Department/Program:

# Mathematics and Computer Science

## Majors, Minors & Degrees:

**Majors**
Data Analytics (B.A., B.S.)
Mathematics (B.A., B.S.)

**Minors**
Computer Science
Data Analytics
Mathematics

Mathematics is an intriguing field that helps us understand the world by modeling physical phenomena quantitatively and employing sound reasoning skills. A degree in mathematics offers students many options, including careers in business, government, industry, and teaching. Some students also pursue post-graduate education in mathematics, medicine, law, and science. Students studying mathematics at Nebraska Wesleyan University have opportunities to engage themselves fully in their education by working collaboratively with their peers, conducting research with faculty, teaching in the Math Tutoring Center, grading for courses, attending Math Club events, and presenting research at conferences.

***Department Learning Outcomes***
Majors will be able to:

1. Demonstrate problem-solving skills.
2. Prove theorems.
3. Learn independently.
4. Explain mathematics in oral and written form.
5. Use computer-based technology to assist in solving problems.
6. Pursue employment or further study.

## Courses

CMPSC 1000 Introduction to Computational Problem Solving (3 hours)

An introduction to computational problem-solving using a programming language. Students learn the syntax and semantics of a language and apply these to the solution of mathematical problems. Students review mathematical concepts and use them as the basis of algorithmic solution during a hands-on lab. The course is recommended for all who wish to explore computer science.
*Prerequisite(s): Math ACT score of at least 21 or permission of the instructor.*
*(Normally offered each fall semester.)*

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

CMPSC 1100 Python Programming I (4 hours)

An introduction to computational problem-solving using Python. Hands-on labs are used to motivate basic programming concepts, including basic data types and structures, functions, conditionals, and loops. Additional topics may include building and scraping HTML webpages. The course is recommended for all who wish to explore data science and/or computer science.

*Prerequisite(s): Math ACT score of at least 21 or permission of instructor.*

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

CMPSC 1500 Program Design (4 hours)

A disciplined approach to the development of programs to solve problems on a computer. Topics include data types, control structures, abstraction, and software development. A lab component introduces a high-level programming language and software tools.

*Prerequisite(s): CMPSC 1000 Introduction to Computational Problem Solving or permission of the instructor.*
(Normally offered each spring semester.)

CMPSC 2100 Python Programming II (4 hours)

A project-based continuation of the techniques developed in CMPSC 1100 Python Programming I. Topics include object-oriented programming, algorithm design and analysis, data structures, and general problem-solving techniques (such as recursion) while following industry-standard software development principles.

*Prerequisite(s): Grade of "C" or better in CMPSC 1100 Python Programming I or permission of instructor.*

CMPSC 2600 Computer Architecture and Interfacing (4 hours)

See PHYS 2600 Computer Architecture and Interfacing.

CMPSC 3000 Data Structures (3 hours)

This course, built in collaboration with Google, will teach you how to understand and use data structures. Data structures are used by almost every program and application to store, access and modify the vast quantities of data that are needed by modern software. By the end of this course you'll learn what data structures are and learn how to use them in the applications you build. This online class has optional live sessions. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions. *Prerequisite(s): CMPSC 2100 Python Programming II.*

CMPSC 3960 Special Projects (1-15 hours)

Supervised individual projects for students on topics selected by the student in consultation with the instructor. Special Projects may not duplicate courses described in the catalog.
*Prerequisite(s): Permission of the instructor.*

CMPSC 3970 Internship (1-8 hours)

On-the-job training in computer science in situations that satisfy the mutual interests of the student, the supervisor, and the instructor. The student will arrange for the position in accordance with the guidelines established by the department.
Pass/Fail only.
*Prerequisite(s): Permission of the instructor and approval of the department chair.*

CMPSC 4000 Algorithms (3 hours)

This course explores algorithms from a coding-focused perspective, using Python. Students will learn about the issues that arise in the design of algorithms for solving computational problems and will explore a number of standard algorithm design paradigms and their applicability. Students will also become familiar with concepts of runtime, recursion, implementation and evaluation. This course features a heavy emphasis on practical application of algorithms to common development and engineering challenges. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

*Prerequisite(s): CMPSC 3000 Data Structures and MATH 1600 Calculus I.*

CMPSC 4970 Internship (1-8 hours)

On-the-job training in computer science in situations that satisfy the mutual interests of the student, the supervisor, and the instructor.
P/F only.
*Prerequisite(s): Permission of the Program Director and junior or senior standing.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

DATA 1200 Excel and SQL Programming (4 hours)

A study of managing, manipulating, and summarizing data using Excel and SQL. Topics in Excel include, but are not limited to: functions, filters, charts and visualizations, pivot tables, and macros. Topics in SQL include, but are not limited to: queries, joins, and basic database management.

