

*Thank you for joining*

# **What's New with MSDS?**

SYMPOSIUM SESSION, NOVEMBER 15, 2024, 3:30 PM CT

**Northwestern**

**SCHOOL OF  
PROFESSIONAL STUDIES**

# 12 Courses

- 6 Core Courses
- 2 Specialization Courses (optional)
- 2 Elective Courses
- 1 Additional core course selected from eight options
- 1 Capstone Project or Thesis

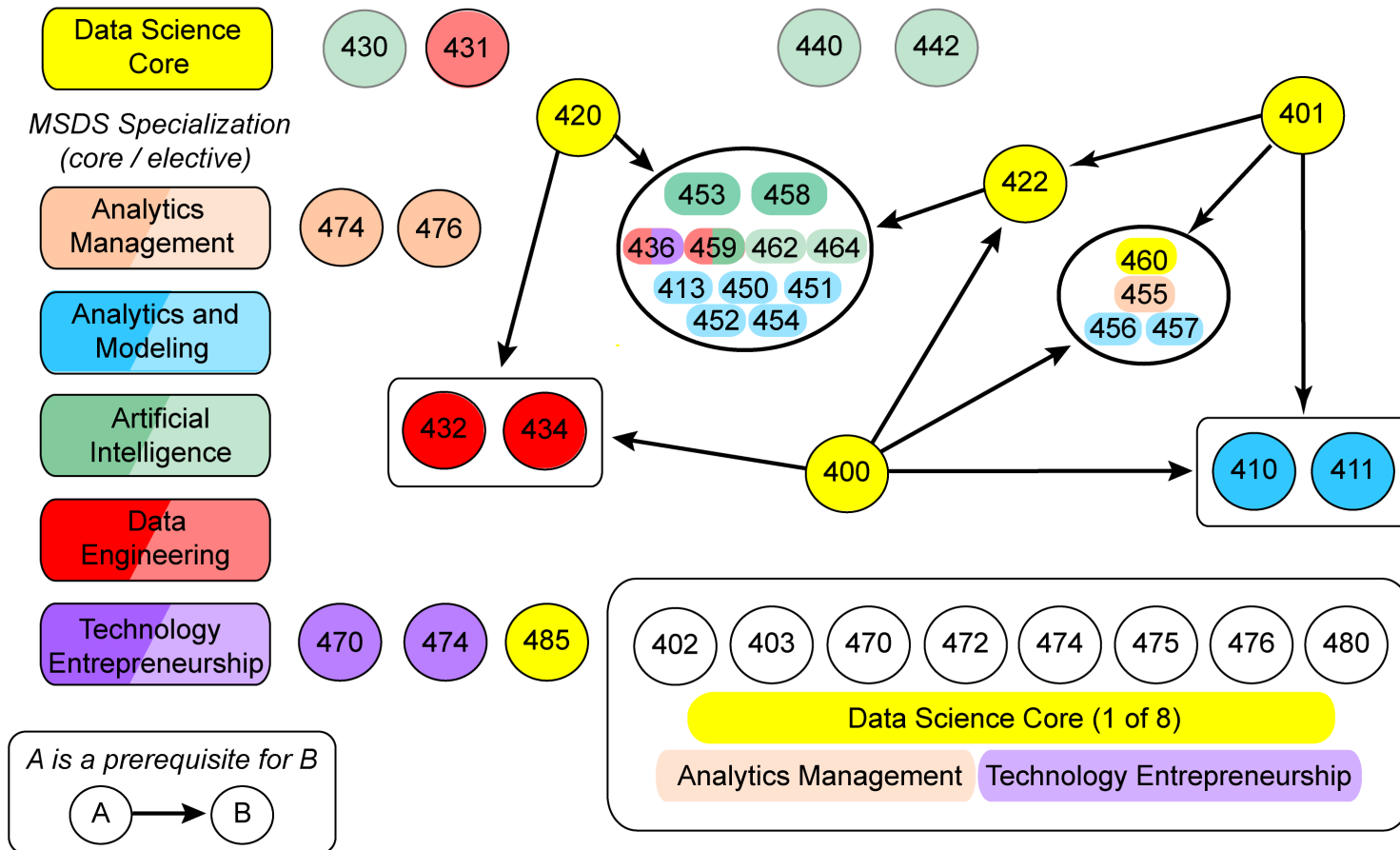
# 5 Specializations

- Analytics Management
- Analytics and Modeling
- Artificial Intelligence
- Data Engineering
- Technology Entrepreneurship

