtering (4.0 cr)
- MATH 5705 - Enumerative Combinatorics (4.0 cr)
- MATH 5707 - Graph Theory and Non-enumerative Combinatorics (4.0 cr)
- PUBH 3415 - Introduction to Clinical Trials - Online (3.0 cr)
- PUBH 6420 - Introduction to SAS Programming (1.0 cr)
- PUBH 6431 - Topics in Hierarchical Bayesian Analysis (1.0 cr)
- PUBH 6432 - Biostatistical Methods in Translational and Clinical Research (1.0 cr)
- PUBH 6470 *{Inactive}*(3.0 cr)
- PUBH 7415 - Introduction to Clinical Trials (3.0 cr)
- WRIT 3562W - Technical and Professional Writing [WI] (4.0 cr)
- MATH 5711 - Linear Programming and Combinatorial Optimization (4.0 cr)
- CSCI 4203 - Computer Architecture (4.0 cr)
  *or* EE 4363 - Computer Architecture and Machine Organization (4.0 cr)
- CSCI 5204 - Advanced Computer Architecture (3.0 cr)
  *or* EE 5364 - Advanced Computer Architecture (3.0 cr)
- CSCI 4921 - History of Computing [TS, HIS] (3.0 cr)
  *or* HSCI 4321 - History of Computing [TS, HIS] (3.0 cr)

**Capstone: Consultation and Communication for Statisticians**

The capstone is a course that focuses on how to interact and collaborate as a statistician on a multidisciplinary team. Students will learn about all aspects of statistical consulting by performing an actual consultation. This includes understanding the needs of the researcher or client, designing a study to investigate the client's needs, and communicating study results in a manner that a non-statistician can understand.

Take exactly 1 course(s) totaling exactly 3 credit(s) from the following:

Students who double major and choose to complete the capstone requirement in their other major are still required to take the statistics BA capstone.

- STAT 4893W - Consultation and Communication for Statisticians [WI] (3.0 cr)

**Upper Division Writing Intensive within the major**

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill other major requirements.

Take 0 - 1 course(s) from the following:

- STAT 4893W - Consultation and Communication for Statisticians [WI] (3.0 cr)

## Program Sub-plans

A sub-plan is not required for this program.

### BA/MS Biostatistics

The College of Liberal Arts and the Division of Biostatistics of the School of Public Health offer an early-admission opportunity for eligible University of Minnesota Statistics BA and BS students also interested in completing the MS in biostatistics.

Interested statistics undergraduates should contact the School of Statistics advisor for more information. Students should apply during the fall semester of their junior year, with the intent of beginning the program the fall of their senior year.

Students admitted to the MS in Biostatistics sub-plan must maintain timely degree progress to ensure all undergraduate degree requirements are completed by the end of their fourth year. Students who are not successful in completing the required SPH courses at the end of their senior year may be placed on probation or dismissed from SPH.

To be considered for admission to the joint program, prospective students must be officially admitted to an undergraduate major (BA or BS) in the School of Statistics in the College of Liberal Arts at the University of Minnesota. All prerequisite courses should be completed with a B or better by the end of a student's junior year. Students should apply during the fall semester of their junior year with the intent of beginning the program the fall of their senior year.

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Admitted students will take 9 Biostatistics course credits in their senior year (year 4, undergraduate credit), which will be applied to their MS degree. They will also take the remainder of the courses required to complete the bachelor's degree. The year 4 biostatistics courses include the core biostatistical methods courses (PubH 7405 and 7406, 8 credits total) and a course on essential skills for biostatistical practice (1 credit), which will teach students career development skills and "job-relevant" computing and communications skills.

**Prerequisite Courses**

All prerequisite courses should be completed with a B or better by the end of Year 3 in the BA degree. Many prerequisite courses are already required for the BA degree, but it is important for students planning to apply to the sub-plan that they be taken in a timely manner, while considering the grade standards for admission to the sub-plan.

Take 0 - 6 course(s) from the following:

**Statistical Theory**

Take 2 courses for a total of 8 credits. In rare cases, students may be permitted to take STAT 5101/5102, or STAT 4101/4102, during their senior year concurrently with the usual Year 4 joint BA/MS program requirements.

STAT 4101 - Theory of Statistics I (4.0 cr)
STAT 4102 - Theory of Statistics II (4.0 cr)
*or* STAT 5101 - Theory of Statistics I (4.0 cr)
STAT 5102 - Theory of Statistics II (4.0 cr)

- **Calculus**

Take 3 courses for a total of 12 credits.

MATH 1271 - Calculus I [MATH] (4.0 cr)
*or* MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
*or* MATH 1571H - Honors Calculus I [MATH] (4.0 cr)
MATH 1272 - Calculus II (4.0 cr)
*or* MATH 1372 - CSE Calculus II (4.0 cr)
*or* MATH 1572H - Honors Calculus II (4.0 cr)
MATH 2263 - Multivariable Calculus (4.0 cr)
*or* MATH 2374 - CSE Multivariable Calculus and Vector Analysis (4.0 cr)
*or* MATH 2573H - Honors Calculus III (4.0 cr)

- **Linear Algebra**

Take 1 course for 4 credits.

- CSCI 2033 - Elementary Computational Linear Algebra (4.0 cr)

*or* MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
*or* MATH 4242 - Applied Linear Algebra (4.0 cr)

- **Statistical Programming**

Experience in basic programming is strongly recommended; exposure to programming in a statistical software package (R or SAS) is preferred.

**Year 4 Courses**

The following courses should be taken during the 4th year of a student's BA degree, in addition to the other courses required to complete the BA.

Take PUBH 6460 and PUBH 7405 for a total of 5 credits during fall of year 4.

PUBH 6460 *{Inactive}*(1.0 cr)
PUBH 7405 - Biostatistical Inference I (4.0 cr)

Take PUBH 7406 for 4 credits during spring of year 4.

PUBH 7406 - Biostatistical Inference II (3.0 cr)

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