DATA 1300 Foundations of Data Analytics I (3 hours)

In an increasingly data-driven world, everyone should be able to understand the numbers that govern our lives. Whether or not you want to work as a data analyst, being "data literate" will help you in your chosen field. In this course, you'll learn the core concepts of inference and data analysis by working with real data. By the end of the term, you'll be able to analyze large datasets and present your results. This course is an online class offered through the Lower Cost Models Consortium. The class has

optional live sessions.

DATA 1400 Foundations of Data Analytics II (3 hours)

This course is intended as a continuation of Foundations of Data Analytics I. In this course, you'll learn how Data Analytics are applied within the workforce. Particular attention will be paid to the role of the Data Scientist or Analyst, machine learning and the applications of Big Data. By the end of the term, you will be able to design and execute a range of data-driven experiments. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

*Prerequisite(s): DATA 1300 Foundations of Data Analytics I.*

DATA 1700 Introduction to Cybersecurity (3 hours)

In today's world, no one is safe from cyber-attacks, but everyone can be prepared. This course will teach you how malicious actors use social skills and technology to facilitate cyber attacks and provide you with the tools and information you need to defend against those attacks. Whether you pursue one of the many available jobs in cybersecurity or just want to secure your own privacy, you'll learn how to make the Internet safer.This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

DATA 1970 Internship (0 hours)

On-the-job training in data analytics in situations that satisfy the mutual interests of the student, the supervisor, and the instructor. The student will arrange for the position in accordance with the guidelines established by the department. Pass/Fail only.

*Prerequisite(s): Permission of the instructor and approval of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Exploratory

DATA 2200 Forecasting And Logistics (3 hours)

Supply chain management is the process by which organizations get us the products we consume, and companies need talented employees to help optimize their supply chain. This course will teach you how to use forecasting techniques to match supply and demand, and how to develop logistics networks that help minimize costs and deliver top customer service. This online class has optional live sessions. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

DATA 2300 Sourcing and Operations (3 hours)

In today's modern economy, something as simple as a razor might be manufactured in multiple countries with each part coming from a different supplier. This course will teach you how businesses manage this increasing complexity behind the scenes through efficient sourcing of suppliers and operations. You will have the opportunity to apply this knowledge by conducting a real-world case study of a product of your choosing. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

*Prerequisite(s): DATA 2200 Forecasting And Logistics.*

DATA 2700 Cybercrime and Governance (3 hours)

Cybercrime is one of the biggest threats companies face on a daily basis, and they are constantly looking for new hires to help protect them. In this course, you will get a firsthand look at the methods used to commit cybercrimes. You will also learn how governments detect, investigate, and stop these crimes, and become familiar with the laws and policies in place to deter cybercriminals. This online class has optional live sessions. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

*Prerequisite(s): DATA 1700 Introduction to Cybersecurity.*

DATA 2970 Internship (1-8 hours)

On-the-job training in data analytics in situations that satisfy the mutual interests of the student, the supervisor, and the instructor. The student will arrange for the position in accordance with the guidelines established by the department. Pass/Fail only.

*Prerequisite(s): Permission of the instructor and approval of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

DATA 3100 Data Visualization With R (4 hours)

A study of data visualization, including principles and techniques. Students will analyze the effectiveness of visualizations, create a wide array of visualizations using the programming language R, and communicate a story through them. Significant emphasis will be placed on getting and cleaning data.

*Prerequisite(s): Grade of "C" or better in CMPSC 1100 Python Programming I and grade of "C" or better in one of the following statistics courses: BUSAD 2100 Business and Economic Statistics, MATH 1300 Statistics, MATH 3100 Differential Equations, POLSC 2000 Introduction to Political Science Statistics, PSYCH 2100 Psychological Statistics, or SOC 2910 Social Statistics.*

DATA 3200 Principles and Techniques of Data Analytics I (3 hours)

This course is based heavily on UC Berkeley's Data 100 class. Data Analytics combines data, computation and inferential thinking to solve challenging problems and understand their intricacies. This class explores key principles and techniques of data science, and teaches students how to create informative data visualizations. It also explores particular concepts of Linear Algebra which are central to Data Science. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

*Prerequisite(s): CMPSC 2100 Python Programming II and DATA 1400 Foundations of Data Analytics II.*

DATA 3300 Principles and Techniques of Data Analytics II (3 hours)

This course builds on DATA 3200 to provide students with a more robust understanding of the tools of a Data Scientist. Data Analytics combines data, computation and inferential thinking to solve challenging problems to thereby better understand the world. This class explores key principles and techniques of data science, including quantitative critical thinking and algorithms for machine learning methods. It will also introduce students to the ways in which data analytics is deployed in healthcare, marketing, political science, criminal justice, and other fields. This course is an online class offered through the Lower Cost Models Consortium. The class has optional live sessions.

