## Statistics

### Bachelor of Arts (BA)

The undergraduate major at Berkeley provides a systematic and thorough grounding in applied and theoretical statistics as well as probability. The quality and dedication of the teaching staff and faculty are extremely high. A major in Statistics from Berkeley is an excellent preparation for a career in science or industry, or for further academic study in a wide variety of fields. The department has particular strength in Machine Learning, a key ingredient of the emerging field of Data Science. It is also very useful to combine studies of statistics and probability with other subjects. Our department excels at interdisciplinary science, and more than half of the department's undergraduate students are double or triple majors.

Students interested in teaching statistics and mathematics in middle or high school should pursue the teaching option within the major. Students interested in teaching should also consider the Cal Teach Program (http://calteach.berkeley.edu).

### Declaring the Major

Students should apply in the semester they will complete their prerequisites. For applicants with prerequisites in progress, applications will be reviewed after the grades for all prerequisites are available, 2-3 weeks after finals. For applicants who have completed all prerequisites in a previous term, applications will be reviewed and processed within a week.

For detailed information regarding the process of declaring the major, please see the Statistics Department website. (http://statistics.berkeley.edu/programs/undergrad/major/#HowtoDeclare)

### Minor Program

The minor is for students who want to study a significant amount of statistics and probability at the upper division level. For information regarding the requirements, please see the Minor Requirements tab on this page.

For detailed information regarding the process of declaring the minor, please see the Statistics Department website. (http://statistics.berkeley.edu/programs/undergrad/minor)

In addition to the University, campus, and college requirements, listed on the College Requirements tab, students must fulfill the below requirements specific to their major program.

### General Guidelines

1. All courses taken to fulfill the major requirements below must be taken for graded credit, other than courses listed which are offered on a Pass/No Pass basis only. Other exceptions to this requirement are noted as applicable.
2. No more than one upper division course may be used to simultaneously fulfill requirements for a student’s major and minor programs, with the exception of minors offered outside of the College of Letters & Science.
3. A minimum grade point average (GPA) of 2.0 must be maintained in both upper and lower division courses used to fulfill the major requirements.

For information regarding residency requirements and unit requirements, please see the College Requirements tab.

### Lower Division Prerequisites (Four Courses)

Students must earn a minimum 3.2 UC grade point average in the lower division math prerequisites with no lower than a C in each.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1A</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1B</td>
<td>Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 53</td>
<td>Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 54</td>
<td>Linear Algebra and Differential Equations</td>
<td>4</td>
</tr>
</tbody>
</table>

### Upper Division Requirements (Nine Courses)

#### Core Statistics Courses (3)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 133</td>
<td>Concepts in Computing with Data</td>
<td>3</td>
</tr>
<tr>
<td>STAT 134</td>
<td>Concepts of Probability</td>
<td>4</td>
</tr>
<tr>
<td>or STAT 140</td>
<td>Probability for Data Science</td>
<td>4</td>
</tr>
<tr>
<td>STAT 135</td>
<td>Concepts of Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Statistics Electives (3)

Select three statistics electives from the following: at least one of the selections must have a lab:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 150</td>
<td>Stochastic Processes</td>
<td></td>
</tr>
<tr>
<td>STAT 151A</td>
<td>Linear Modelling: Theory and Applications (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 152</td>
<td>Sampling Surveys (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 153</td>
<td>Introduction to Time Series (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 154</td>
<td>Modern Statistical Prediction and Machine Learning (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 155</td>
<td>Game Theory</td>
<td></td>
</tr>
<tr>
<td>STAT 156</td>
<td>Seminar on Topics in Probability and Statistics</td>
<td></td>
</tr>
<tr>
<td>STAT 158</td>
<td>The Design and Analysis of Experiments (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 159</td>
<td>Reproducible and Collaborative Statistical Data Science (LAB COURSE)</td>
<td></td>
</tr>
</tbody>
</table>

#### Applied Cluster Courses (3)

Select three applied cluster courses. See Cluster Course Information 9-12 and Approved Cluster Courses below the Teaching Option requirements.

### Upper Division Requirements: Teaching Option (Nine Courses)

#### Core Statistics Courses (3)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 133</td>
<td>Concepts in Computing with Data</td>
<td>3</td>
</tr>
<tr>
<td>STAT 134</td>
<td>Concepts of Probability</td>
<td>4</td>
</tr>
<tr>
<td>or STAT 140</td>
<td>Probability for Data Science</td>
<td>4</td>
</tr>
<tr>
<td>STAT 135</td>
<td>Concepts of Statistics</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Statistics Electives (2)

Select two of the following; at least one course must include a lab:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>STAT 150</td>
<td>Stochastic Processes</td>
<td></td>
</tr>
<tr>
<td>STAT 151A</td>
<td>Linear Modelling: Theory and Applications (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 152</td>
<td>Sampling Surveys (LAB COURSE)</td>
<td></td>
</tr>
<tr>
<td>STAT 153</td>
<td>Introduction to Time Series (LAB COURSE)</td>
<td></td>
</tr>
</tbody>
</table>
Cluster Course Information

The applied cluster is a chance to learn about areas in which statistics can be applied and to learn specialized techniques not taught in the Statistics Department. Students need to design their own applied cluster. The courses should have a unifying theme. Picking their own applied cluster is a valuable exercise that gives students a chance to explore and refine their interests and to develop a coherent course of study. A preapproved list has been provided below. However, it is not exhaustive. If students would like to use a course that is not on the list, the undergraduate major faculty adviser must approve it. Clusters may consist of courses from more than one department, but at least two must be approved courses from the same department. Students’ choices should reflect a theme so that students study some area of application in breadth and depth. Cluster courses should meet the following criteria:

1. Courses must be upper division courses and at least 3 units.
2. Courses in the biological and physical sciences, chemistry, and engineering are often acceptable.
3. Courses in social sciences must be quantitative.
4. Courses with statistics prerequisites are often acceptable.
5. Courses that are similar to courses offered in the Statistics Department are not acceptable.
6. Courses that primarily teach how to use a particular software package are not acceptable.
7. Courses that focus on the use of spreadsheet software (e.g., UGBA 104) are not acceptable.
8. Courses should be taken in the home department. For instance, economics classes should be taken in the economics or business department.
9. Seminars and special topics courses require approval by the undergraduate faculty adviser.