# 6 Core Courses

- Math for Modelers
- Applied Statistics with R
- Data Governance, Ethics, and Law
- Database Systems
- Practical Machine Learning
- Decision Analytics

## Curriculum Map for Graduate Courses in Data Science



The MSDS degree requires twelve courses, including a capstone course or master's thesis. Registration for the capstone (MSDS 498) or thesis (MSDS 590) requires prior completion of core courses and all but one elective course. This curriculum map shows hard prerequisites as checked by the registration system.



# Words of Advice

- Transfer credits from other graduate programs (reduces the number of credits for MSDS degree)
- Waive core courses (more electives)
- Limit the total course load (commitment to each course could be 10 to 15 hours)
- Only one heavy programming course each term
- Only one “killer course” each term
- Try to focus on one computer language each term
- Take advantage of learning studios
- Note recommended prior courses as well as formal prerequisites

# SPS Distance Learning Philosophy

Courses designed to ensure the success of every student

## **Learning-by-doing and case study approach to education**

- Courses are grounded in theories of learning and cognition that facilitate active engagement in individual learning
- Students are immersed in vibrant discussion, applying high-end skill sets, and developing solutions to real-life problems

## **Rich distance learning experience**

- Designed to promote interactions among students and faculty
- Asynchronous with live elements layered in as appropriate
- Courses continually updated with current technology

## **Employing universal instructional design**

- Courses are designed and taught utilizing principles of universal instructional design, creating a learning environment in which every student can succeed
- Universal instructional design recognizes and respects that students bring diverse cultures, backgrounds, and learning styles to the classroom

# Languages for Data Science: Python, R, Go, and SQL

Students in the MSDS program gain experience with key languages for data science and data engineering and can tailor studies to their own needs and interests. See <https://msds-program.netlify.app>

- Python is the primary language in most Artificial Intelligence courses
- R is the primary language in most Analytics and Modeling courses
- Go is used extensively in Data Engineering courses along with other languages and systems. See <https://msdsgo.netlify.app>
- Structured query language (SQL) used in courses with relational databases

## Courses Introducing Languages for Data Sciences

**Python for Data  
Science**

**Applied Statistics  
with R**

**Data Engineering  
with Go**

**Database Systems  
(SQL)**

# Analytics and Modeling

- Builds on the tradition of the Master of Science in Predictive Analytics (MSPA) program. Designed for data scientists seeking technical roles as data analysts, applied statisticians, and modelers. Courses focus on statistical inference and applications of predictive models.

**R Learning Studio**

## REQUIRED COURSES

**Supervised Learning  
Methods**

**Unsupervised  
Learning Methods**

## SUGGESTED ELECTIVE COURSES

**Time Series Analysis  
and Forecasting**

**Marketing  
Data Science**

**Financial  
Machine Learning**

**Applied Probability  
and Simulation  
Modeling**

**Web and Network  
Data Science**

**Research Design for  
Data Science**

**Data Visualization**

**Special Topics: SAS  
for Data Scientists**

# MSDS 491-DL SAS for Data Scientists

**Special Topics: SAS  
for Data Scientists**

- (Winter 2025) The SAS programming language and environment, available since 1960, continues to be used in many Fortune 500 companies. SAS provides extensive libraries for data preparation, analytics, and modeling. The course prepares students for programming and consulting roles that require the maintenance of legacy SAS code and conversion of that code to open-source solutions in Python. Students use the SAS data step for data preparation, missing data imputation, and working with external databases (SQL). They use SAS statistical procedures for linear regression, logistic regression, and multivariate analysis. Prerequisites: (1) MSDS 420-DL Database Systems or CIS 417 Database Systems Design and Implementation and (2) MSDS 422-DL Practical Machine Learning or CIS 435 Practical Data Science Using Machine Learning.



