# STATISTICS, BACHELOR OF SCIENCE

**College of Letters & Science**

Statistics enables us to make inferences about entire populations based on samples taken from them. Statistical methods can be applied to problems in almost every discipline and are vitally important to researchers in the agricultural, biological, environmental, social, engineering, and medical sciences.

## The Program

Statistics majors may receive either a Bachelor of Arts (A.B.) or a Bachelor of Science (B.S.) degree. Both the A.B. and B.S. degree programs require coursework in both theoretical and applied statistics, highlighting the strong interdependence between statistical theory and its applications and computational aspects. The B.S. degree program has four tracks: Applied Statistics Track, General Track, Machine Learning Track, and the Statistical Data Science Track. Students choose one track to pursue based on their interests. Multiple track selection is not possible.

**B.S. in Statistics-Applied Statistics Track** emphasizes statistical applications. This track is recommended for students who are interested in applications of statistical techniques to various disciplines including the biological, physical and social sciences.

**B.S. in Statistics-General Track** emphasizes statistical theory and is especially recommended as preparation for graduate study in statistics.

**B.S in Statistics-Machine Learning Track** emphasizes algorithmic and theoretical aspects of statistical learning methodologies that are geared towards building predictive and explanatory models for large and complex data. It is recommended for students interested in pursuing graduate programs in statistics, machine learning, or data science, as well as for students interested in learning statistical techniques for industry.

**B.S. in Statistic-Statistical Data Science Track** emphasizes data handling skills and statistical computation. This track is recommended for students interested in statistical learning methodology, advanced data handling techniques and computational aspects of statistical analysis.

### Major Advisors

For a current list of faculty and staff advisors, see Undergraduate Advising (https://statistics.ucdavis.edu/undergrad/advising/).

The requirements for continuing students to change into the Statistics major can be found at Statistics Change of Major Requirements & Process (https://statistics.ucdavis.edu/undergrad/advising/change-of-major/statistics/).

Students are encouraged to meet with an advisor to plan a program as early as possible.

### Career Alternatives

Probability models, statistical methods, and computational techniques are used in a great many fields, including the biological, physical, social, and health sciences, business, and engineering. The wide applicability of statistics is reflected in the strong demand for graduates with statistical training in both the public and private sectors. Employment opportunities include careers in data & policy analysis in government & industry, financial management, quality control, insurance & healthcare industry, actuarial science, engineering, public health, biological & pharmaceutical research, law, and education. Students with an undergraduate degree in statistics have entered advanced studies in statistics, economics, finance, psychology, medicine, business management & analytics, and other professional school programs.

The major requirements below are in addition to meeting University Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/university-degree-requirements/) & College Degree Requirements (https://catalog.ucdavis.edu/undergraduate-education/college-degree-requirements/); unless otherwise noted. Respective of the Track, the minimum number of units required for the Statistics Bachelor of Science are 75, 82, 79, & 79.

## Applied Statistics Track

| Code | Title | Units |
|---|---|---|
| **Preparatory Subject Matter** | | |
| *Mathematics* | | |
| Choose a series: | | 9-12 |
| MAT 016A & MAT 016B DISCO | and (Discontinued) | |
| MAT 017A & MAT 017B & MAT 017C | Calculus for Biology & Medicine and Calculus for Biology & Medicine and Calculus for Biology & Medicine | |
| MAT 019A & MAT 019B & MAT 019C | Calculus for Data-Driven Applications and Calculus for Data-Driven Applications and Calculus for Data-Driven Applications | |
| MAT 021A & MAT 021B & MAT 021C | Calculus and Calculus and Calculus | |
| MAT 021 series preferred. | | |
| MAT 022A | Linear Algebra | 3 |
| *Computer Science Engineering* | | |
| ECS 032A | Introduction to Programming | 4 |
| or ECS 032AV | Introduction to Programming | |
| or ECS 036A | Programming & Problem Solving | |
| *Statistics* | | |
| Choose one: | | 4 |
| STA 013 | Elementary Statistics | |
| or STA 013Y | Elementary Statistics | |
| STA 032 | Gateway to Statistical Data Science | |
| STA 100 | Applied Statistics for Biological Sciences | |
| STA 032 or STA 100 preferred. | | |
| *Cluster Elective Prerequisites* | | |
| Two introductory courses serving as the prerequisites to the chosen Cluster Electives (see **Cluster Electives** section below). | | 7-8 |
| **Note:** Additional coursework beyond this requirement may be needed to fulfill the Cluster Elective prerequisites. | | |
| Preparatory Subject Matter Subtotal | | 27-31 |
| **Depth Subject Matter** | | |
| *Core Coursework* | | |
| Statistics | | 24 |
| STA 106 | Applied Statistical Methods: Analysis of Variance | |

