Welcome to the Data Science Undergraduate Major Town Hall

Proposal Overview and Discussion

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November 2, 2017
Town Hall Plan

- Share an overview of the proposed Data Science undergraduate degree
- Hear your perspectives and questions
- Answer as many as possible
- Hear from chairs, faculty, advisors, …
- Hear from student teams, supporting students and creating opportunities to contribute
- Answer more questions
Caveats

• The approval process is still underway, with many stages ahead to ensure a high quality, well-supported program.
• Everything we present today is preliminary – it is only to try to keep the community well-informed as that process moves along.
• Only after the program is finalized, i.e., approved and implemented, can any statement be final.
• Today is informational.
Divisional Ad Hoc Major/Minor Committee

- Alexei Efros, EECS
- Ani Adhikari, Statistics
- David Culler, EECS
- Deborah Nolan, Statistics
- Haiyan Huang, Statistics
- James Demmel, Math, EECS
- John DeNero, EECS
- Joseph Gonzalez, EECS
- Michael Jordan, Statistics, EECS, CCB
- Philip Stark, Statistics
- Alexey Pozdnukhov, CEE
- Anca Dragan, EECS
- Carl Boettiger, ESPM
- Cathryn Carson, History
- Charis Thompson, Gender and Women’s Studies
- Daniel Rokhsar, MCB, Physics
- Deirdre Mulligan, I–School, Law
- Heather Haveman, Sociology
- Jack Gallant, Psychology, Neuroscience
- Jasjeet Sekhon, Political Science, Statistics
- Joseph Hellerstein, EECS
- Joshua Blumenstock, I–School
- Laurel Larsen, Geography
- Laurent El Ghaoui, EECS
- Lisa Barcellos, Public Health, CCB
- Lisa Garcia Bedolla, Education
- Nicolaas Veldhuis, Near Eastern Studies
- Paul Grigas, IEOR
- Paul Waddell, City and Regional Planning
- Perry De Valpine, ESPM
- Philip Marcus, Mechanical Engineering
- Ronald Cohen, Chemistry, Earth and Planetary Science
- Uros Seljak, Physics
- Zsolt Katona, Haas
Goals for a Data Science Major

• Build knowledge and skills for students to engage in data science upon graduation
  – Inferential & Computational Thinking in the real world
  – Framing and Tackling Questions, Bridging Domains
  – Data lifecycle, management, workflow
  – Principles & techniques, their limits & trade-offs,
  – Foundations and Technology
  – Software engineering & Solid professional practice
  – Communication of results, Decision making
  – Ethics & contexts of data

• Develop connections among computation, inference, domain context, and society

• Provide integrative course experiences in both the lower division & upper division.
Structure of the Proposed Data Science Major

Designed to be available as a BA in L&S and BS in CoE Group Major (SR 810.B 30–36 UDiv units).
Approval target Fall 2017.
Expanding the categories

1 of **Stat140**, IEOR 172, EE126, Stat 134
1 of **Data102**, CS189, IEOR 142, Stat 154
1+2 in one of several lists

2 of list in EECS, IEOR, Info, Stat, …

Calculus
Linear Algebra

**Data8**: Foundations of Data Science

**Data100**: Principles & Techniques of Data Science

Computational & Inferential Depth
Modeling, Learning, & Decision Making
Probability
Domain Emphasis
Human Contexts & Ethics
Electives

Domain Emphasis
College Breadth & Electives

Program Structures
Data Structures

1 of list in BIOE, CYPLAN, ENE, ENVECON, ETH STD, GEOG, INFO, ISF, BUC, POL SCI, STS, SOCIOl (Data 104)
Major Requirements

Lower Division (25+ units):
- Foundations of data science (Data 8)
- Calculus (Math 1A/1B or equivalent)
- Linear algebra (Math 54 or EE 16A/16B)
- Program structures (CS 61A or CS 88 or E7)
- Data structures (CS 61B)
- Domain Emphasis (application context or theory; may fulfill breadth req.)