*Prerequisite(s): DATA 3200 Principles and Techniques of Data Analytics I and MATH 1600 Calculus I.*

DATA 3970 Internship (1-8 hours)

On-the-job training in data analytics in situations that satisfy the mutual interests of the student, the supervisor, and the instructor. The student will arrange for the position in accordance with the guidelines established by the department. Pass/Fail only.

*Prerequisite(s): Permission of the instructor and approval of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

DATA 4970 Internship (1-8 hours)

On-the-job training in data analytics in situations that satisfy the mutual interests of the student, the supervisor, and the instructor. The student will arrange for the position in accordance with the guidelines established by the department. Pass/Fail only.

*Prerequisite(s): Permission of the instructor and approval of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

DATA 4980 Capstone Project (3 hours)

A student-driven collaborative project synthesizing skills developed in the data analytics major.

*Prerequisite(s): At least Junior standing and grades of "C" or better in CMPSC 2100 Python Programming II and DATA 3100 Data Visualization With R.*

MATH 1000 Mathematics for Liberal Arts (3 hours)

An investigation of the application of mathematical reasoning and problem solving. Topics may include networks, linear programming, data sampling and analysis, voting systems, game theory, measurement analysis, and coding.
(Normally offered each fall semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1010 Mathematics and Democracy (3 hours)

A study of various aspects of mathematics pertinent to a democracy including voting methods, logic of argumentation, statistics in the media, and financial mathematics.
(Normally offered each spring semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving
Archway Curriculum: Integrative Core: Democracy Thread

MATH 1090 Intermediate Algebra (3 hours)

A study of properties of real numbers, linear and nonlinear inequalities, factoring, exponents and radicals, linear and polynomial equations, fractional equations, functions and their graphs. Emphasis on mathematical modeling and problem-solving. This course does not fulfill any degree requirements.

MATH 1100 College Algebra (3 hours)

A study of functions from algebraic, graphical, numerical and modeling perspectives. The functions are chosen from among linear, polynomial, rational, exponential and logarithmic.
*Prerequisite(s): Math ACT score of at least 21.*
(Normally offered each semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1200 Mathematics for Elementary Teachers (3 hours)

A course for elementary education majors designed to promote a deep understanding of elementary mathematics topics, including the decimal system, fractions, percentages, arithmetic operations and problem-solving. Emphasis is placed on communicating mathematics, both in writing and orally.
(Normally offered each fall semester.)

MATH 1300 Statistics (3 hours)

An introduction to statistics concepts with an emphasis on applications. Topics include descriptive statistics, discrete and continuous probability distributions, the central limit theorem, confidence intervals, hypothesis testing, and linear regression.
(Normally offered each fall semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1400 Pre-Calculus (4 hours)

A study of elementary functions, their graphs, and applications, including polynomial, rational, algebraic, exponential, logarithmic, and trigonometric functions.
*Prerequisite(s): Math ACT score of at least 24 or grade of "C" or better in MATH 1100 College Algebra.*

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1450 Finite Mathematics (4 hours)

A survey of specialized mathematical techniques used to solve contemporary problems in business, economics and the social sciences. Topics may include linear regression, mathematical finance, systems of equations, matrix algebra, linear programming, enumeration, probability, and statistics.
*Prerequisite(s): Math ACT of at least 24 or a grade of "C "or better in MATH 1100 College Algebra.*
(Normally offered each semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1470 Trigonometry (2 hours)

A study of trigonometric functions, identities, equations, and their applications.
*Prerequisite(s): Math ACT score of at least 24 or a grade of "C" or better in MATH 1100 College Algebra.*
*MATH 1100 College Algebra and MATH 1470 Trigonometry may be taken concurrently with the permission of the Trigonometry instructor or department chair.*
(Normally offered during the last 8 weeks of each semester in an online format.)

