DATA SCIENCE FLOW CHART

THIS FLOW CHART IS ONLY A GUIDE. PLEASE REFER TO YOUR ADVISOR FOR QUESTIONS

1. DS 110 Orientation R Cr
   - Math 165 Calculus I (Pre-req ALEKS placement or C- in Math 143) 4 Cr
   - Com S 127 Intro to Computer Programming - Python 4 Cr
   - Engl 150 (If English ACT 24 or higher, placement into English 250) 3 Cr
   - Lib 160 (Take with Engl 150/250) 1 Cr
   - Social Science 3 Cr

2. DS 110 Orientation R Cr
   - Math 166 Calculus II (Pre-req C- in Math 165) 4 Cr
   - Com S 227 Object-oriented Programming - Java (Pre-req Cr/E in Math 143 or higher; Com S 127 or Cpr E 185 or S E 185 or E E 285 or DS 201) 4 Cr
   - Stat Option Stat 201, 101, 104, or 105 (Check pre-req) 4 Cr
   - Engl 250 (Pre-req Engl 150 or exempt from Engl 150) 3 Cr

3. DS 201 Introduction to Data Science 3 Cr
   - Math 265 Calculus III (Pre-req C- in Math 166 or Math 166H) 4 Cr
   - Com S 228 Introduction to Data Structures (Pre-req C- in Com S 227; Cr/E Math 165) 3 Cr
   - Stat 301 Intermediate Statistical Concepts & Methods (Pre-req Stat 101 or 104 or 105 or 201) 4 Cr
   - Arts & Humanities 3 Cr

4. DS 202 Data Acquisition and Exploratory Data Analysis (Pre-req DS 201) 3 Cr
   - Math 207 Matrices and Linear Algebra (Pre-req 2 semesters calculus) 3 Cr
   - Choose Option Com S 230 or Cpr E 310 (Check pre-req) 4 Cr
   - Social Science 3 Cr
   - Arts & Humanities 3 Cr

5. DS 303 Concepts & Applications of Machine Learning (Pre req DS 202; Math 207, Math 265, Stat 301) 3 Cr
   - Stat 347 Probability & Statistical Theory for Data Science (Pre-req Math 207 or 317; Math 265, Stat 301 or 326) 4 Cr
   - Com S 311 Introduction to the Design & Analysis of Algorithms (Pre req C- in Com S 228; Math 166, Engl 150; Com S 230 or Cpr E 310) 3 Cr
   - Elective or World Language 3-4 Cr
   - Arts & Humanities 3 Cr

6. Com S 363 Introduction to Database Management Systems (Pre req: C- in Com S 228; Math 165, Engl 250) 3 Cr
   - Stat 477 Introduction to Categorical Data Analysis (Pre req Stat 301 or 326 or 401 or 587) 3 Cr
   - Elective or World Language 3-4 Cr
   - Arts & Humanities 3 Cr
   - Natural Science 4 Cr

7. Choose Option
   - Engl 302, 314, or 332 (Pre-req Engl 250 and junior classification) 3 Cr
   - Application Emphasis Area 3 Cr
   - Application Emphasis Area 3 Cr
   - Natural Science 4 Cr
   - Social Science 3 Cr

8. DS 401 Data Science Capstone (Pre-req DS 301 or DS 303) 3 Cr
   - Cpr E 419 Software Tools for Large Scale Data Analysis (Pre req Com S 363 or Com S 352 or Cpr E 308; Com S 228) 4 Cr
   - Application Emphasis Area 3 Cr
   - Electives 300+ 3-6 Cr

ALEKS Math Placement
- Math 140 (3 cr) College Algebra
- Math 143 (4 cr) Calculus Prep
- Math 165 (4 cr) Calculus I

Curriculum Requirements
- World Language
  - 1 year at college level or
  - 3 years at high school
- Arts and Humanities - 12 cr
  - Select credits from the LAS approved list on degree audit
- Social Sciences - 9 cr
  - Select credits from the LAS approved list on degree audit
- Natural Sciences - 8 cr
  - Select credits from the LAS approved list on degree audit
- International Perspectives AND U.S. Diversity - 6 cr
  - Select credits from the LAS approved list on degree audit
- A student must take at least 9 credits from any single application emphasis area and may choose from: Big Data; Engineering Applications; Optimization; Security; Software Analytics; Statistics; Computational Biology; and Numerical Analysis.