| | | |
|---|---|---|
| STA 108 | Applied Statistical Methods: Regression Analysis | |
| STA 130A | Mathematical Statistics: Brief Course | |
| STA 130B | Mathematical Statistics: Brief Course | |
| STA 138 | Analysis of Categorical Data | |
| STA 141A | Fundamentals of Statistical Data Science | |
| *Restricted Electives* | | |
| Choose three: | | 12 |
| STA 104 | Applied Statistical Methods: Nonparametric Statistics | |
| STA 135 | Multivariate Data Analysis | |
| STA 137 | Applied Time Series Analysis | |
| STA 141B | Data & Web Technologies for Data Analysis | |
| Only one of STA 141B or STA 141C can be used as an elective. | | |
| STA 141C | Big Data & High Performance Statistical Computing | |
| Only one of STA 141B or STA 141C can be used as an elective. | | |
| STA 144 | Sampling Theory of Surveys | |
| STA 145 | Bayesian Statistical Inference | |
| STA 160 | Practice in Statistical Data Science | |
| MAT 168 | Optimization | |
| With advisor approval, one of STA 194HA or STA 194HB or STA 199 may be used as an elective. The course must be taken for four units. | | |
| STA 194HA | Special Studies for Honors Students | |
| STA 194HB | Special Studies for Honors Students | |
| STA 199 | Special Study for Advanced Undergraduates | |
| *Cluster Electives* | | |
| Choose four upper division elective courses outside of statistics: | | 12-16 |
| Cluster electives are chosen with and must be approved by the major advisor. Electives must follow a coherent sequence in one single disciple/cluster where statistical methods and models are applied. At least three of the cluster electives must cover the quantitative aspects of the discipline. **A list of pre-approved electives can be found on the Statistics Department website.** | | |
| Pre-Approved Electives List (https://statistics.ucdavis.edu/undergrad/bs-applied-track/electives/) | | |
| Depth Subject Matter Subtotal | | 48-52 |
| **Total Units** | | **75-83** |

# General Statistics Track

| Code | Title | Units |
|---|---|---|
| **Preparatory Subject Matter** | | |
| *Mathematics* | | |
| MAT 021A | Calculus | 4 |
| MAT 021B | Calculus | 4 |
| MAT 021C | Calculus | 4 |
| MAT 021D | Vector Analysis | 4 |
| MAT 022A | Linear Algebra | 3-4 |
| or MAT 067 | Modern Linear Algebra | |
| *Computer Science Engineering* | | |
| ECS 032A | Introduction to Programming | 4 |
| or ECS 032AV | Introduction to Programming | |
| or ECS 036A | Programming & Problem Solving | |
| *Statistics* | | |
| Choose one: | | 4 |
| STA 013 | Elementary Statistics | |
| or STA 013Y | Elementary Statistics | |
| STA 032 | Gateway to Statistical Data Science | |
| STA 100 | Applied Statistics for Biological Sciences | |
| STA 032 or STA 100 preferred. | | |
| Preparatory Subject Matter Subtotal | | 27-28 |
| **Depth Subject Matter** | | |
| *Core Coursework* | | |
| Statistics | | 24 |
| STA 106 | Applied Statistical Methods: Analysis of Variance | |
| STA 108 | Applied Statistical Methods: Regression Analysis | |
| STA 131A | Introduction to Probability Theory | |
| STA 131B | Introduction to Mathematical Statistics | |
| STA 131C | Introduction to Mathematical Statistics | |
| STA 138 | Analysis of Categorical Data | |
| Mathematics | | 16 |
| MAT 108 | Introduction to Abstract Mathematics | |
| or MAT 127C | Real Analysis | |
| MAT 127A | Real Analysis | |
| MAT 127B | Real Analysis | |
| MAT 167 | Applied Linear Algebra | |
| *Restricted Electives* | | |
| Choose three: | | 12 |
| STA 104 | Applied Statistical Methods: Nonparametric Statistics | |
| STA 135 | Multivariate Data Analysis | |
| STA 137 | Applied Time Series Analysis | |
| STA 141A | Fundamentals of Statistical Data Science | |
| STA 141B | Data & Web Technologies for Data Analysis | |
| Only one of STA 141B or STA 141C can be used as an elective. | | |
| STA 141C | Big Data & High Performance Statistical Computing | |
| Only one of STA 141B or STA 141C can be used as an elective. | | |
| STA 142A | Statistical Learning I | |
| STA 142B | Statistical Learning II | |
| STA 144 | Sampling Theory of Surveys | |
| STA 145 | Bayesian Statistical Inference | |
| STA 160 | Practice in Statistical Data Science | |
| MAT 168 | Optimization | |
| With advisor approval, one of STA 194HA or STA 194HB or STA 199 may be used as an elective. The course must be taken for four units. | | |
| STA 194HA | Special Studies for Honors Students | |
| STA 194HB | Special Studies for Honors Students | |
| STA 199 | Special Study for Advanced Undergraduates | |
| *Related Elective Course* | | *3-4* |