Upper Division (30 units):
- Principles & Techniques (Data 100)
- Modeling & Learning (**Data 102** or CS 189 or Stat 154 or IEOR 142)
- Probability (Stat 140 or Stat 134 or EE 126)
- 7+ units of computational, inferential, analytical depth
- 7+ units of Domain Emphasis (application context or theory)
- 3+ units of Human Contexts and Ethics
Substitutions for Current Students

Data 8 is fulfilled by:
• Stat 133 + CS 61A
• Stat 20/21 + CS 61A

Data Science 100 is fulfilled by:
• CS 194-16
Major Calculus Requirement

The standard calculus path is 1A and 1B
Alternative paths are:
  • 10A, 10B, 1B
  • 16A, 16B, 1B
Computational & Inferential Depth

- CS 161. Computer Security
- CS 162. Operating Systems and Systems Programming
- CS 164. Programming Languages and Compilers
- CS 168. Introduction to the Internet: Architecture and Protocols
- CS 169. Software Engineering
- CS 170. Efficient Algorithms and Intractable Problems
- CS 186. Introduction to Database Systems
- CS 188. Introduction to Artificial Intelligence
- EECS 127. Optimization Models in Engineering
- EE 123. Digital Signal Processing
- EE 129. Neural and Nonlinear Information Processing
- ESPM 174 Design and Analysis of Ecological Research (4 units)
- IEOR 115 Industrial and Commercial Data Systems (3)
- IEOR 135 Applied Data Science with Venture Applications (3)
- INFO 159 Natural Language Processing (3)
- INFO 190-1 Introduction to Data Visualization (3)
- Phys 188. Data science and Bayesian statistics (pending COCI approval)
- Stat 135. Concepts of Statistics
- Stat 151A. Linear Modelling: Theory and Applications
- Stat 152. Sampling Surveys
- Stat 153. Introduction to Time Series
- Stat 158. The Design and Analysis of Experiments
- Stat 159. Reproducible and Collaborative Statistical Data Science
Goals for Domain Emphases

• Bring data science students into the context of a domain
  – Learn vocabulary and range of methods of study
  – Gain theoretical foundations and cultural outlook

• Roughly half a minor (1 lower div + 2 upper div of 3-4 units each)

• 3 models
  – Prepare to engage in data-intensive inquiry in an application domain
    • e.g, computational molecular biology
  – Gain depth in a theoretical area –
    • e.g, efficiency & optimization
  – Explore intellectual threads weaving across departments
    • E.g, creative/performative uses of data
**Goals for Human Contexts & Ethics**

- Provide understanding of human and societal structures shaping data science activity
- Gain practice in critical thinking, reflection, and decision-making in context
- Criteria for inclusion
  - Give significant attention to data analytics
  - Provide access to forms of academic inquiry in humanities, social sciences, or related professional fields
  - Use reflective inquiry, writing, analysis, project work, or practice (engaged inquiry)
  - Surface issues of individual or societal choices in complex situations
  - 3 or 4 units
Human Contexts and Ethics (current)

- AMERSTD/AFRICAM C134 – Information Technology & Society (4 units)
- BIO ENG 100 – Ethics in Science and Engineering (3 units)
- CY PLAN 101 – Introduction to Urban Data Analytics (4 units)
- ESPM C167/PUB HLTH C160 – Environmental Health and Development (4 units)
- INFO 190 – Data Ethics (units TBD, pending prep. for COCI)
- ISF 100J – The Social Life of Computing (4 units)
- STS/ISF C100 / HIST C182C – Introduction to Science, Technology, & Society (4 units)