# MSDS 450-DL Marketing Data Science

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**Marketing  
Data Science**

- (Spring 2025) This course introduces algorithms and methods for digital marketing. It reviews the strategic marketing process, and the design of marketing surveys and experiments, including online testing of marketing messages. Students explore methods for understanding consumer preferences, market segmentation and target marketing, product design, search engine optimization, dynamic pricing, effects of advertising and promotion, recommender systems, and competitive intelligence. This is a case study course that requires active participation in weekly class discussions. Recommended prior courses: MSDS 410-DL Supervised Learning Methods and MSDS 411-DL Unsupervised Learning Methods. Prerequisites: (1) MSDS 420-DL Database Systems or CIS 417 Database Systems Design and Implementation and (2) MSDS 422-DL Practical Machine Learning or CIS 435 Practical Data Science Using Machine Learning.

# Artificial Intelligence

- Designed for students seeking technical positions in machine learning and artificial intelligence (AI). Students develop programming skills in deep learning, as needed for computer vision, natural language processing, intelligent systems, and robotics.

## LANGUAGE PRELIMINARIES

**Python Learning  
Studio**

**Python for Data  
Science**

## REQUIRED COURSES

**Artificial Intelligence  
and Deep Learning**

**Natural Language  
Processing**

## SUGGESTED ELECTIVE COURSES

**Conversational AI  
Assistants**

**AI Agent Design and  
Development**

**Computer Vision**

**Intelligent Systems  
and Robotics**

**Knowledge  
Engineering**

**Special Topics:  
Generative AI**

# MSDS 440-DL Conversational AI Assistants

<p><b>Conversational AI Assistants</b></p>
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- (Winter 2025) This is an applied artificial intelligence (AI) course. It introduces the development life cycle process, methods, and technologies for developing, configuring, and training conversational AI assistants. It draws on traditional natural language understanding, large language models, and open-source generative AI frameworks and libraries. The course surveys fundamental concepts of dialogue and domain engineering. It examines three pillars for building conversational AI assistants: business process workflow, dialogue understanding, and automatic conversation repair with fallbacks. Students employ common patterns and templates in dialogue engineering. They learn how to use conversational assistants in business process workflows across various industries, including services, healthcare, transportation, and retail. This is a case-study and project-based course with a programming component. Prerequisites: None.

# MSDS 442-DL AI Agent Design and Development

## AI Agent Design and Development

- (Spring 2025) This is an applied artificial intelligence (AI) course. It provides an in-depth exploration of designing, developing, and deploying AI agents, with a focus on creating stateful, autonomous, and multi-agent systems. Students learn key concepts behind reason-and-act methods, intelligent prompting, finite state machines, and agent architectures. They use open-source frameworks and libraries to build multi-actor applications with large language models. They develop dynamic, reliable agents capable of executing complex multi-step workflows, incorporating human-in-the-loop processes, and interacting with external tools and application programming interfaces. Students learn how to design and deploy sophisticated AI agents, ranging from simple reactive systems to advanced goal-driven systems. This is a case-study and project-based course with a programming component. Prerequisites: None.

# MSDS 490-DL Applied Generative AI for Enterprises

## Applied Generative AI for Enterprises

- (Winter 2025) This course explores recent developments in generative artificial intelligence, with applications to language processing, computer vision, and software development. Students work with deep generative models, including attention and transformer models, and generative pretrained transformers (GPTs). They build special-purpose applications from open-source software, utilizing application programming interfaces (APIs) to GPT-based models and knowledge bases. This is a project-based course with extensive hands-on programming assignments. Prerequisites: (1) MSDS 420-DL Database Systems or CIS 417 Database Systems Design and Implementation and (2) MSDS 422-DL Practical Machine Learning or CIS 435 Practical Data Science Using Machine Learning.