MATH 1500 Calculus for Management, Biological, and Social Sciences (4 hours)

A calculus course for non-mathematics majors. Topics include limits, continuity, differentiation, and integration with emphasis on relevant applications.
*Prerequisite(s): Math ACT score of at least 24 or grade of "C" or better in MATH 1100 College Algebra.*
(Normally offered once a year.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1600 Calculus I (5 hours)

An introduction to calculus of a single variable. Topics include limits, continuity, differentiation, and beginning integration with applications. Assignments are given that help build proficiency in the use of a computer algebra system.
*Prerequisite(s): Math ACT score of at least 27, or a grade of "C" or better in MATH 1470 Trigonometry or MATH 1400 Pre-Calculus, or permission of the instructor.*

(Normally offered each semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1610 Calculus II (5 hours)

A continuation of MATH 1600 Calculus I. Topics studied include integration techniques and applications, differential equations, numerical approximations, sequences and series, and vectors. Assignments are given that help build proficiency in the use of a computer algebra system.
*Prerequisite(s): Permission of the department chair or grade of "C" or better in MATH 1600 Calculus I.*
(Normally offered each semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 1950 Independent Study (1-4 hours)

This is a course where a student works independently on a topic. The student initially meets with the department chair to select a study topic. At this time the student will be assigned a faculty resource person to guide his or her work and assist in an advisory capacity. A copy of the student's work is filed in the archives for the department. Independent Study may not duplicate courses described in the catalog.
*Prerequisite(s): Permission of the department chair.*

MATH 1970 Internship (0-8 hours)

An on-the-job experience oriented toward the student's major interest. The student is to secure a position in an organization that satisfies the mutual interests of the instructor, the sponsor, and the student. P/F Only.
*Prerequisite(s): Permission of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Exploratory

MATH 2200 Foundations of Modern Mathematics (3 hours)

A course on the essential techniques of mathematical proof, such as case analysis, contradiction, and induction. Proofs will be written in the context of mathematical foundations (logic, sets, functions, etc.). Emphasis will be placed on developing the ability to write clear and precise arguments, which is useful for students in any major.

*Prerequisite(s): Grade of "C" or better in MATH 1600 Calculus I or permission of the instructor.*

(Normally offered each spring semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving
Archway Curriculum: Essential Connections: Writing Instructive

MATH 2600 Calculus III (4 hours)

An introduction to multivariable calculus. Topics include vector-valued functions, functions of several variables, partial derivatives, multiple integrals, and analysis. Assignments are given that help build proficiency in the use of a computer algebra system.
*Prerequisite(s): Permission of department chair or grade of "C" or better in MATH 1610 Calculus II.*
(Normally offered each fall semester.)

Archway Curriculum: Foundational Literacies: Mathematical Problem Solving

MATH 2700 Tutoring Experience (0 hours)

A tutoring experience comprised of at least 20 hours of mathematics tutoring. Tutoring may include, but is not limited to, these types: volunteer tutoring, tutoring at NWU's Math Tutoring Center or private tutoring. A reflection component is required.
*Prerequisite(s): Permission of Department Chair.*
Pass/Fail Only.

Archway Curriculum: Essential Connections: Experiential Learning: Exploratory

MATH 2950 Independent Study (1-4 hours)

This is a course where a student works independently on a topic. The student initially meets with the department chair to select a study topic. At this time the student will be assigned a faculty resource person to guide his or her work and assist in an advisory capacity. A copy of the student's work is filed in the archives for the department. Independent Study may not duplicate courses described in the catalog.
*Prerequisite(s): Sophomore standing and permission of the department chair.*

MATH 2970 Internship (1-8 hours)

An on-the-job experience oriented toward the student's major interest. The student is to secure a position in an organization that satisfies the mutual interests of the instructor, the sponsor, and the student. P/F Only.
*Prerequisite(s): Permission of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

MATH 3100 Differential Equations (4 hours)

A study of ordinary differential equations. Topics include first- and higher-order, linear and nonlinear differential equations with applications. Additional topics may be chosen from systems of differential equations, transform techniques, and numerical methods. Use will be made of a computer algebra system.
*Prerequisite(s): Grade of "C" or better in MATH 1610 Calculus II.*
(Normally offered each spring semester.)

MATH 3200 Linear Algebra (3 hours)

A study of vector spaces, determinants, linear transformations, matrices, matrix equations, and their applications in the natural and social sciences.
*Prerequisite(s): Grade of "C" or better in MATH 1610 Calculus II.*
(Normally offered each spring semester.)