- “Data 104” in early stage of design
Domain Emphases – initial list

- Applied Mathematics and Modeling
- Business Analytics
- Cognition and Artificial Intelligence
- Computational Imaging
- Computational Linguistics and Natural Language Processing
- Computational Molecular Biology
- Digital Humanities and Data Arts
- Ecology and Environment
- Econometrics
- Environmental Economics
- Evolution, Genetics and Biodiversity
- Geospatial Information and Technology
- Health Sciences and Human Biology
- Human Behavior Modeling
- Industrial Analytics
- Inequalities in Society
- Optimization and Efficiency
- Organizations and the Economy
- Physical Science Analytics
- Psychology
- Quantitative Social Science
- Robotics
- Social Policy and Law
- Social Welfare, Health, and Poverty
- Urban Planning and Sustainable Development & Engineering
Draft Domain Emphases

Information Only - Proposal in Approval Process
Applied Mathematics and Modeling

- MATH 53. Multivariable Calculus (4 units)
- MATH 110. Linear Algebra (4 units)
- MATH 128A. Numerical Analysis (4 units)
- MATH 128B. Numerical Analysis (4 units)
- IEOR 162. Linear Programming and Network Flows (3 units)
- IEOR 173. Introduction to Stochastic Processes (3 units)
- STAT 150. Stochastic Processes (3 units)
- CEE C133 / ME C180 Engineering Analysis Using the Finite Element Method (3 units)
- CS 267. Applications of Parallel Computers (3 units)
Business Analytics

- ECON 1. Introduction to Economics (4 units)
- UGBA 104. Analytic Decision Modeling Using Spreadsheets (3 units)
- UGBA 137. Introduction to Financial Engineering (3 units) (piloted as a topics course, to be regularized)
- UGBA 141. Production and Operations Management (3 units)
- UGBA 161. Marketing Research: Data and Analytics (3 units)
- UGBA 190T. Topics in Business Analytics and Data Mining (3 units) (to be regularized)
- UGBA 192L. Applied Impact Evaluation (2 units)
Cognition and Artificial Intelligence

- COG SCI 1. Introduction to Cognitive Science (4 units)
- MATH 53. Multivariable Calculus (4 units)
- MCELLBI/PSYCH C61. Brain, Mind, and Behavior (3 units)
- MCELLBI/PSYCH C64. Exploring the Brain: Introduction to Neuroscience (3 units)
- COMPSCI 188. Introduction to Artificial Intelligence (4 Units)
- EECS 127. Optimization Models in Engineering (4 units)
- COG SCI C120 / PSYCH C120 Basic Issues in Cognition (3 units)
- COG SCI/PSYCH C127 Cognitive Neuroscience (3 units)
- COG SCI 131. Computational Models of Cognition (4 units)
- COG SCI 190. Data Science and Cognition (3 units) (piloted as a topics course, to be regularized)
- PSYCH 114 Biology of Learning (3 units)
- PSYCH 117 Human Neuropsychology (3 units)
- PSYCH 122 Introduction to Human Learning and Memory (3 units)
Computational Imaging

- EL ENG 16B Designing Information Devices and Systems II (4 Units)
- COMPSCI 184. Foundations of Computer Graphics (4 units)
- EECS C145B / BIOE C165. Medical Imaging Signals and Systems (4 units)
- NUC ENG 107. Introduction to Imaging (3 units)
- EPS 122. Physics of the Earth and Planetary Interiors (3 units)
- BIO ENG 164. Optics and Microscopy (4 units)
- PSYCH 117. Human Neuropsychology (3 units)
- PSYCH C127. Cognitive Neuroscience (3 units)
- ASTRON 120. Optical and Infrared Astronomy Laboratory (4 units)
- ASTRON 121. Radio Astronomy Laboratory (4 units)
- HISTART 192DH. Digital Imaging and Forensic Art History (4 units)
Computational Linguistics and Natural Language Processing

- LINGUIS 5 Language and Linguistics 4 Units
- LINGUIS 110. Introduction to Phonetics and Phonology (4 units)
- LINGUIS 113. Experimental Phonetics (3 units)
- LINGUIS C160 / COGSCI C140. Quantitative Methods in Linguistics (4 units)
- INFO 159. Natural Language Processing (3 units)
Computational Molecular Biology

