DATA SCIENCE

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MISSION STATEMENT

Data Science prepares WPI undergraduates with the skills to understand, apply and develop models, algorithms and statistical techniques to gather huge amounts of data, draw new insights from it, and formulate appropriate action plans. Through courses and hands-on project work, students in the Data Science program will master foundational and advanced topics, including state-of-the-art data analytic technologies like machine/deep learning, artificial intelligence, and big data. This prepares the student to tackle the most critical data challenges in interdisciplinary teams with diverse perspectives in this increasingly digital world from climate change, self-driving cars, digital healthcare, to social justice. In addition to being a discipline in and of itself, Data Science complements many of the existing undergraduate majors at WPI. Disciplines from the sciences to engineering increasingly grapple with large data sets using computational and statistical techniques and tools.

Students interested in Data Science, both majors and minors, should check with the Data Science program as early as possible in their academic career to develop a plan of study. Students will be assigned a Data Science advisor after completing a major/minor declaration form.

PROGRAM EDUCATIONAL OBJECTIVES

In support of its goals and mission, the WPI Data Science undergraduate program's educational objectives are to graduate students who will:

- Bring together a community of diverse disciplinary backgrounds and experiential perspectives to promote creative solutions to critical real-world problems and advance knowledge at the cutting edge
- Achieve professional success due to their mastery of Data Science theory and practice
- Conduct impactful research and project work in data sciences tacking the world's most challenging problems
- Engage in discovery through purpose-driven project-based learning
- Collaborate with partners both internally and externally in interdisciplinary projects
- Become leaders in business, academia, and society due to a broad preparation in data science, computational thinking, mathematics, science & engineering, communication, and social issues
- Pursue lifelong learning and continuing professional development
- Use their understanding of the impact of data science on society for the benefit of humankind

Theme:
"Gather Information, Form Insights, Impact the World"!

PROGRAM OUTCOMES

Students graduating with a Bachelor of Science degree in Data Science:

- Have mastered foundational studies in business, computer science, and mathematical sciences
- Have mastered advanced principles and techniques in at least one of the three disciplines
- Can apply computational and mathematical knowledge to the solution of big data problems
- Can communicate effectively across disciplines both verbally and in writing
- Can locate, read, and interpret primary literature in data science
- Can function effectively as members of an interdisciplinary team
- Have an understanding of accepted standards of ethical and professional behavior
- Have the ability to be a life-long independent learner

Program Distribution Requirements for the Data Science Major

The distribution requirements for the BS degree in Data Science consists a series of interdisciplinary courses in Data Science, fundamental courses in Computer Science, Mathematical Sciences, and Business, and a set of more advanced courses selected primarily from the three supporting disciplines: Computer Science, Mathematical Sciences, and/or Business.

REQUIREMENTS	MINIMUM UNITS
1. Data Science Core Courses (Note 1)	3/3
2. Business (Note 2)	2/3
3. Computer Science (Note 3)	3/3
4. Mathematical Sciences (Note 4)	5/3
5. Data Privacy and Ethics (Note 5)	1/3
6. Natural or Engineering Sciences (Note 6)	2/3
7. Disciplinary Elective Courses (Note 7)	11/3
8. MQP (Note 8)	3/3

NOTES:

1. Students must complete the series of three DS core courses (DS 1010, DS 2010, and DS 3010)
2. Business foundation courses must include 1/3 unit in entrepreneurship and innovation, and 1/3 unit in business analysis:

   One of BUS 1010, ETR 1100, BUS 3010, ETR 3633

   One of BUS 2080 or OIE 2081
3. Computer science foundation courses must include 2/3 units of introductory computer science (with no more than 1/3 unit at the 1000 level) and 1/3 unit of algorithms. CS elective courses at level of 3000 and above as defined in Note 7 may substitute for introductory computer science credits.

   Two of CS 1004, 1101, 1102, CS 2102, CS 2103, CS 2119, or CS elective courses below.

   One of CS 2223
4. Mathematics foundation courses must include 2/3 units calculus, 2/3 units applied statistics, and 1/3 unit linear algebra. Mathematics disciplinary elective courses as defined in Note 7 may substitute for introductory calculus credits.

   Two of MA 1020, MA 1021, MA 1022, MA 1120, or disciplinary elective courses in MA as per Note 7. (Students cannot take both MA 1020 and

MA 1021 for credits. Students cannot take both MA 1022 and MA 1120 for credits.)