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|---|---|
| One upper division course outside of Statistics approved by major advisor. The Related Elective should be in mathematics, computer science or cover quantitative aspects of a substantive discipline. **A list of pre-approved electives can be found on the Statistics Department website.** | |
| Pre-Approved Electives List (https://statistics.ucdavis.edu/undergrad/bs-general-track/electives/) | |
| Depth Subject Matter Subtotal | 55-56 |
| **Total Units** | **82-84** |

# Machine Learning Track

| Code | Title | Units |
|---|---|---|
| **Preparatory Subject Matter** | | |
| *Mathematics* | | |
| MAT 021A | Calculus | 4 |
| MAT 021B | Calculus | 4 |
| MAT 021C | Calculus | 4 |
| MAT 021D | Vector Analysis | 4 |
| MAT 022A | Linear Algebra | 3 |
| *Computer Science Engineering* | | |
| ECS 032A | Introduction to Programming | 4 |
| or ECS 032AV | Introduction to Programming | |
| or ECS 036A | Programming & Problem Solving | |
| Note: Additional coursework in Python is strongly recommended; e.g., ECS 032B. | | |
| *Statistics* | | |
| Choose one: | | 4 |
| STA 013 | Elementary Statistics | |
| or STA 013Y | Elementary Statistics | |
| STA 032 | Gateway to Statistical Data Science | |
| STA 100 | Applied Statistics for Biological Sciences | |
| STA 032 or STA 100 preferred. | | |
| Preparatory Subject Matter Subtotal | | 27 |
| **Depth Subject Matter** | | |
| *Core Coursework* | | |
| Statistics | | 36 |
| STA 106 | Applied Statistical Methods: Analysis of Variance | |
| STA 108 | Applied Statistical Methods: Regression Analysis | |
| STA 131A | Introduction to Probability Theory | |
| STA 131B | Introduction to Mathematical Statistics | |
| STA 131C | Introduction to Mathematical Statistics | |
| STA 141A | Fundamentals of Statistical Data Science | |
| STA 142A | Statistical Learning I | |
| STA 142B | Statistical Learning II | |
| STA 144 | Sampling Theory of Surveys | |
| or STA 145 | Bayesian Statistical Inference | |
| Mathematics | | 4 |
| MAT 167 | Applied Linear Algebra | |
| or MAT 168 | Optimization | |
| *Restricted Electives* | | |
| Choose three: | | 12 |
| STA 104 | Applied Statistical Methods: Nonparametric Statistics | |
| STA 135 | Multivariate Data Analysis | |
| STA 137 | Applied Time Series Analysis | |
| STA 138 | Analysis of Categorical Data | |
| STA 141B | Data & Web Technologies for Data Analysis | |
| STA 141C | Big Data & High Performance Statistical Computing | |
| STA 144 | Sampling Theory of Surveys | |
| STA 145 | Bayesian Statistical Inference | |
| MAT 127A | Real Analysis | |
| MAT 128A | Numerical Analysis | |
| MAT 170 | Mathematics for Data Analytics & Decision Making | |
| ECS 122A | Algorithm Design & Analysis | |
| ECS 158 | Programming on Parallel Architectures | |
| ECS 163 | Information Visualization | |
| ECS 165A | Database Systems | |
| ECS 170 | Introduction to Artificial Intelligence | |
| ECS 174 | Computer Vision | |
| With advisor approval, one of STA 194HA or STA 194HB or STA 199 may be used as an elective. The course must be taken for four units. | | |
| STA 194HA | Special Studies for Honors Students | |
| STA 194HB | Special Studies for Honors Students | |
| STA 199 | Special Study for Advanced Undergraduates | |
| **Note**: A course used to fulfill the core requirement cannot be used as an elective. | | |
| Depth Subject Matter Subtotal | | 52 |
| **Total Units** | | **79** |