- BIOLOGY 1A. General Biology (4 units)
- CMPBIO 175. Introduction to Computational Biology and Precision Medicine (3 units)
- MATH 127. Mathematical and Computational Methods in Molecular Biology (4 units)
- COMPSCI 176. Algorithms for Computational Biology (4 units)
- MCELLBI 100B. Biochemistry: Pathways, Mechanisms, and Regulation (4 units)
- MCELLBI 104. Genetics, Genomics and Cell Biology (4 units)
- MCELLBI 110. Molecular Biology: Macromolecular Synthesis and Cellular Function (4 units)
- MCELLBI 130. Cell and Systems Biology (4 units)
- MCELLBI 137. Physical Biology of the Cell (3 units)
- MCELLBI 140. General Genetics (4 units)
- BIO ENG 131. Introduction to Computational Molecular and Cell Biology (4 units)
- BIO ENG 143. Computational Methods in Biology (4 units)
- BIO ENG 144. Introduction to Protein Informatics (4 units)
- MCELLBI 160. Cellular and Molecular Neurobiology (4 units)
- MEC ENG 120. Computational Biomechanics Across Multiple Scales (3 units)
Digital Humanities and Data Arts

- ART W23AC. Data Arts (4 units)
- HISTORY 88. How Does History Count (2 units) (likely to evolve to 3 units)
- L&S 88. Rediscovering Texts as Data (2 units) (to be regularized within a departmental rubric)
- HISTORY 100. Text Analysis for Digital Humanists and Social Scientists (4 units) (piloted as a topics course, to be regularized)
- HISTORY 100. Calculating Americans: Big Histories of Small Data (4 units) (piloted as a topics course, to be regularized)
- HISTORY 104. The Craft of History (4 units)
- HISTART 192DH Digital Imaging and Forensic Art History (4 units)
- INFO 159. Natural Language Processing (3 units)
- INFO 190-1 Introduction to Data Visualization (3 units)
- THEATER 166 / NWMEDIA 190. Making Sense of Cultural Data (units TBD) (piloted as a topics course, to be regularized)
- ENGLISH/HISTART C181. Digital Humanities, Visual Cultures (4 units)
- NESTUD 190. Introduction to Digital Humanities: From Analog to Digital (units TBD) (piloted as a topics course, to be regularized)
Ecology and the Environment

- ESPM 2. The Biosphere (3 units)
- ESPM 6. Environmental Biology (3 units)
- ESPM 15. Introduction to Environmental Sciences (3 units)
- GEOG 40. Introduction to Earth System Science (4 units)
- ESPM/L&S C46. Climate Change and the Future of California (4 units)
- ESPM 72. Introduction to Geographic Information Systems (3 units)
- ESPM 72. Introduction to Geographic Information Systems (3 units)
- ESPM 88B. Data Sciences in Ecology and the Environment (2 units, may evolve to 3)
- ESPM 100. Environmental Problem Solving (4 units)
- ESPM 100ES. Introduction to the Methods of Environmental Science (4 units) (Open only to Environmental Science double majors)
- ESPM 102B. Natural Resource Sampling (2 units)
- ESPM 102BL. Laboratory in Natural Resource Sampling (2 units)
- ESPM 102C. Resource Management (4 units)
- ESPM C103 / INTEGBIO C156. Principles of Conservation Biology (4 units)
- ESPM C104 / ENVECON C115. Modeling and Management of Biological Resources (4 units)
- INTEGBIO/ESPM C105. Natural History Museums and Biodiversity Science (3 units)
- ESPM 108B. Environmental Change Genetics (3 units)
- ESPM 111. Ecosystem Ecology (4 units)
- INTEGBI 153. Ecology (3 units)
- INTEGBI 170LF. Methods in Population and Community Ecology (3 units)
- EPS/ESPM C129. Biometeorology (3 units)
- GEOG C136/ESPM C130. Terrestrial Hydrology (4 units)
- ESPM 157. Data Science in Global Change Ecology (3 units)
- ESPM C170 / EPS C183. Carbon Cycle Dynamics (3 units)
- ESPM 174. Design and Analysis of Ecological Research (4 units) (if equivalent courses not already taken)
- ESPM/EPS C180 / CIV ENG C106. Air Pollution (3 units)
- ESPM/ENVECON C183. Forest Ecosystem Management (4 units)
Econometrics