Approved Cluster Courses

Of the three applied cluster courses required for the major, at least two must be approved courses from the same department. This is not an exhaustive list.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>ANTHRO C100</td>
<td>Human Paleontology</td>
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<tr>
<td>ANTHRO C103</td>
<td>Introduction to Human Osteology</td>
<td>6</td>
</tr>
<tr>
<td>ANTHRO 115</td>
<td>Introduction to Medical Anthropology</td>
<td>4</td>
</tr>
<tr>
<td>ANTHRO 121C</td>
<td>Historical Archaeology: Historical Artifact Identification and Analysis</td>
<td>4</td>
</tr>
<tr>
<td>ANTHRO C124C/INTEGBI C187</td>
<td>Human Biogeography of the Pacific</td>
<td>3</td>
</tr>
<tr>
<td>ANTHRO 127A</td>
<td>Bioarchaeology: Introduction to Skeletal Biology and Bioarchaeology</td>
<td>4</td>
</tr>
<tr>
<td>ANTHRO 127B</td>
<td>Bioarchaeology: Reconstruction of Life in Bioarchaeology</td>
<td>4</td>
</tr>
<tr>
<td>ANTHRO C129D/INTEGBI C155</td>
<td>Holocene Paleoecology: How Humans Changed the Earth</td>
<td>3</td>
</tr>
<tr>
<td>ANTHRO 132A</td>
<td>Analysis of Archaeological Materials: Analysis of Archaeological Ceramics</td>
<td>4</td>
</tr>
<tr>
<td>ANTHRO 135</td>
<td>Paleoethnobotany: Archaeological Methods and Laboratory Techniques</td>
<td>4</td>
</tr>
<tr>
<td>ANTHRO 169B</td>
<td>Research Theory and Methods in Socio-Cultural Anthropology</td>
<td>5</td>
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<tr>
<td>ARCH 140</td>
<td>Energy and Environment</td>
<td>4</td>
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<tr>
<td>ARCH 150</td>
<td>Introduction to Structures</td>
<td>4</td>
</tr>
<tr>
<td>ARCH 154</td>
<td>Design and Computer Analysis of Structure</td>
<td>3</td>
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<tr>
<td>ASTRON 160</td>
<td>Stellar Physics</td>
<td>4</td>
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<tr>
<td>ASTRON C161</td>
<td>Relativistic Astrophysics and Cosmology</td>
<td>4</td>
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<tr>
<td>ASTRON C162</td>
<td>Planetary Astrophysics</td>
<td>4</td>
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<tr>
<td>BIO ENG 104</td>
<td>Biological Transport Phenomena</td>
<td>4</td>
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<tr>
<td>BIO ENG C112</td>
<td>Molecular Biomechanics and Mechanobiology of the Cell</td>
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<tr>
<td>BIO ENG C117</td>
<td>Structural Aspects of Biomaterials</td>
<td>4</td>
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<tr>
<td>BIO ENG C119</td>
<td>Orthopedic Biomechanics</td>
<td>4</td>
</tr>
<tr>
<td>BIO ENG C125</td>
<td>Introduction to Robotics</td>
<td>4</td>
</tr>
<tr>
<td>BIO ENG C125B</td>
<td>Robotic Manipulation and Interaction</td>
<td>4</td>
</tr>
<tr>
<td>BIO ENG 131</td>
<td>Introduction to Computational Molecular and Cell Biology</td>
<td>4</td>
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<tr>
<td>BIO ENG C136L</td>
<td>Laboratory in the Mechanics of Organisms</td>
<td>3</td>
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<tr>
<td>BIO ENG C137</td>
<td>Designing for the Human Body</td>
<td>3</td>
</tr>
<tr>
<td>BIO ENG 144</td>
<td>Introduction to Protein Informatics</td>
<td>4</td>
</tr>
<tr>
<td>BIO ENG C145L</td>
<td>Introductory Electronic Transducers Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>BIO ENG C145M</td>
<td>Introductory Microcomputer Interfacing Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>BIO ENG 147</td>
<td>Principles of Synthetic Biology</td>
<td>4</td>
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<tr>
<td>BIO ENG C165</td>
<td>Medical Imaging Signals and Systems</td>
<td>4</td>
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<tr>
<td>BIO ENG C181</td>
<td>The Berkeley Lectures on Energy: Energy from Biomass</td>
<td>3</td>
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<tr>
<td>CHM ENG 140</td>
<td>Introduction to Chemical Process Analysis</td>
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<tr>
<td>CHM ENG 141</td>
<td>Chemical Engineering Thermodynamics</td>
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</tr>
<tr>
<td>CHM ENG C195A</td>
<td>The Berkeley Lectures on Energy: Energy from Biomass</td>
<td>3</td>
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</tbody>
</table>
Air Pollution
Planetary Astrophysics
Geological Oceanography
Strong Motion Seismology
Biometeorology
Field Geology and Digital Mapping
Introduction to Population Analysis
Introduction to Machine Learning
Introduction to Artificial Intelligence
Introduction to Database Systems
Foundations of Computer Graphics
Efficient Algorithms and Intractable Problems
Software Engineering
Protocols
Introduction to the Internet: Architecture and Operating Systems and System Programming
Computer Security
User Interface Design and Development
Computer Architecture and Engineering

Statistics major: Only one from the following may be used in an applied cluster for the Statistics major:

ECON 136  Financial Economics
ENGIN 120  Principles of Engineering Economics
UGBA 103  Introduction to Finance
ECON 138  Financial and Behavioral Economics
ECON 141  Econometric Analysis
ECON C142  Applied Econometrics and Public Policy
ECON 157  Health Economics
ECON 174  Global Poverty and Impact Evaluation
ECON C175  Economic Demography
or ECON N175  Economic Demography
ECON C181  International Trade
ECON 182  International Monetary Economics
EL ENG 105  Microelectronic Devices and Circuits
EL ENG C106A  Introduction to Robotics
EL ENG C106B  Robotic Manipulation and Interaction
EL ENG 113  Power Electronics
EL ENG 117  Electromagnetic Fields and Waves
EL ENG 118  Introduction to Optical Engineering
EL ENG 120  Signals and Systems
EL ENG 121  Introduction to Digital Communication Systems
EL ENG 122  Introduction to Communication Networks
EL ENG 123  Digital Signal Processing
EL ENG C128  Feedback Control Systems
EL ENG 129  Neural and Nonlinear Information Processing
EL ENG 130  Integrated-Circuit Devices
EL ENG 134  Fundamentals of Photovoltaic Devices
EL ENG 137A  Introduction to Electric Power Systems
EL ENG 137B  Introduction to Electric Power Systems
EL ENG 140  Linear Integrated Circuits
EL ENG 142  Integrated Circuits for Communications
EL ENG 143  Microfabrication Technology
EL ENG 144  Fundamental Algorithms for Systems Modeling, Analysis, and Optimization
EL ENG C145B  Medical Imaging Signals and Systems
EL ENG C145L  Introductory Electronic Transducers Laboratory
EL ENG C145M  Introductory Microcomputer Interfacing Laboratory
EL ENG C145O  Laboratory in the Mechanics of Organisms
EL ENG 147  Introduction to Microelectromechanical Systems (MEMS)
EL ENG C149  Course Not Available
ENE RES C100  Energy and Society
ENE RES 102  Quantitative Aspects of Global Environmental Problems
### Statistics Major

Only one from the following may be used in an applied cluster for the Statistics major:

- **ENGIN 117** Methods of Engineering Analysis
- **ECON 136** Financial Economics
- **UGBA 103** Introduction to Finance
- **ENVECON C101** Environmental Economics
- **ENVECON C102** Natural Resource Economics
- **ENVECON C115** Modeling and Management of Biological Resources
- **ENVECON 131** Globalization and the Natural Environment
- **ENVECON 140** Economics of Race, Agriculture, and the Environment
- **ENVECON 141** Agricultural and Environmental Policy
- **ENVECON 142** Industrial Organization with Applications to Agriculture and Natural Resources
- **ENVECON 143** Economics of Innovation and Intellectual Property
- **ENVECON 145** Health and Environmental Economic Policy
- **ENVECON 147** Regulation of Energy and the Environment
- **ENVECON C151** Economic Development
- **ENVECON 152** Advanced Topics in Development and International Trade
- **ENVECON 153** Population, Environment, and Development
- **ENVECON 154** Economics of Poverty and Technology
- **ENVECON 161** Advanced Topics in Environmental and Resource Economics
- **ENVECON 162** Economics of Water Resources
- **ENVECON C175** The Economics of Climate Change
- **ENVECON C176** Climate Change Economics
- **ENVECON C181** International Trade
- **ENVECON C183** Forest Ecosystem Management
- **ENVECON C184** Forest Ecosystem Management and Planning
- **ENVECON 140AC** Economics of Race, Agriculture, and the Environment

### Additional Courses

- **ENVECON 173** Introduction to Ecological Data Analysis
- **ENVECON 177** Course Not Available
- **ENVECON 180** Air Pollution
- **ENVECON 181A** Fire Ecology
- **ENVECON 182** Forest Operations Management
- **ENVECON 183** Forest Ecosystem Management
- **ENVECON 185** Applied Forest Ecology
- **ENVECON 186** Management and Conservation of Rangeland Ecosystems
- **ENVECON 187** Restoration Ecology
- **GEOG C139** Atmospheric Physics and Dynamics
- **GEOG 140A** Physical Landscapes: Process and Form
- **GEOG 142** Climate Dynamics
- **GEOG 143** Global Change Biogeochemistry
- **GEOG C145** Geological Oceanography
- **GEOG 148** Biogeography
- **GEOG 187** Geographic Information Analysis
- **GEOG C188** Geographic Information Systems
- **IND ENG 115** Industrial and Commercial Data Systems
- **IND ENG 130** Methods of Manufacturing Improvement
- **IND ENG 131** Discrete Event Simulation
- **IND ENG 142** Introduction to Machine Learning and Data Analytics
- **IND ENG 150** Production Systems Analysis
- **IND ENG 151** Service Operations Design and Analysis
- **IND ENG 153** Logistics Network Design and Supply Chain Management
- **IND ENG 160** Nonlinear and Discrete Optimization
- **IND ENG 162** Linear Programming and Network Flows
- **IND ENG 166** Decision Analytics
- **IND ENG 170** Industrial Design and Human Factors
- **IND ENG 171** Technology Firm Leadership
- **IND ENG 221** Introduction to Financial Engineering
- **IND ENG 222** Financial Engineering Systems I
NOT Ind Eng 165, Ind Eng 172 or Ind Eng 173
INFO 159 Natural Language Processing 3
INFO 202 Information Organization and Retrieval 2
INFO 213 User Interface Design and Development 4
INFO 232 Applied Behavioral Economics for Information Systems 3
INFO 247 Information Visualization and Presentation 4
INFO 253 Web Architecture 3
INFO 256 Applied Natural Language Processing 3
INFO 271B Quantitative Research Methods for Information Systems and Management 3
INFO 272 Qualitative Research Methods for Information Systems and Management 3
INTEGBI 102LF Introduction to California Plant Life with Laboratory 4
INTEGBI 103LF Invertebrate Zoology with Laboratory 5
INTEGBI 104LF Natural History of the Vertebrates with Laboratory 5
INTEGBI 106A Physical and Chemical Environment of the Ocean 4
INTEGBI C107L Principles of Plant Morphology with Laboratory 4
INTEGBI C109 Evolution and Ecology of Development 3
INTEGBI C110L Biology of Fungi with Laboratory 4
INTEGBI 113L Paleobiological Perspectives on Ecology and Evolution 4
INTEGBI 115 Introduction to Systems in Biology and Medicine 4
INTEGBI 117 Medical Ethnobotany 4
& 117LF and Medical Ethnobotany Laboratory 4
INTEGBI 118 Host-Pathogen Interactions: A Trans-Discipline 4
Outlook 4
INTEGBI 119 Evaluating Scientific Evidence in Medicine 3
INTEGBI 123AL Exercise and Environmental Physiology with Laboratory 5
INTEGBI 125L Introduction to the Biomechanical Analysis of Human Movement 4
INTEGBI 128 Sports Medicine 3
INTEGBI C129L Human Physiological Assessment 3
INTEGBI 131 General Human Anatomy 3
INTEGBI 132 Survey of Human Physiology 4
INTEGBI 135 The Mechanics of Organisms 4
INTEGBI C135L Laboratory in the Mechanics of Organisms 3
INTEGBI 137 Human Endocrinology 4
INTEGBI 138 Comparative Endocrinology 4
INTEGBI 139 The Neurobiology of Stress 4
INTEGBI 140 Biology of Human Reproduction 4
INTEGBI C142L Introduction to Human Osteology 6
INTEGBI C143A Biological Clocks: Physiology and Behavior 3
INTEGBI C143B Hormones and Behavior 3
INTEGBI C144 Animal Behavior 4
INTEGBI 146LF Behavioral Ecology with Laboratory 5
INTEGBI 148 Comparative Animal Physiology 3
INTEGBI C149 Molecular Ecology 4
INTEGBI 151 Plant Physiological Ecology 4
INTEGBI 152 Environmental Toxicology 4
INTEGBI 153 Ecology 3
INTEGBI 154 Plant Ecology 3
INTEGBI C155 Holocene Paleoecology: How Humans Changed the Earth 3
INTEGBI C156 Principles of Conservation Biology 4
INTEGBI 157LF Ecosystems of California 4
INTEGBI 158LF Biology and Geomorphology of Tropical Islands 13
INTEGBI 160 Evolution 4
INTEGBI 161 Population and Evolutionary Genetics 4
INTEGBI 162 Ecological Genetics 4
INTEGBI 164 Human Genetics and Genomics 4
INTEGBI 166 Evolutionary Biogeography 4
INTEGBI 168L Systematics of Vascular Plants with Laboratory 4
INTEGBI 169 Evolutionary Medicine 4
INTEGBI 173LF Mammalogy with Laboratory 5
INTEGBI 174LF Ornithology with Laboratory 4
INTEGBI 175LF Herpetology with Laboratory 4
INTEGBI 181L Paleobotany - The 500-Million Year History of a Greening Planet 4
INTEGBI 183L Evolution of the Vertebrates with Laboratory 4
INTEGBI 184L Morphology of the Vertebrate Skeleton with Laboratory 4
INTEGBI C185L Human Paleontology 5
INTEGBI C187 Human Biogeography of the Pacific 3
IAS C175 The Economics of Climate Change 4
IAS C176 Climate Change Economics 4
LD ARCH 122 Hydrology for Planners 4
LD ARCH C177 Course Not Available 4
LD ARCH C188 Geographic Information Systems 4
L & S C180U Wealth and Poverty 4
LINGUIS 100 Introduction to Linguistic Science 4
LINGUIS C105 The Mind and Language 4
LINGUIS 110 Introduction to Phonetics and Phonology 4
LINGUIS 113 Experimental Phonetics 3
LINGUIS 140 Introduction to Field Methods 3
LINGUIS C146 Language Acquisition 3
LINGUIS C147 Language Disorders 3
LINGUIS C160 Quantitative Methods in Linguistics 4
MATH C103 Introduction to Mathematical Economics 4
MATH 104 Introduction to Analysis 4
MATH H104 Honors Introduction to Analysis 4
MATH 105 Second Course in Analysis 4
MATH 110 Linear Algebra 4
MATH H110 Honors Linear Algebra 4
MATH 113 Introduction to Abstract Algebra 4
MATH H113 Honors Introduction to Abstract Algebra 4
MATH 114 Second Course in Abstract Algebra 4
MATH 115 Introduction to Number Theory 4
MATH 116 Cryptography 4
MATH 118 Fourier Analysis, Wavelets, and Signal Processing 4
MATH 121A Mathematical Tools for the Physical Sciences 4
MATH 121B Mathematical Tools for the Physical Sciences 4
MATH 123 Ordinary Differential Equations 4
MATH 125A Mathematical Logic 4
MATH 126 Introduction to Partial Differential Equations 4
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MATH 127</td>
<td>Mathematical and Computational Methods in Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>MATH 128A</td>
<td>Numerical Analysis</td>
<td>4</td>
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<tr>
<td>MATH 128B</td>
<td>Numerical Analysis</td>
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<tr>
<td>MATH 130</td>
<td>The Classical Geometries</td>
<td>4</td>
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<tr>
<td>MATH 135</td>
<td>Introduction to the Theory of Sets</td>
<td>4</td>
</tr>
<tr>
<td>MATH 136</td>
<td>Incompleteness and Undecidability</td>
<td>4</td>
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<td>MATH 140</td>
<td>Metric Differential Geometry</td>
<td>4</td>
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<tr>
<td>MATH 141</td>
<td>Elementary Differential Topology</td>
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<tr>
<td>MATH 142</td>
<td>Elementary Algebraic Topology</td>
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<tr>
<td>MATH 143</td>
<td>Elementary Algebraic Geometry</td>
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<tr>
<td>MATH 170</td>
<td>Mathematical Methods for Optimization</td>
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<tr>
<td>MATH 172</td>
<td>Combinatorics</td>
<td>4</td>
</tr>
<tr>
<td>MATH 185</td>
<td>Introduction to Complex Analysis</td>
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</tr>
<tr>
<td>MATH H185</td>
<td>Honors Introduction to Complex Analysis</td>
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<tr>
<td>MATH 189</td>
<td>Mathematical Methods in Classical and Quantum Mechanics</td>
<td>4</td>
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<tr>
<td>MEC ENG 101</td>
<td>Introduction to Lean Manufacturing Systems</td>
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<tr>
<td>MEC ENG 102A</td>
<td>Introduction to Mechanical Systems for Mechatronics</td>
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<tr>
<td>MEC ENG 102B</td>
<td>Mechatronics Design</td>
<td>4</td>
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<tr>
<td>MEC ENG 104</td>
<td>Engineering Mechanics II</td>
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<tr>
<td>MEC ENG 106</td>
<td>Fluid Mechanics</td>
<td>3</td>
</tr>
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<td>MEC ENG 107</td>
<td>Mechanical Engineering Laboratory</td>
<td>3</td>
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<td>MEC ENG 108</td>
<td>Mechanical Behavior of Engineering Materials</td>
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<tr>
<td>MEC ENG 109</td>
<td>Heat Transfer</td>
<td>3</td>
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<tr>
<td>MEC ENG 110</td>
<td>Introduction to Product Development</td>
<td>3</td>
</tr>
<tr>
<td>MEC ENG 115</td>
<td>Molecular Biomechanics and Mechanobiology of the Cell</td>
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<td>Introduction to Environmental Health Sciences</td>
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Only one from the following may be used in an applied cluster for the Statistics major:

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### General Guidelines

1. All courses taken to fulfill the minor requirements below must be taken for graded credit.
2. A minimum of three of the upper division courses taken to fulfill the minor requirements must be completed at UC Berkeley.
3. A minimum grade point average (GPA) of 2.0 is required for courses used to fulfill the minor requirements.
4. Courses used to fulfill the minor requirements may be applied toward the Seven-Course Breadth requirement, for Letters & Science students.
5. No more than one upper division course may be used to simultaneously fulfill requirements for a student’s major and minor programs.
6. All minor requirements must be completed prior to the last day of finals during the semester in which the student plans to graduate. Students who cannot finish all courses required for the minor by that time should see a College of Letters & Science adviser.
7. All minor requirements must be completed within the unit ceiling. (For further information regarding the unit ceiling, please see the College Requirements tab.)

### Requirements

#### Lower Division Prerequisites

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<td>MATH 54</td>
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#### Upper Division Requirements

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<tr>
<th>Course</th>
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<td>STAT 140</td>
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<tr>
<td>STAT 135</td>
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Select three statistics electives from the following: at least one of the selections must have a lab:

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<tr>
<th>Course</th>
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<td>STAT 158</td>
<td>Reproducible and Collaborative Statistical Data Science (LAB COURSE)</td>
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</table>

Undergraduate students in the College of Letters & Science must fulfill the following requirements in addition to those required by their major program.

For detailed lists of courses that fulfill college requirements, please review the College of Letters & Sciences (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science) page in this Guide.

### Entry Level Writing (http://writing.berkeley.edu/node/78)

All students who will enter the University of California as freshmen must demonstrate their command of the English language by fulfilling the Entry Level Writing requirement. Fulfillment of this requirement is also a prerequisite to enrollment in all reading and composition courses at UC Berkeley.

### American History and American Institutions (http://guide.berkeley.edu/undergraduate/colleges-schools/letters-science/american-history-institutions-requirement)

The American History and Institutions requirements are based on the principle that a US resident graduated from an American university, should have an understanding of the history and governmental institutions of the United States.

### American Cultures (http://americancultures.berkeley.edu/students/courses)

American Cultures is the one requirement that all undergraduate students at Cal need to take and pass in order to graduate. The requirement offers an exciting intellectual environment centered on the study of race, ethnicity and culture of the United States. AC courses offer students
opportunities to be part of research-led, highly accomplished teaching environments, grappling with the complexity of American Culture.

**Quantitative Reasoning**

The Quantitative Reasoning requirement is designed to ensure that students graduate with basic understanding and competency in math, statistics, or computer science. The requirement may be satisfied by exam or by taking an approved course.