# Data Engineering

- Designed for students seeking technical positions with a focus on data science applications, software development, and information systems analysis and deployment.
- Students learn about technologies for gathering, storing, and analyzing data in interactive, batch, and stream processing environments.

## SUGGESTED LANGUAGE PRELIMINARIES

**Go Learning Studio**

**Data Engineering  
with Go**

## REQUIRED COURSES

**Foundations of Data  
Engineering**

**Data Science and  
Cloud Computing**

## SUGGESTED ELECTIVE COURSES

**Technology Product  
Engineering**

**Knowledge  
Engineering**

**Special Topics:  
Recommender  
Systems**

# MSDS 490-DL Recommender Systems

## Recommender Systems

- (Spring 2025) This course equips students with knowledge and hands-on experience in designing, implementing, and evaluating recommender systems. Through a blend of theoretical foundations and practical applications, students will explore data preprocessing, matrix factorization, embedding-based models, sequential recommendation models, and deep learning techniques. Leveraging industry-standard frameworks, the course emphasizes scalability, explainability, and ethical considerations in real-world scenarios. Weekly assignments build on recent research and prepare students to tackle complex challenges in the field of recommender systems. Recommended prior courses: MSDS 410-DL Supervised Learning Methods and MSDS 411-DL Unsupervised Learning Methods. Prerequisites: (1) MSDS 420-DL Database Systems or CIS 417 Database Systems Design and Implementation and (2) MSDS 422-DL Practical Machine Learning or CIS 435 Practical Data Science Using Machine Learning.

# Analytics Management

- Designed for students seeking technical leadership and data science management positions.

## REQUIRED COURSES

**Accounting and Finance  
for Technology  
Managers**

**Business Process  
Analytics**

## SUGGESTED ELECTIVE COURSES

**Data Science and  
Digital Transformation**

**Management  
Consulting**

**Project Management**

**Business Leadership  
and Communication**

**Research Design for  
Data Science**

**Data Visualization**



# Technology Entrepreneurship

- Entrepreneurship involves creating a new business or business function where one did not exist before.
- Data science, machine learning, and artificial intelligence provide new business opportunities. This specialization shows students ways of building successful, innovation-driven startups.