- ECON 1. Introduction to Economics (4 units)
- ECON 100A. Economic Analysis--Micro (4 units)
- ECON/MATH C103. Introduction to Mathematical Economics (4 units)
- ENVECON/IAS C118. Introductory Applied Econometrics (4 units)
- ECON 119. Psychology and Economics (4 units)
- ECON/PUB POL C142 / POL SCI C131A. Applied Econometrics and Public Policy (4 units)
Environmental Economics

● ENVECON C1 / ECON C3. Introduction to Environmental Economics and Policy (4 units)
● ENVECON 100. Microeconomic Theory with Application to Natural Resources (4 units)
● ENVECON C101 / ECON C125. Environmental Economics (4 units)
● ENVECON C115 / ESPM C104. Modeling and Management of Biological Resources (4 units)
● ENVECON 141. Agricultural and Environmental Policy (4 units)
Evolution, Genetics, and Biodiversity

- BIOLOGY 1A (4 units) or 1B (4 units). General Biology (depending on UD choices)
- ESPM/INTEGBI C105. Natural History Museums and Biodiversity Science (3 units)
- ESPM 108B. Environmental Change Genetics (3 units)
- ESPM 152. Global Change Biology (3 units)
- INTEGBI 113L. Paleobiological Perspectives on Ecology and Evolution (4 units)
- INTEGBI 141. Human Genetics (4 units) OR INTEGBI 164. Human Genetics and Genomics (4 units)
- INTEGBI 160. Evolution (4 units) OR INTEGBI 167. Evolution and Earth History: From Genes to Fossils (4 units)
- INTEGBI 161. Population and Evolutionary Genetics (4 units)
- INTEGBI 162. Ecological Genetics (4 units)
- INTEGBI 172. Coevolution: From Genes to Ecosystems (4 units)
- MCELLBI 143. Evolution of Genomes, Cells and Development (3 units)
- MCELLBI/PLANTBI C148. Microbial Genetics and Genomics (4 units)
- MCELLBI 149. The Human Genome (3 units)
Evolution, Genetics, and Biodiversity

- BIOLOGY 1A (4 units) or 1B (4 units). General Biology (depending on UD choices)
- ESPM/INTEGBI C105. Natural History Museums and Biodiversity Science (3 units)
- ESPM 108B. Environmental Change Genetics (3 units)
- ESPM 152. Global Change Biology (3 units)
- INTEGBI 113L. Paleobiological Perspectives on Ecology and Evolution (4 units)
- INTEGBI 141. Human Genetics (4 units) OR INTEGBI 164. Human Genetics and Genomics (4 units)
- INTEGBI 160. Evolution (4 units) OR INTEGBI 167. Evolution and Earth History: From Genes to Fossils (4 units)
- INTEGBI 161. Population and Evolutionary Genetics (4 units)
- INTEGBI 162. Ecological Genetics (4 units)
- INTEGBI 172. Coevolution: From Genes to Ecosystems (4 units)
- MCELLBI 143. Evolution of Genomes, Cells and Development (3 units)
- MCELLBI/PLANTBI C148. Microbial Genetics and Genomics (4 units)
- MCELLBI 149. The Human Genome (3 units)
Geospatial Information and Technology