**Foreign Language**

The Foreign Language requirement may be satisfied by demonstrating proficiency in reading comprehension, writing, and conversation in a foreign language equivalent to the second semester college level, either by passing an exam or by completing approved course work.

**Reading and Composition**

In order to provide a solid foundation in reading, writing, and critical thinking the College requires two semesters of lower division work in composition in sequence. Students must complete a first-level reading and composition course by the end of their second semester and a second-level course by the end of their fourth semester.

**Breadth Requirements**

The undergraduate breadth requirements provide Berkeley students with a rich and varied educational experience outside of their major program. As the foundation of a liberal arts education, breadth courses give students a view into the intellectual life of the University while introducing them to a multitude of perspectives and approaches to research and scholarship. Engaging students in new disciplines and with peers from other majors, the breadth experience strengthens interdisciplinary connections and context that prepares Berkeley graduates to understand and solve the complex issues of their day.

**Unit Requirements**

- 120 total units, including at least 60 L&S units
- Of the 120 units, 36 must be upper division units
- Of the 36 upper division units, 6 must be taken in courses offered outside your major department

**Residence Requirements**

For units to be considered in “residence,” you must be registered in courses on the Berkeley campus as a student in the College of Letters & Science. Most students automatically fulfill the residence requirement by attending classes here for four years. In general, there is no need to be concerned about this requirement, unless you go abroad for a semester or year or want to take courses at another institution or through UC Extension during your senior year. In these cases, you should make an appointment to meet an adviser to determine how you can meet the Senior Residence Requirement.

Note: Courses taken through UC Extension do not count toward residence.

**Senior Residence Requirement**

After you become a senior (with 90 semester units earned toward your BA degree), you must complete at least 24 of the remaining 30 units in residence in at least two semesters. To count as residence, a semester must consist of at least 6 passed units. Intercampus Visitor, EAP, and UC Berkeley-Washington Program (UCDC) units are excluded.

You may use a Berkeley Summer Session to satisfy one semester of the Senior Residence requirement, provided that you successfully complete 6 units of course work in the Summer Session and that you have been enrolled previously in the college.

**Modified Senior Residence Requirement**

Participants in the UC Education Abroad Program (EAP) or the UC Berkeley Washington Program (UCDC) may meet a Modified Senior Residence requirement by completing 24 (excluding EAP) of their final 60 semester units in residence. At least 12 of these 24 units must be completed after you have completed 90 units.

**Upper Division Residence Requirement**

You must complete in residence a minimum of 18 units of upper division courses (excluding EAP units), 12 of which must satisfy the requirements for your major.

**Mission**

Statisticians help to design data collection plans, analyze data appropriately, and interpret and draw conclusions from those analyses. The central objective of the undergraduate major in Statistics is to equip students with consequently requisite quantitative skills that they can employ and build on in flexible ways.

**Learning Goals for the Major**

Majors are expected to learn concepts and tools for working with data and have experience in analyzing real data that goes beyond the content of a service course in statistical methods for non-majors. Majors should understand the following:

1. The fundamentals of probability theory
2. Statistical reasoning and inferential methods
3. Statistical computing
4. Statistical modeling and its limitations

**Skills**

Graduates should also have skills in the following:

1. Description, interpretation, and exploratory analysis of data by graphical and other means
2. Effective communication
Statistics

STAT 0PX Preparatory Statistics 1 Unit
Terms offered: Summer 2016 10 Week Session, Summer 2015 10 Week Session, Summer 2014 10 Week Session
This course assists entering Freshman students with basic statistical concepts and problem solving. Designed for students who do not meet the prerequisites for 2. Offered through the Student Learning Center.
Preparatory Statistics: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Hours & Format
Summer:
6 weeks - 5 hours of lecture and 4.5 hours of workshop per week
8 weeks - 5 hours of lecture and 4.5 hours of workshop per week
Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam required.
Instructor: Purves
Preparatory Statistics: Read Less [-]

STAT 2 Introduction to Statistics 4 Units
Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
Introduction to Statistics: Read More [+]
Rules & Requirements
Credit Restrictions: Students who have taken 2X, 5, 20, 21, 21X, or 25 will receive no credit for 2.
Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2-2 hours of laboratory per week
Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week
Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Also listed as: COMPSCI C8/INFO C8
Foundations of Data Science: Read Less [-]

STAT C8 Foundations of Data Science 4 Units
Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
Foundations of data science from three perspectives: inferential thinking, computational thinking, and real-world relevance. Given data arising from some real-world phenomenon, how does one analyze that data so as to understand that phenomenon? The course teaches critical concepts and skills in computer programming and statistical inference, in conjunction with hands-on analysis of real-world datasets, including economic data, document collections, geographical data, and social networks. It delves into social and legal issues surrounding data analysis, including issues of privacy and data ownership.
Foundations of Data Science: Read More [+]
Rules & Requirements
Prerequisites: This course may be taken on its own, but students are encouraged to take it concurrently with a data science connector course (numbered 88 in a range of departments)
Hours & Format
Fall and/or spring: 15 weeks - 3-3 hours of lecture and 2-2 hours of laboratory per week
Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week
Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Foundations of Data Science: Read Less [-]
STAT C8R Introduction to Computational Thinking with Data 3 Units

Terms offered: Not yet offered
An introduction to computational thinking and quantitative reasoning, preparing students for further coursework, especially Foundations of Data Science (CS/Info/Stat C8). Emphasizes the use of computation to gain insight about quantitative problems with real data. Expressions, data types, collections, and tables in Python. Programming practices, abstraction, and iteration. Visualizing univariate and bivariate data with bar charts, histograms, plots, and maps. Introduction to statistical concepts including averages and distributions, predicting one variable from another, association and causality, probability and probabilistic simulation. Relationship between numerical functions and graphs. Sampling and introduction to inference.

Introduction to Computational Thinking with Data: Read More [+]

Objectives Outcomes

Course Objectives: C8R also includes quantitative reasoning concepts that aren't covered in Data 8. These include certain topics in: principles of data visualization; simulation of random processes; and understanding numerical functions through their graphs. This will help prepare students for computational and quantitative courses other than Data 8. C8R takes advantage of the complementarity of computing and quantitative reasoning to enliven abstract ideas and build students' confidence in their ability to solve real problems with quantitative tools. Students learn computer science concepts and immediately apply them to plot functions, visualize data, and simulate random events.

Foundations of Data Science (CS/Info/Stat C8, a.k.a. Data 8) is an increasingly popular class for entering students at Berkeley. Data 8 builds students' computing skills in the first month of the semester, and students rely on these skills as the course progresses. For some students, particularly those with little prior exposure to computing, developing these skills benefits from further time and practice. C8R is a rapid introduction to Python programming, visualization, and data analysis, which will prepare students for success in Data 8.

Student Learning Outcomes: Students will be able to perform basic computations in Python, including working with tabular data. Students will be able to understand basic probabilistic simulations. Students will be able to understand the syntactic structure of Python code. Students will be able to use good practices in Python programming. Students will be able to use visualizations to understand univariate data and to identify associations or causal relationships in bivariate data.