# Statistical Data Science Track

| Code | Title | Units |
|---|---|---|
| **Preparatory Subject Matter** | | |
| *Mathematics* | | |
| MAT 021A | Calculus | 4 |
| MAT 021B | Calculus | 4 |
| MAT 021C | Calculus | 4 |
| MAT 021D | Vector Analysis | 4 |
| MAT 022A | Linear Algebra | 3 |
| *Computer Science Engineering* | | |
| ECS 032A | Introduction to Programming | 4 |
| or ECS 032AV | Introduction to Programming | |
| or ECS 036A | Programming & Problem Solving | |
| Note: Additional coursework in Python is strongly recommended; e.g., ECS 032B. | | |
| *Statistics* | | |
| Choose one: | | 4 |
| STA 013 | Elementary Statistics | |
| or STA 013Y | Elementary Statistics | |
| STA 032 | Gateway to Statistical Data Science | |
| STA 100 | Applied Statistics for Biological Sciences | |

| | | |
|---|---|---|
| STA 032 or STA 100 preferred. | | |
| Preparatory Subject Matter Subtotal | | 27 |
| **Depth Subject Matter** | | |
| *Core Coursework* | | |
| Statistics | | 36 |
| STA 106 | Applied Statistical Methods: Analysis of Variance | |
| STA 108 | Applied Statistical Methods: Regression Analysis | |
| STA 131A | Introduction to Probability Theory | |
| or STA 130A | Mathematical Statistics: Brief Course | |
| STA 131B | Introduction to Mathematical Statistics | |
| or STA 130B | Mathematical Statistics: Brief Course | |
| STA 135 | Multivariate Data Analysis | |
| STA 141A | Fundamentals of Statistical Data Science | |
| STA 141B | Data & Web Technologies for Data Analysis | |
| STA 141C | Big Data & High Performance Statistical Computing | |
| STA 160 | Practice in Statistical Data Science | |
| Machine Learning | | 4 |
| STA 142A | Statistical Learning I | |
| or ECS 171 | Machine Learning | |
| Mathematics | | 4 |
| MAT 167 | Applied Linear Algebra | |
| or MAT 168 | Optimization | |
| *Restricted Electives* | | |
| Choose two: | | 8 |
| STA 104 | Applied Statistical Methods: Nonparametric Statistics | |
| STA 137 | Applied Time Series Analysis | |
| STA 138 | Analysis of Categorical Data | |
| STA 142A | Statistical Learning I | |
| STA 142B | Statistical Learning II | |
| STA 144 | Sampling Theory of Surveys | |
| STA 145 | Bayesian Statistical Inference | |
| MAT 128A | Numerical Analysis | |
| MAT 170 | Mathematics for Data Analytics & Decision Making | |
| ECS 122A | Algorithm Design & Analysis | |
| ECS 158 | Programming on Parallel Architectures | |
| ECS 163 | Information Visualization | |
| ECS 165A | Database Systems | |
| With advisor approval, one of STA 194HA or STA 194HB or STA 199 may be used as an elective. The course must be taken for four units. | | |
| STA 194HA | Special Studies for Honors Students | |
| STA 194HB | Special Studies for Honors Students | |
| STA 199 | Special Study for Advanced Undergraduates | |
| **Note**: A course used to fulfill a core requirement cannot be used as a restricted elective. | | |
| Depth Subject Matter Subtotal | | 52 |
| **Total Units** | | **79** |