MATH 3300 Mathematical Statistics I (3 hours)

An introduction to basic probability and statistics concepts with an emphasis on applications. Topics include descriptive statistics, probability, Bayes' Theorem, discrete and continuous probability distributions, joint probability distributions, estimation and hypothesis testing.
*Prerequisite(s): Grade of "C" or better in MATH 1610 Calculus II.*
(Normally offered fall of even-numbered years.)

MATH 3500 Geometry (3 hours)

Selected topics from Euclidean and non-Euclidean geometry, geometry as a mathematical structure, and geometry as a study of invariants of set transformations.
*Prerequisite(s): Grade of "C" or better in MATH 2200 Foundations of Modern Mathematics.*
(Normally offered fall of odd-numbered years.)

MATH 3600 Mathematical Problem Solving (1 hour)

A seminar on problem solving skills and their application to nontrivial problems. May be repeated.
*Prerequisite(s): Grade of "C" or better in MATH 2200 Foundations of Modern Mathematics or permission of the instructor.*
(Normally offered each fall semester.)

MATH 3700 Mathematical Modeling (3 hours)

A course that explores applications of mathematics to real-world problems. One or more topics may be chosen from the non-inclusive list: dynamical systems, linear programming, queueing theory, game theory, numerical analysis, wavelets, coding theory, and partial differential equations. Computer-based exercises will be a component of the course.
*Prerequisite(s): Grade of "C" or better in MATH 1610 Calculus II.*

MATH 3750 Numerical Analysis (3 hours)

An introduction to the numerical approximation of solutions of various types of problems. Topics include root-finding, interpolation and numerical differentiation and integration. Additional topics may be drawn from numerical solutions of ordinary differential equations and linear systems.
*Prerequisite(s): Grade of "C" or better in MATH 1610 Calculus II.*
(Normally offered fall of odd-numbered years.)

MATH 3950 Independent Study (1-4 hours)

This is a course where a student works independently on a topic. The student initially meets with the department chair to select a study topic. At this time the student will be assigned a faculty resource person to guide his or her work and assist in an advisory capacity. A copy of the student's work is filed in the archives for the department. Independent Study may not duplicate courses described in the catalog.
*Prerequisite(s): Junior standing or permission of the department chair.*

MATH 3970 Internship (1-8 hours)

An on-the-job experience oriented toward the student's major interest. The student is to secure a position in an organization that satisfies the mutual interests of the instructor, the sponsor, and the student. P/F Only.
*Prerequisite(s): Permission of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

MATH 4200 Abstract Algebra I (4 hours)

A study of various algebraic systems arising in modern mathematics, such as groups and rings.
*Prerequisite(s): Grade of "C" or better in MATH 2200 Foundations of Modern Mathematics.*
(Normally offered fall of even-numbered years.)

MATH 4300 Real Analysis (4 hours)

A formal approach to limits, continuity, differentiation, and integration with emphasis on the proofs of theorems. Additional topics may include topology, uniform continuity, and uniform convergence.
*Prerequisite(s): Grade of "C" or better in MATH 2200 Foundations of Modern Mathematics and MATH 1610 Calculus II.*
(Normally offered spring of even-numbered years.)

MATH 4800 Research Experience (0-3 hours)

A guided, original research experience on a mathematical topic. This course will culminate in a conference-style presentation and written report. Students will keep a reflection journal throughout the experience.

*Prerequisite(s): Instructor permission.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

MATH 4950 Independent Study (1-4 hours)

This is a course where a student works independently on a topic. The student initially meets with the department chair to select a study topic. At this time the student will be assigned a faculty resource person to guide his or her work and assist in an advisory capacity. A copy of the student's work is filed in the archives for the department. Independent Study may not duplicate courses described in the catalog.
*Prerequisite(s): Senior standing or permission of the department chair.*

MATH 4970 Internship (1-8 hours)

An on-the-job experience oriented toward the student's major interest. The student is to secure a position in an organization that satisfies the mutual interests of the instructor, the sponsor, and the student. P/F Only.
*Prerequisite(s): Permission of the department chair.*

Archway Curriculum: Essential Connections: Experiential Learning: Intensive

MATH 4980 Mathematics Seminar (3 hours)

A study of topics of special interest in mathematics. Students begin the course by studying an advanced topic in mathematics. Students then work on individualized projects culminating in a symposium presentation and survey paper.
*Prerequisite(s): Major in mathematics, senior standing, grade of "C" or better in either MATH 4200 Abstract Algebra I or MATH 4300 Real Analysis, and permission of the instructor.*
(Normally offered each spring semester.)

Archway Curriculum: Essential Connections: Writing Instructive
Archway Curriculum: Essential Connections: Speaking Instructive