Rules & Requirements

Credit Restrictions: Students who have taken COMPSCI/INFO/STAT C8 will receive no credit for COMPSCI/STAT C8R.

Hours & Format

Summer: 6 weeks - 4 hours of lecture, 2 hours of discussion, and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introduction to Computational Thinking with Data: Read More [+]

STAT 20 Introduction to Probability and Statistics 4 Units

Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
For students with mathematical background who wish to acquire basic concepts. Relative frequencies, discrete probability, random variables, expectation. Testing hypotheses. Estimation. Illustrations from various fields.

Introduction to Probability and Statistics: Read More [+]

Rules & Requirements

Prerequisites: One semester of calculus

Credit Restrictions: Students who have taken 2, 2X, 5, 21, 21X, or 25 will receive no credit for 20.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introduction to Probability and Statistics for Business: Read Less [-]

STAT 21 Introductory Probability and Statistics for Business 4 Units

Terms offered: Fall 2016, Fall 2015, Fall 2014
Descriptive statistics, probability models and related concepts, sample surveys, estimates, confidence intervals, tests of significance, controlled experiments vs. observational studies, correlation and regression.

Introductory Probability and Statistics for Business: Read More [+]

Rules & Requirements

Prerequisites: One semester of calculus

Credit Restrictions: Students who have taken 2, 2X, 5, 21, 21X, or 25 will receive no credit for Statistics 21 after completing Statistics 2, 2X, 5, 20, 21X, N21, W21 or 25. A deficiency in Statistics 21 may be moved by taking W21.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 5 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introductory Probability and Statistics for Business: Read Less [-]

STAT 20 Introduction to Probability and Statistics 4 Units

Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
For students with mathematical background who wish to acquire basic concepts. Relative frequencies, discrete probability, random variables, expectation. Testing hypotheses. Estimation. Illustrations from various fields.

Introduction to Probability and Statistics: Read More [+]

Rules & Requirements

Prerequisites: One semester of calculus

Credit Restrictions: Students who have taken 2, 2X, 5, 21, 21X, or 25 will receive no credit for 20.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 6 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introductory Probability and Statistics for Business: Read Less [-]

STAT 21 Introductory Probability and Statistics for Business 4 Units

Terms offered: Fall 2016, Fall 2015, Fall 2014
Descriptive statistics, probability models and related concepts, sample surveys, estimates, confidence intervals, tests of significance, controlled experiments vs. observational studies, correlation and regression.

Introductory Probability and Statistics for Business: Read More [+]

Rules & Requirements

Prerequisites: One semester of calculus

Credit Restrictions: Students who have taken 2, 2X, 5, 21, 21X, or 25 will receive no credit for Statistics 21 after completing Statistics 2, 2X, 5, 20, 21X, N21, W21 or 25. A deficiency in Statistics 21 may be moved by taking W21.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Summer: 8 weeks - 5 hours of lecture and 4 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Introductory Probability and Statistics for Business: Read Less [-]
STAT W21 Introductory Probability and Statistics for Business 4 Units
Terms offered: Spring 2018, Summer 2017 8 Week Session, Spring 2017
Reasoning and fallacies, descriptive statistics, probability models and related concepts, combinatorics, sample surveys, estimates, confidence intervals, tests of significance, controlled experiments vs. observational studies, correlation and regression.
Introductory Probability and Statistics for Business: Read More [+]

Rules & Requirements

Prerequisites: One semester of calculus

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of web-based lecture per week
Summer: 8 weeks - 7.5 hours of web-based lecture per week
Online: This is an online course.

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Formerly known as: N21
Introductory Probability and Statistics for Business: Read Less [-]

STAT 28 Statistical Methods for Data Science 4 Units
Terms offered: Spring 2018, Spring 2017
This is a lower-division course that is a follow-up to STAT8/CS8 (Foundations of Data Science). The course will teach a broad range of statistical methods that are used to solve data problems. Topics will include group comparisons and ANOVA, standard parametric statistical models, multivariate data visualization, multiple linear regression and classification, classification and regression trees and random forests. An important focus of the course will be on statistical computing and reproducible statistical analysis. The students will be introduced to the widely used R statistical language and they will obtain hands-on experience in implementing a range of commonly used statistical methods on numerous real world datasets.
Statistical Methods for Data Science: Read More [+]

Rules & Requirements

Prerequisites: Statistics/Information/Computer Science C8 is the only course prerequisite. In addition, mathematical fluency and comfort at the level of precalculus (Math 32) is expected

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Statistical Methods for Data Science: Read Less [-]

STAT 24 Freshman Seminars 1 Unit
Terms offered: Fall 2006, Fall 2003, Spring 2001
The Berkeley Seminar Program has been designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small-seminar setting. Berkeley seminars are offered in all campus departments, and topics vary from department to department and semester to semester. Enrollment limited to 15 freshmen.
Freshman Seminars: Read More [+]

Rules & Requirements
Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format
Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.
Freshman Seminars: Read Less [-]

STAT 39D Freshman/Sophomore Seminar 2 - 4 Units
Terms offered: Fall 2008, Fall 2007
Freshman and sophomore seminars offer lower division students the opportunity to explore an intellectual topic with a faculty member and a group of peers in a small-seminar setting. These seminars are offered in all campus departments; topics vary from department to department and from semester to semester.
Freshman/Sophomore Seminar: Read More [+]

Rules & Requirements
Repeat rules: Course may be repeated for credit as topic varies. Course may be repeated for credit when topic changes.

Hours & Format
Fall and/or spring: 15 weeks - 2-4 hours of seminar per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: The grading option will be decided by the instructor when the class is offered. Final exam required.
Freshman/Sophomore Seminar: Read Less [-]
STAT C79 Societal Risks and the Law 3 Units
Terms offered: Spring 2013
Defining, perceiving, quantifying and measuring risk; identifying risks and estimating their importance; determining whether laws and regulations can protect us from these risks; examining how well existing laws work and how they could be improved; evaluating costs and benefits. Applications may vary by term. This course cannot be used to complete engineering unit or technical elective requirements for students in the College of Engineering.
Societal Risks and the Law: Read More [+]

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam not required.
Also listed as: COMPSCI C79/POL SCI C79
Societal Risks and the Law: Read Less [-]

STAT 88 Probability and Mathematical Statistics in Data Science 2 Units
Terms offered: Spring 2018, Fall 2017, Spring 2017
In this connector course we will state precisely and prove results discovered in the foundational data science course through working with data. Topics include: total variation distance between discrete distributions; the mean, standard deviation, and tail bounds; correlation, and the derivation of the regression equation; probabilities, random variables, and the Central Limit Theorem; probabilistic models; symmetries in random permutations; prior and posterior distributions, and Bayes’ rule.
Probability and Mathematical Statistics in Data Science: Read More [+]
Rules & Requirements
Prerequisites: One semester of calculus. This course is meant to be taken concurrently with Computer Science C8/Statistics C8/Information C8. Students may take more than one data science connector course if they wish, ideally concurrently with or after having taken the C8 course

Hours & Format
Fall and/or spring: 15 weeks - 2 hours of lecture per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Alternative to final exam.
Probability and Mathematical Statistics in Data Science: Read Less [-]

STAT 94 Special Topics in Probability and Statistics 1 - 4 Units
Terms offered: Fall 2015
Topics will vary semester to semester.
Special Topics in Probability and Statistics: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit when topic changes.

Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of lecture and 0-2 hours of discussion per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Special Topics in Probability and Statistics: Read Less [-]
STAT 97 Field Study in Statistics 1 - 3 Units
Terms offered: Fall 2015, Spring 2012
Supervised experience relevant to specific aspects of statistics in off-campus settings. Individual and/or group meetings with faculty.
Field Study in Statistics: Read More [+]

Rules & Requirements
Repeat rules: Course may be repeated for credit.

Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of fieldwork per week
Summer:
6 weeks - 2.5-7.5 hours of fieldwork per week
8 weeks - 1.5-5.5 hours of fieldwork per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Field Study in Statistics: Read Less [-]

STAT 98 Directed Group Study 1 - 3 Units
Terms offered: Fall 2014, Fall 2013, Spring 2013
Must be taken at the same time as either Statistics 2 or 21. This course assists lower division statistics students with structured problem solving, interpretation and making conclusions.
Directed Group Study: Read More [+]

Rules & Requirements
Prerequisites: Consent of instructor

Hours & Format
Fall and/or spring: 15 weeks - 2-3 hours of directed group study per week
Summer: 8 weeks - 4-6 hours of directed group study per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Directed Group Study: Read Less [-]

STAT C100 Principles & Techniques of Data Science 4 Units
Terms offered: Spring 2018, Fall 2017, Spring 2017
In this course, students will explore the data science lifecycle, including question formulation, data collection and cleaning, exploratory data analysis and visualization, statistical inference and prediction, and decision-making. This class will focus on quantitative critical thinking and key principles and techniques needed to carry out this cycle. These include languages for transforming, querying and analyzing data; algorithms for machine learning methods including regression, classification and clustering; principles behind creating informative data visualizations; statistical concepts of measurement error and prediction; and techniques for scalable data processing.
Principles & Techniques of Data Science: Read More [+]

Rules & Requirements
Prerequisites: Computer Science/Information/Statistics C8 or Engineering 7; and either Computer Science 61A or Computer Science 88. Corequisite: Mathematics 54 or Electrical Engineering 16A

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 1 hour of laboratory per week
Summer:
8 weeks - 5 hours of lecture and 4 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

Also listed as: COMPSCI C100
Principles & Techniques of Data Science: Read Less [-]

STAT 131A Introduction to Probability and Statistics for Life Scientists 4 Units
Terms offered: Spring 2018, Fall 2017, Spring 2017
Ideas for estimation and hypothesis testing basic to applications, including an introduction to probability, linear estimation and normal regression theory.
Introduction to Probability and Statistics for Life Scientists: Read More [+]

Rules & Requirements
Prerequisites: One semester of calculus or consent of instructor

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week
Summer: 8 weeks - 5 hours of lecture and 4 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

Introduction to Probability and Statistics for Life Scientists: Read Less [-]
STAT 133 Concepts in Computing with Data 3 Units
Terms offered: Spring 2018, Fall 2017, Summer 2017 10 Week Session
An introduction to computationally intensive applied statistics. Topics will include organization and use of databases, visualization and graphics, statistical learning and data mining, model validation procedures, and the presentation of results.
Concepts in Computing with Data: Read More [+]

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week
Summer: 10 weeks - 4 hours of lecture and 3 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Concepts in Computing with Data: Read Less [-]

STAT 134 Concepts of Probability 4 Units
Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
An introduction to probability, emphasizing concepts and applications. Conditional expectation, independence, laws of large numbers. Discrete and continuous random variables. Central limit theorem. Selected topics such as the Poisson process, Markov chains, characteristic functions.
Concepts of Probability: Read More [+]

Rules & Requirements
Prerequisites: One year of calculus
Credit Restrictions: Students will not receive credit for 134 after taking 140 or 201A.

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of discussion per week
Summer: 8 weeks - 6 hours of lecture and 4 hours of discussion per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Concepts of Probability: Read Less [-]

STAT 135 Concepts of Statistics 4 Units
Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
A comprehensive survey course in statistical theory and methodology. Topics include descriptive statistics, maximum likelihood estimation, non-parametric methods, introduction to optimality, goodness-of-fit tests, analysis of variance, bootstrap and computer-intensive methods and least squares estimation. The laboratory includes computer-based data-analytic applications to science and engineering.
Concepts of Statistics: Read More [+]

Rules & Requirements
Prerequisites: Statistics 134 and linear algebra (Mathematics 54 or equivalent). Statistics 133 strongly recommended

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week
Summer: 8 weeks - 6 hours of lecture and 4 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Concepts of Statistics: Read Less [-]
STAT 140 Probability for Data Science 4 Units
Terms offered: Spring 2018, Spring 2017
Probability for Data Science: Read More [+]

Objectives Outcomes

Course Objectives: The emphasis on simulation and the bootstrap in Data 8 gives students a concrete sense of randomness and sampling variability. Stat 140 will capitalize on this, abstraction and computation complementing each other throughout.

The syllabus has been designed to maintain a mathematical level at least equal to that in Stat 134. So Stat 140 will start faster than Stat 134 (due to the Data 8 prerequisite), avoid approximations that are unnecessary when SciPy is at hand, and replace some of the routine calculus by symbolic math done in SymPy. This will create time for a unit on the convergence and reversibility of Markov Chains as well as added focus on conditioning and Bayes methods.

With about a thousand students a year taking Foundations of Data Science (Stat/CS/Info C8, a.k.a. Data 8), there is considerable demand for follow-on courses that build on the skills acquired in that class. Stat 140 is a probability course for Data 8 graduates who have also had a year of calculus and wish to go deeper into data science.