Graduation Requirements
- Minimum of 120 Cr.
- All students are required to take at least 45 hours of courses at the 300+ level or above.
- This may require taking additional electives.
- Last 32 credits must be taken at Iowa State.
- Advisor can waive 6 of the last 32 credits taken at Iowa State.
**APPLICATION EMPHASIS AREAS**

*PAY ATTENTION TO SEMESTER OFFERINGS FOR COURSES*

<table>
<thead>
<tr>
<th>1</th>
<th>BIG DATA</th>
<th>2</th>
<th>ENGINEERING APPLICATIONS</th>
<th>3</th>
<th>OPTIMIZATION</th>
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<tbody>
<tr>
<td><strong>Com S 424</strong></td>
<td>Introduction to High Performance Computing</td>
<td><strong>BcBio 322</strong></td>
<td>Intro to Bioinformatics and Computational Biology</td>
<td><strong>I E 312</strong></td>
<td>Optimization</td>
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<tr>
<td>(Pre-req Math 265; Math 207 or 317)</td>
<td>3 Cr</td>
<td>(Pre-req Biol 212)</td>
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<td><strong>Com S 426</strong></td>
<td>Introduction to Parallel Algorithms and Programming</td>
<td><strong>Cpr E 425</strong></td>
<td>High Performance Computing for Scientific and Engineering Applications</td>
<td><strong>I E 483</strong></td>
<td>Data Mining</td>
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<tr>
<td>(Pre-req CPR E 308 or Com S 321; CPR E 315 or Com S 311)</td>
<td>4 Cr</td>
<td>(Pre-req Com S 311; Engl 250; SpCM 212)</td>
<td>3 Cr</td>
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<td><strong>Com S 435</strong></td>
<td>Algorithms for Large Data Sets: Theory and Practice</td>
<td><strong>Com S 474</strong></td>
<td>Intro to Machine Learning</td>
<td><strong>I E 487</strong></td>
<td>Big Data Analytics and Optimization</td>
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<td>(Pre-req Com S 311)</td>
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<td>(Pre-req Com S 311; Stat 330 or Stat 305 or Stat 341 or Stat 347; Math 165; Engl 250)</td>
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<td><strong>Com S 454</strong></td>
<td>Distributed Systems</td>
<td><strong>Cpr E 416</strong></td>
<td>Software Evolution and Maintenance</td>
<td><strong>E E 425</strong></td>
<td>Machine learning: A Signal Processing Perspective</td>
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<tr>
<td>(Pre-req Com S 311; Com S 325 or CPR E 308)</td>
<td>3 Cr</td>
<td>(Pre-req CPR E 308; Stat 330 or Stat 305; Math 207 or 407 (preferred))</td>
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<th>SECURITY</th>
<th>5</th>
<th>SOFTWARE ANALYTICS</th>
<th>6</th>
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<tr>
<td><strong>Com S 421</strong></td>
<td>Logic for Mathematics and Computer Science</td>
<td><strong>Com S 432</strong></td>
<td>Principles of Programming Languages</td>
<td><strong>Stat 471</strong></td>
<td>Introduction to Experimental Design</td>
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<td>(Pre-req CPR E 328 and Math 165; Com S 230 or CPR E 310)</td>
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<td><strong>Com S 453</strong></td>
<td>Privacy Preserving Algorithms and Data Security</td>
<td><strong>Com S 440</strong></td>
<td>Principles and Practice of Compiling</td>
<td><strong>Stat 473</strong></td>
<td>Introduction to Survey Sampling</td>
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<td><strong>Com S 474</strong></td>
<td>Intro to Machine Learning</td>
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<td><strong>Stat 475</strong></td>
<td>Introduction to Multivariate Data Analysis</td>
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<td><strong>Cpr E 416</strong></td>
<td>Software Evolution and Maintenance</td>
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<td><strong>Com S 474</strong></td>
<td>Intro to Machine Learning</td>
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<td>(Pre-req Com S 309)</td>
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<th>NUMERICAL ANALYSIS</th>
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<td><strong>BcBio 322</strong></td>
<td>Intro to Bioinformatics and Computational Biology</td>
<td><strong>Com S 474</strong></td>
<td>Introduction to Machine Learning</td>
<td><strong>BcBio 401</strong></td>
<td>Fundamentals of Bioinformatics and Computational Biology</td>
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<td><strong>Math 373</strong></td>
<td>Intro to Scientific Computing</td>
<td><strong>Math 407</strong></td>
<td>Applied Linear Algebra</td>
<td><strong>Math 424</strong></td>
<td>Introduction to High Performance Computing</td>
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<td>(Pre-req Math 265)</td>
<td>3 Cr</td>
<td>(Pre-req Math 317; or Math 307 and experience w/ proof)</td>
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