- GEOG 1. Global Environmental Change (4 units)
- ESPM 72. Introduction to Geographic Information Systems (3 units)
- GEOG 80. Digital Worlds: An Introduction to Geospatial Technologies (4 units)
- GEOG 88. Data Science Applications in Geography (2 units)
- ESPM 88A. Exploring Geospatial Data (2 units) (likely to evolve to 3 units)
- CIVENG 88. Data Science for Smart Cities (2 units)
- GEOG 183. Cartographic Representation (5 units)
- GEOG 185. Earth System Remote Sensing (3 units)
- GEOG 187. Geographic Information Analysis (4 units)
- GEOG/LD ARCH C188. Geographic Information Systems (4 Units)
- ESPM 137. Landscape Ecology (3 units)
- ESPM 164. Geographic Information Systems for Environmental Science and Management (3 units)
- ESPM 172. Photogrammetry and Remote Sensing (3 units)
- ESPM 173. Introduction to Ecological Data Analysis (3 units)
- EPS 101. Field Geology and Digital Mapping (4 units)
Health Sciences and Human Biology

- BIOLOGY 1A. General Biology (4 units)
- MCELLBI 50. Immune System and Disease (4 units)
- MCELLBI 55. Plagues and Pandemics (3 units)
- DEMOG 110. Introduction to Population Analysis (3 units)
- INTEGBI 131. General Human Anatomy (3 units)
- INTEGBI 132. Survey of Human Physiology (4 units) OR MCELLBI 136. Physiology (4 units)
- INTEGBI 123AL. Exercise and Environmental Physiology with Laboratory (5 units)
- INTEGBI 164. Human Genetics and Genomics (4 units)
- MCELLBI 132. Biology of Human Cancer (4 units)
- MCELLBI 150. Molecular Immunology (4 units)
- MCELLBI 165. Neurobiology of Disease (3 units)
- NUSCTX 110. Toxicology (4 units)
- NUSCTX 115. Principles of Drug Action (2 units)
- NUSCTX 121. Computational Toxicology (3 units)
- NUSCTX 160. Metabolic Bases of Human Health and Diseases (4 units)
- PUB HLTH 150A. Introduction to Epidemiology (4 units)
Human Behavior Modeling

- MCELLBI/PSYCH C61. Brain, Mind, and Behavior (3 units)
- COGSCI 131. Computational Models of Cognition (4 units)
- COMPSCI 188. Introduction to Artificial Intelligence (4 units)
- ECON C110 / POLI SCI C135. Game Theory in the Social Sciences (4 units)
- ECON 119. Psychology and Economics (4 units)
- PSYCH C113 / INTEGBI C143A. Biological Clocks: Physiology and Behavior (3 units)
Industrial Analytics

- MATH 53. Multivariable Calculus (4 units)
- ENGIN 120. Principles of Engineering Economics (3 units)
- IEOR 115. Industrial and Commercial Data Systems (3 units)
- IEOR 130. Methods of Manufacturing Improvement (3 units)
- IEOR 150. Production Systems Analysis (3 units)
- IEOR 151. Service Operations Design and Analysis (3 units)
- IEOR 153. Logistics Network Design and Supply Chain Management (3 units)
- IEOR 166. Decision Analytics (3 units)
- IEOR 173. Introduction to Stochastic Processes (3 units)
- UGBA 137. Introduction to Financial Engineering (3 units) (piloted as a topics course, to be regularized)
- UGBA 141. Production and Operations Management (3 units)
- UGBA 190T. Topics in Business Analytics and Data Mining (3 units) (to be regularized)
Inequalities in Society