Student Learning Outcomes: Understand the difference between math and simulation, and appreciate the power of both
Use a variety of approaches to problem solving
Work with probability concepts algebraically, numerically, and graphically

Rules & Requirements

Prerequisites: Statistics/Computer Science/Information C8 and one year of calculus at the level of Mathematics 1A-1B or higher. Co-requisite: Mathematics 54, Electrical Engineering 16A, or equivalent linear algebra course

Credit Restrictions: Students who have earned credit for Stat 134 will not receive credit for Stat 140.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture, 1 hour of discussion, and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Probability for Data Science: Read Less [-]

STAT 150 Stochastic Processes 3 Units
Terms offered: Spring 2018, Fall 2017, Fall 2016
Random walks, discrete time Markov chains, Poisson processes. Further topics such as: continuous time Markov chains, queueing theory, point processes, branching processes, renewal theory, stationary processes, Gaussian processes.
Stochastic Processes: Read More [+]

Rules & Requirements

Prerequisites: 101 or 103A or 134

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Stochastic Processes: Read Less [-]

STAT 151A Linear Modelling: Theory and Applications 4 Units
Terms offered: Spring 2018, Fall 2017, Spring 2017
A coordinated treatment of linear and generalized linear models and their application. Linear regression, analysis of variance and covariance, random effects, design and analysis of experiments, quality improvement, log-linear models for discrete multivariate data, model selection, robustness, graphical techniques, productive use of computers, in-depth case studies.
Linear Modelling: Theory and Applications: Read More [+]

Rules & Requirements

Prerequisites: 102 or 135. 133 recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
Linear Modelling: Theory and Applications: Read Less [-]
STAT 152 Sampling Surveys 4 Units

Rules & Requirements
Prerequisites: 101 or 134, 133 and 135 recommended

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

STAT 153 Introduction to Time Series 4 Units
Terms offered: Spring 2018, Fall 2017, Spring 2017
An introduction to time series analysis in the time domain and spectral domain. Topics will include: estimation of trends and seasonal effects, autoregressive moving average models, forecasting, indicators, harmonic analysis, spectra.

Rules & Requirements
Prerequisites: 101, 134 or consent of instructor. 133 or 135 recommended

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

STAT 154 Modern Statistical Prediction and Machine Learning 4 Units
Terms offered: Spring 2018, Fall 2017, Spring 2017

Rules & Requirements
Prerequisites: Mathematics 53 and 54 or equivalents; Statistics 135 or equivalent; experience with some programming language. Mathematics 55 or equivalent exposure to counting arguments is recommended but not required

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week
Summer: 10 weeks - 4.5 hours of lecture and 3 hours of laboratory per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.

STAT 155 Game Theory 3 Units
Terms offered: Spring 2018, Fall 2017, Summer 2017 8 Week Session
General theory of zero-sum, two-person games, including games in extensive form and continuous games, and illustrated by detailed study of examples.

Rules & Requirements
Prerequisites: 101 or 134

Hours & Format
Fall and/or spring: 15 weeks - 3 hours of lecture per week
Summer: 8 weeks - 6 hours of lecture per week

Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Letter grade. Final exam required.
STAT 157 Seminar on Topics in Probability and Statistics 3 Units
Terms offered: Fall 2017, Fall 2016, Spring 2016
Substantial student participation required. The topics to be covered each semester that the course may be offered will be announced by the middle of the preceding semester; see departmental bulletins. Recent topics include: Bayesian statistics, statistics and finance, random matrix theory, high-dimensional statistics.
Seminar on Topics in Probability and Statistics: Read More [+]

Rules & Requirements

Prerequisites: Mathematics 53-54, Statistics 134, 135. Knowledge of scientific computing environment (R or Matlab) often required. Prerequisites might vary with instructor and topics

Repeat rules: Course may be repeated for credit with consent of instructor. Course may be repeated for credit when topic changes.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of seminar per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Seminar on Topics in Probability and Statistics: Read Less [-]

STAT 158 The Design and Analysis of Experiments 4 Units
Terms offered: Spring 2018, Spring 2016, Spring 2015
An introduction to the design and analysis of experiments. This course covers planning, conducting, and analyzing statistically designed experiments with an emphasis on hands-on experience. Standard designs studied include factorial designs, block designs, latin square designs, and repeated measures designs. Other topics covered include the principles of design, randomization, ANOVA, response surface methodology, and computer experiments.
The Design and Analysis of Experiments: Read More [+]

Rules & Requirements

Prerequisites: Statistics 134 and 135 or consent of instructor. Statistics 135 may be taken concurrently. Statistics 133 is recommended

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.
The Design and Analysis of Experiments: Read Less [-]

STAT 159 Reproducible and Collaborative Statistical Data Science 4 Units
Terms offered: Fall 2017, Fall 2016, Fall 2015
A project-based introduction to statistical data analysis. Through case studies, computer laboratories, and a term project, students will learn practical techniques and tools for producing statistically sound and appropriate, reproducible, and verifiable computational answers to scientific questions. Course emphasizes version control, testing, process automation, code review, and collaborative programming. Software tools may include Bash, Git, Python, and LaTeX.
Reproducible and Collaborative Statistical Data Science: Read More [+]

Rules & Requirements

Prerequisites: Statistics 133, Statistics 134, and Statistics 135 (or equivalent)

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 2 hours of laboratory per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.
Reproducible and Collaborative Statistical Data Science: Read Less [-]

STAT H195 Special Study for Honors Candidates 1 - 4 Units
Terms offered: Spring 2015, Fall 2014, Fall 2010
Special Study for Honors Candidates: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit.

Hours & Format

Fall and/or spring: 15 weeks - 0 hours of independent study per week

Summer:
6 weeks - 1-5 hours of independent study per week
8 weeks - 1-4 hours of independent study per week

Additional Details

Subject/Course Level: Statistics/Undergraduate

Grading/Final exam status: Letter grade. Final exam not required.
Special Study for Honors Candidates: Read Less [-]
STAT 197 Field Study in Statistics 1 - 3 Units
Terms offered: Spring 2018, Spring 2017, Fall 2015
Supervised experience relevant to specific aspects of statistics in off-campus settings. Individual and/or group meetings with faculty.
Field Study in Statistics: Read More [+]
Rules & Requirements
Credit Restrictions: Enrollment is restricted; see the Introduction to Courses and Curricula section of this catalog.
Repeat rules: Course may be repeated for credit.
Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of fieldwork per week
Summer:
6 weeks - 3-8 hours of fieldwork per week
8 weeks - 2-6 hours of fieldwork per week
10 weeks - 1.5-4.5 hours of fieldwork per week
Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Field Study in Statistics: Read Less [-]

STAT 198 Directed Study for Undergraduates 1 - 3 Units
Terms offered: Spring 2016, Fall 2015, Spring 2015
Special tutorial or seminar on selected topics.
Directed Study for Undergraduates: Read More [+]
Rules & Requirements
Prerequisites: Consent of instructor
Repeat rules: Course may be repeated for credit.
Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of directed group study per week
Summer:
6 weeks - 1-4 hours of independent study per week
8 weeks - 1-3 hours of independent study per week
10 weeks - 1-3 hours of independent study per week
Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.
Directed Study for Undergraduates: Read Less [-]

STAT 199 Supervised Independent Study and Research 1 - 3 Units
Terms offered: Spring 2018, Spring 2017, Fall 2015
Supervised Independent Study and Research: Read More [+]
Rules & Requirements
Repeat rules: Course may be repeated for credit.
Hours & Format
Fall and/or spring: 15 weeks - 1-3 hours of independent study per week
Summer:
6 weeks - 1-4 hours of independent study per week
8 weeks - 1-3 hours of independent study per week
10 weeks - 1-3 hours of independent study per week
Additional Details
Subject/Course Level: Statistics/Undergraduate
Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.