Both MA 2611, MA 2612

One of MA 2071, MA 2072

5. Data Privacy and Ethics. Choose 1/3 unit from among the following:

CS 3043

GOV 2313, GOV 2314, GOV 2315, GOV 2320

PY 2713, PY/RE 2731

RBE 3100

6. 2/3 units of work chosen in Natural or Engineering Science (courses with prefixes AE, AREN, BB, BME, CHE, CE, CH, ECE, ES, GE, ME, PH or RBE count).

7. Chosen from disciplinary elective courses in CS, MA, or BUS listed below.

At least one course must be selected from each of the following categories:

- Data access and management (CS 3431, MIS 3720, CS 4432, CS4433/DS4433)
- Data mining/machine learning (CS 4445, CS 4342)
- Business modeling and prediction (MIS 4084, OIE 4420)
- Disciplinary electives must include at least 4/3 units at the 4000 level or above.

8. Data Science MQP projects must have a MQP faculty advisor that has a formal collaborative appointment in the Data Science program.

Disciplinary Elective Courses in CS:

CS 2022	Discrete Mathematics
CS 2301	Systems Programming For Non-Majors
CS 2303	Systems Programming Concepts
CS 3133	Foundations of Computer Science
CS 3733	Software Engineering
+CS 3431	Database Systems I
CS 3041	Human-Computer Interaction
CS 4120	Analysis of Algorithms
+CS 4341	Introduction to Artificial Intelligence
+CS 4432	Database Systems II
+CS 4445	Data Mining and Knowledge Discovery in Databases
CS 4803/BCB 4003	Biological and Biomedical Database Mining
+CS 4342/DS 4342	Machine Learning
+CS 4804	Data Visualization
CS 4802/BCB 4002	Bio Visualization
+CS 4433/DS 4433	Big Data Management & Analytics
CS 4233	Object-Oriented Analysis and Design
CS 4241	Webware: Computational Technology for Network Information Systems

Students are encouraged to take elective courses with a (+) prefix.

Disciplinary Elective Courses in MA:

MA 1023	Calculus III
MA 1024	Calculus IV
MA 1033	Theoretical Calculus III
MA 1034	Theoretical Calculus IV
MA 2201	Discrete Mathematics
MA 2051	Ordinary Differential Equations
MA 2073	Matrices and Linear Algebra II
MA 2210	Mathematical Methods in Decision Making
MA 2431	Mathematical Modeling with Ordinary Differential Equations
+MA 2621	Probability for Applications
+MA 2631	Probability (Students cannot take both MA 2621 and MA 2631 for credits)
MA 3231	Linear Programming
MA 3233	Discrete Optimization
MA 3257	Numerical Methods for Linear and Nonlinear Systems
+MA 3627	Introduction to the Design and Analysis of Experiments
+MA 3631	Mathematical Statistics
MA 4213	Loss Models I - Risk Theory
MA 4214	Loss Models II - Survival Models
MA 4235	Mathematical Optimization
MA 4237	Probabilistic Methods of Operations Research
+MA 4603	Statistical Methods in Genetics and Bioinformatics
MA 4631	Probability and Mathematical Statistics I
MA 4632	Probability and Mathematical Statistics II
+MA 4635/DS4635	Data Analytics and Statistical Learning

Students are encouraged to take elective courses with a (+) prefix.

Disciplinary Elective Courses in BUS:

+MIS 3720	Business Data Management
MKT 3650	Consumer Behavior
OIE 3460	Simulation Modeling and Analysis
+MIS 4084	Business Intelligence
MIS 4720	Systems Analysis and Design
MIS 4741	User Experience and Design
+OIE 4420	Practical Optimization: Methods and Applications

Students are encouraged to take elective courses with a (+) prefix.

MINOR IN DATA SCIENCE

MISSION STATEMENT

The Minor in Data Science prepares WPI undergraduates in any major with the skills essential to understand and work with data by applying models, algorithms and statistical techniques to extract, model, analyze and predict data.The minor complements many of the existing undergraduate majors at WPI from sciences to engineering that increasingly must work with large digital data sets using computational and statistical techniques and tools by providing these students with the core competencies of Data Science.

Students interested in the minor should meet with the Data Science minor advisor as early as possible in their academic career to develop a plan of study.They will be assigned a Data Science minor advisor after completing a minor declaration form.