- SOCIOL 5. Evaluation of Evidence (4 units)
- AFRICAM 101. Research Methods for African American Studies (4 units)
- AFRICAM 111. Race, Class, and Gender in the United States (3 units)
- ETH STD 101A. Social Science Methods in Ethnic Studies (4 units)
- ETH STD 101B. Humanities Methods in Ethnic Studies (4 units)
- GWS 131. Gender and Science (4 units)
- GEOG C155 / AFRICAM C156. Race, Space, and Inequality (4 units)
- SOCIOL 130 / SOCIOL 130AC. Social Inequalities (4 units)
- PSYCH 167. Stigma and Prejudice (3 units)
- PUB POL C103. Wealth and Poverty (4 units)
- PUB POL 117AC. Race, Ethnicity, and Public Policy (4 units)
- SOCIOL 111. Sociology of the Family (4 units)
- SOCIOL 113. Sociology of Education (4 units)
- SOCIOL 124. Sociology of Poverty (4 units)
- SOCIOL 131. Race and Ethnic Relations (4 units)
- SOCIOL 133. Sociology of Gender (4 units)
Optimization and Efficiency

- MATH 53. Multivariable Calculus (4 units)
- EECS 127. Optimization Models in Engineering (4 units)
- EE 144. Fundamental Algorithms for Systems Modeling, Analysis, and Optimization (4 units)
- IEOR 160. Nonlinear and Discrete Optimization (3 units)
- IEOR 162. Linear Programming and Network Flows (3 units)
- IEOR 130. Methods of Manufacturing Improvement (3 units)
- IEOR 190. Introduction to Optimization Modeling (units TBD) (to be regularized as IEOR 164)
Organizations and the Economy

- SOCIOL 5. Evaluation of Evidence (4 units)
- SOCIOL 110. Organizations and Social Institutions (4 units)
- SOCIOL 120. Economy and Society (4 units)
- SOCIOL 116. Sociology of Work (4 units)
- SOCIOL 119S. Organizational Strategy and Design (4 units)
- SOCIOL 121. Innovation and Entrepreneurship (4 units)
- ECON 121. Industrial Organization and Public Policy (4 units)
- ENVECON 142. Industrial Organization with Applications to Agriculture and Natural Resources (4 units)
- GWS 139. Women, Gender, and Work (4 units)
Physical Science Analytics

- PHYS 77. Introduction to Computational Techniques in Physics (3 units)
- PHYS 129. Particle Physics (4 units)
- PHYS/ASTRON C161. Relativistic Astrophysics and Cosmology (4 units)
- ASTRON 121 Radio Astronomy Laboratory (4 units)
- EPS 101. Field Geology and Digital Mapping (4 units)
- EPS 122. Physics of the Earth and Planetary Interiors (3 units)
- EPS C183 / ESPM C170. Carbon Cycle Dynamics (3 units)
- GEOG C136 / ESPM C130. Terrestrial Hydrology (4 units)
- GEOG C139 / EPS C181. Atmospheric Physics and Dynamics (3 units)
- NUC ENG 130. Analytical Methods for Non-proliferation (4 units)
- NUC ENG 155. Introduction to Numerical Simulations in Radiation Transport (3 units)
Psychology

● PSYCH 1. General Psychology (3 units)
● PSYCH 127. Cognitive Neuroscience (3 units)
● PSYCH 134. Health Psychology (3 units)
● PSYCH 102. Methods for Research in Psychological Sciences -- some overlap with other courses in data science major
● PSYCH 143. Language Acquisition (3 units)
● PSYCH 167. Stigma and Prejudice (3 units)
● ECON 119. Psychology and Economics (4 units)
● UGBA 160. Consumer Behavior (3 units)
Quantitative Social Sciences

- SOCIOL 5. Evaluation of Evidence (4 units)
- POLI SCI 3. Introduction to Empirical Analysis and Quantitative Methods (4 units)
- ECON C110. Game Theory in the Social Sciences (4 units)
- ENVECON C118/IAS C118. Introductory Applied Econometrics (4 units)
- DEMOG 110. Introduction to Population Analysis (3 units)
- SOCIOL 106. Quantitative Sociological Methods (4 units)
- MASSC 130. Research Methods in Media Studies (4 units)
- PHILOS 141. Philosophy and Game Theory (4 units)
- POLI SCI 133. Selected Topics in Quantitative Methods (4 units)
- DEMOG/SOCIOL C126. Sex, Death, and Data (4 units)
- SOCIOL 165. Social Networks (4 units)
- DEMOG/ECON C175. Economic Demography (4 units)
- DEMOG 180. Social Networks (3 units)
Robotics