## REQUIRED COURSES

**Technology  
Entrepreneurship**

**Accounting and  
Finance for  
Technology Managers**

## SUGGESTED ELECTIVE COURSES

**Project Management**

**Business Leadership  
and Communications**

**Management  
Consulting**

**Business Process  
Analytics**

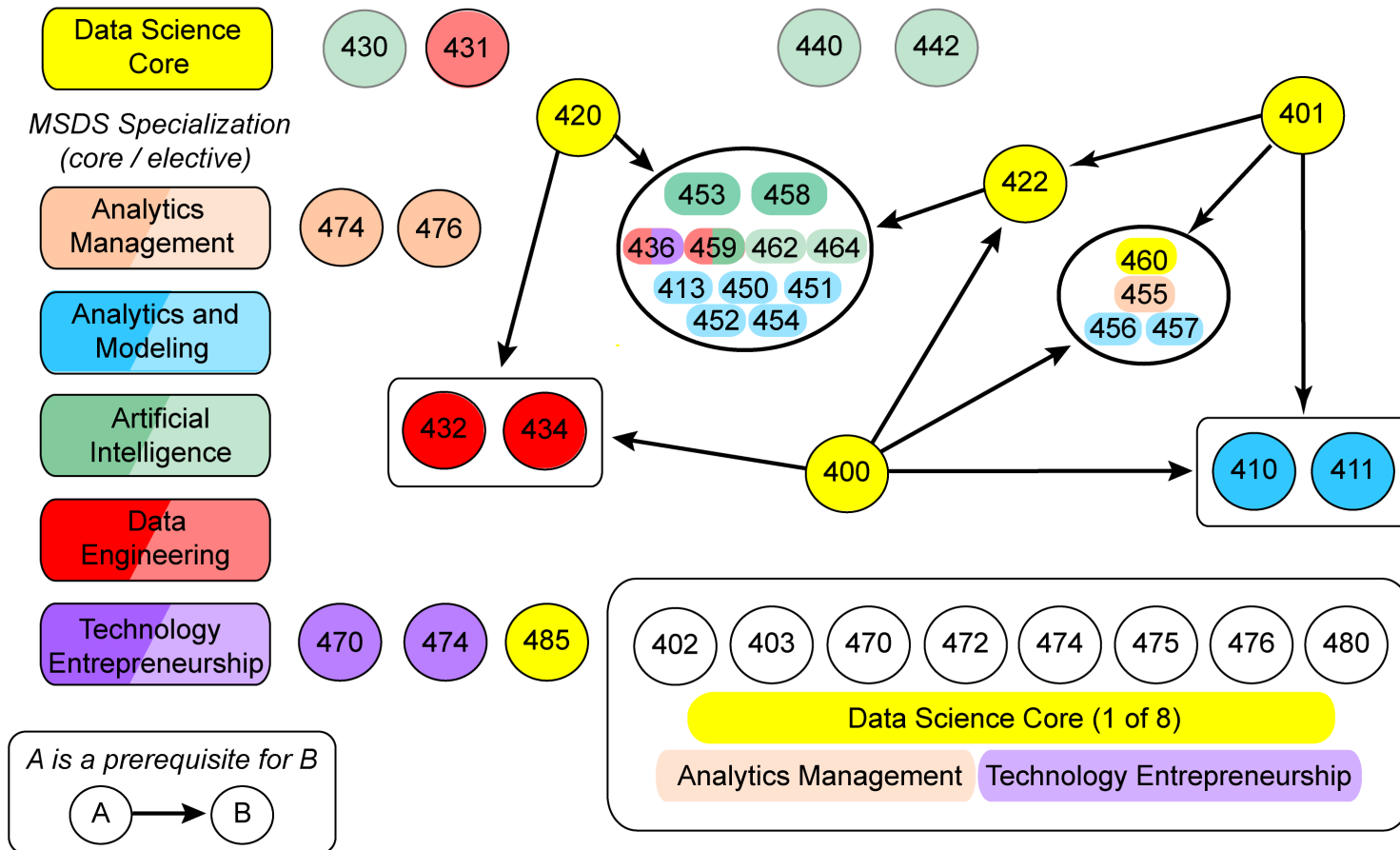
**Technology Product  
Engineering**

# MSDS 436-DL Technology Product Engineering

**Technology Product  
Engineering**

- (Fall 2025) This course introduces design principles and best practices for implementing systems for data ingestion, processing, storage, and analytics. Students learn about full-stack development and software alternatives for implementing analytics solutions and intelligent, knowledge-based systems. They evaluate system performance and resource utilization in batch, interactive, and streaming environments. They create and run performance benchmarks for comparing alternative software stacks. Students work in software engineering teams, practicing agile/scrum project management as they develop new technology products. Recommended prior course: MSDS 430-DL Python for Data Science or MSDS 431-DL Data Engineering with Go. Prerequisites: (1) MSDS 420-DL Database Systems or CIS 417 Database Systems Design and Implementation and (2) MSDS 422-DL Practical Machine Learning or CIS 435 Practical Data Science Using Machine Learning.

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- Academic planning and course selection
- Career coaching
- Resume and cover letter guidance
- Career workshops and events
- Student experience support



- Quantitative coursework support (The Math Place)
- Writing and editing assistance (The Writing Place)
- In-course TA Assistance
- Access to science, language, and ESL tutoring
- Independent tutor referral

- Student Leadership Council (SLC)
- A Day at the Google-Chicago Office
- MSDS Alumni Panel Event

- MSDS Alumni Panel Event
- Data Science Go Bootcamp
- Career Panel Roundtable and Networking

- MSDS Student Research Expo
- Ace the Data Science Interview with Nick Singh

# Information and Advising

## ACADEMIC ADVISERS

- [datascience-advising@northwestern.edu](mailto:datascience-advising@northwestern.edu)

## ONLINE RESOURCES

- <https://sps.northwestern.edu/masters/data-science/>
- <https://msds-program.netlify.app>
- <https://msdsgo.netlify.app>