- MATH 53. Multivariable Calculus (4 units)
- CS 188. Introduction to Artificial Intelligence (4 units)
- EE 120. Signals and Systems (4 units)
- EE C106A / BIO ENG C125. Introduction to Robotics (4 units)
- EE C106B / BIO ENG C125B. Robotic Manipulation and Interaction (4 units)
- EE 129. Neural and Nonlinear Information Processing (3 units)
- EE C128 / MEC ENG C134. Feedback Control Systems (4 units)
- MEC ENG 136 Introduction to Control of Unmanned Aerial Vehicles (3 units)
Social Policy and Law

- SOCIOL 5. Evaluation of Evidence (4 units)
- PUB POL 101. Introduction to Public Policy Analysis (4 units)
- PUB POL/ECON C142 / POLI SCI C131A. Applied Econometrics and Public Policy (4 units)
- ECON 121. Industrial Organization and Public Policy (4 units)
- GWS 132AC. Gender, Race, and Law (4 units)
- POL SCI 124M. The Scientific Study of International Conflict (4 units)
- SOC WEL 112. Social Welfare Policy (3 units)
- SOC WEL 181. Social Science and Crime Prevention Policy (3 Units)
- SOCIOL 111P. Families, Inequality and Social Policy (4 units)
- LEGALST 102. Policing and Society (4 units)
- LEGALST 160. Punishment, Culture, and Society (4 units)
- POLECON 111. Poverty and Social Policy (3 units)
- ENVECON 142. Industrial Organization with Applications to Agriculture and Natural Resources (4 units)
- ENVECON 145. Health and Environmental Economic Policy (4 units)
- ENVECON 147. Regulation of Energy and the Environment (4 units)
Social Welfare, Health, and Poverty

- SOCIOL 5. Evaluation of Evidence (4 units)
- GPP 105. The Ethics, Methods, and Pragmatics of Global Practice (4 units)
- GPP 115. Global Poverty: Challenges and Hopes in the New Millennium (4 units)
- GLOBAL 102. Critical Thinking in Global Studies (4 units)
- GWS 130AC. Gender, Race, Nation, and Health (4 units)
- LEGALST 158. Law and Development (4 units)
- PB HLTH 112. Global Health: A Multidisciplinary Examination (4 units)
- PB HLTH 145. Statistical Analysis of Continuous Outcome Data (4 units)
- PB HLTH/SOCIOL C155. Sociology of Health and Medicine (4 units)
- PB HLTH C160 / ESPM C167. Environmental Health and Development (4 units)
- PB HLTH 181. Poverty and Population (3 units)
- POLECON 111. Poverty and Social Policy (3 units)
- SOCIOL 115G. Global Health and Social Justice (4 units)
- SOC WEL 112. Social Welfare Policy (3 units)
- SOC WEL 181. Social Science and Crime Prevention Policy (3 units)
- INFO 181. Technology and Poverty (3 units)
Urban Planning and Sustainable Development & Engineering

- CIV ENG 11. Engineered Systems and Sustainability (3 units)
- LD ARCH 12. Environmental Science for Sustainable Development (4 units)
- CIVENG 88A. Data Science for Smart Cities (2 units)
- CIV ENG 107. Climate Change Mitigation (3 units)
- CIV ENG 110. Water Systems of the Future (3 units)
- CIV ENG 156. Infrastructure Planning and Management (3 units)
- LD ARCH 130. Sustainable Cities and Landscapes (4 units)
- GEOG 181. Urban Field Study (4 units)
- GEOG/LD ARCH C188. Geographic Information Systems (4 units)
- CY PLAN 101. Urban Data Analytics (4 units)
- CY PLAN 119. Planning for Sustainability (3 units)