

COMPUTER SCIENCE, B.S. (BEHREND)

Begin Campus: Any Penn State Campus

End Campus: Erie

Program Description

The goals of the Computer Science major at Behrend are to:

- Provide strong fundamentals in both theoretical and applied computer science
- Train our students to solve real-world problems
- Prepare graduates to be employed as a practicing computing professional in fields such as design, research, development, testing, maintenance, and manufacturing
- Assume positions of leadership and responsibility within an organization
- Progress through advanced degree or certificate programs in engineering, science, business, and other professionally related fields.

These goals are consistent with the objectives outlined for the ABET accreditation.

The program consists of a number of core courses in computer programming, algorithm, and computer systems. In addition, the program offers a selection of advanced topics from which students may choose elective courses with concentrations in Cyber Security, Artificial Intelligence and Data Science, and Web Services and Applications. The students will be required to analyze and solve a significant industry sponsored computer problem during the senior year.

What is Computer Science?

Computer science is the study of computational methods, including their principles and foundations, their efficient implementation, their analyses, and their practical application in wide-ranging areas. It includes the foundations of software development, computational problem solving, the principles of system software, and the fundamental principles and limits of computing. It is much more than just programming. It includes the mathematical foundations that support analyzing, evaluating, and proving the correctness of computational solutions. It includes specializations such as artificial intelligence, machine learning, cybersecurity, data mining, high-performance computing, computer networks, computer graphics, computer vision, quantum computing, and others. It is continually evolving with the development of new and faster forms of computation and with the identification of new problems that require computational solutions.

You Might Like This Program If...

- You enjoy math, logic, coding, and programming, and also want to take coursework in the natural sciences.
- You use all of your devices' capabilities, not just the obvious ones.
- You'd like to work in a specialized field in computer science such as artificial intelligence, machine learning, security, or web development.

Entrance to Major

To be eligible for entrance to the Computer Science (CMPBC) major, a student must have completed MATH 140, MATH 141, CMPSC 121,

CMPSC 122, and one of the following: BIOL 110, or CHEM 110 and CHEM 111 or PHYS 211 with a grade of C or better in each of these courses.

Degree Requirements

For a Bachelor of Science degree in Computer Science, a minimum of 122-123 credits is required:

Requirement	Credits
General Education	45
Electives	1
Requirements for the Major	97-98

21 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 6 credits of GQ courses, 6 credits of GWS courses, 9 credits of GN courses.

Per Senate Policy 83.80.5, the college dean or campus chancellor and program faculty may require up to 24 credits of coursework in the major to be taken at the location or in the college or program where the degree is earned.

Requirements for the Major

A student enrolled in this major must earn at least a grade of C in each 300- and 400-level course in the major field.

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44>).

Code	Title	Credits
Prescribed Courses		
CMPSC 221	Object Oriented Programming with Web-Based Applications	3
MATH 220	Matrices	2
<i>Prescribed Courses: Require a grade of C or better</i>		
CAS 100A	Effective Speech	3
CMPSC 121	Introduction to Programming Techniques	3
CMPSC 122	Intermediate Programming	3
CMPSC 312	Computer Organization and Architecture	3
CMPSC 335	Fundamentals of Communication Networks	3
CMPSC 360	Discrete Mathematics for Computer Science	3
CMPSC 421	Net-centric Computing	3
CMPSC 431W	Database Management Systems	3
CMPSC 461	Programming Language Concepts	3
CMPSC 465	Data Structures and Algorithms	3
CMPSC 474	Operating System & Systems Programming	3
CMPSC 484	Computer Science Senior Project I	2
CMPSC 485W	Computer Science Senior Project II	3
ENGL 202C	Effective Writing: Technical Writing	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
STAT/MATH 318	Elementary Probability	3
Additional Courses		
Select one of the following sequences:		10-11

CHEM 110 & BIOL 110 & BIOL 220W	Chemical Principles I and Biology: Basic Concepts and Biodiversity and Biology: Populations and Communities	
CHEM 110 & BIOL 110 & BIOL 230W	Chemical Principles I and Biology: Basic Concepts and Biodiversity and Biology: Molecules and Cells	
CHEM 110 & BIOL 110 & BIOL 230M	Chemical Principles I and Biology: Basic Concepts and Biodiversity and Honors Biology: Molecules and Cells	
CHEM 110 & BIOL 110 & BIOL 240W	Chemical Principles I and Biology: Basic Concepts and Biodiversity and Biology: Function and Development of Organisms	
CHEM 110 & BIOL 110 & BIOL 240M	Chemical Principles I and Biology: Basic Concepts and Biodiversity and Honors Biology: Function and Development of Organisms	
CHEM 110 & CHEM 111 & CHEM 112 & CHEM 113 & CHEM 210	Chemical Principles I and Experimental Chemistry I and Chemical Principles II and Experimental Chemistry II and Organic Chemistry I	
PHYS 211 & PHYS 212 & PHYS 213	General Physics: Mechanics and General Physics: Electricity and Magnetism and General Physics: Fluids and Thermal Physics	
PHYS 211 & PHYS 212 & PHYS 214	General Physics: Mechanics and General Physics: Electricity and Magnetism and General Physics: Wave Motion and Quantum Physics	
Select at least 15 additional science credits from department approved list		15

Supporting Courses and Related Areas

Select 6 credits from the school approved list ¹	6
Select 9 additional credits from department approved courses in CMPSC, CMPEN, or SWENG	9

¹ Students may apply 6 credits of ROTC and/or 6 credits of internship CMPSC 495.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (<https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN**, may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher: 6 credits

University Degree Requirements**First Year Engagement**

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or

within time constraints (see Senate Policy 83-80 (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#83-80>)). For more information, check the Suggested Academic Plan for your intended program.

Academic Advising

The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and out-of class educational opportunities in order that they become self-directed learners and decision makers.

Both advisers and advisees share responsibility for making the advising relationship succeed. By encouraging their advisees to become engaged in their education, to meet their educational goals, and to develop the habit of learning, advisers assume a significant educational role. The advisee's unit of enrollment will provide each advisee with a primary academic adviser, the information needed to plan the chosen program of study, and referrals to other specialized resources.

READ SENATE POLICY 32-00: ADVISING POLICY (<https://senate.psu.edu/policies-and-rules-for-undergraduate-students/32-00-advising-policy/>)

Erie

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Suggested Academic Plan

The suggested academic plan(s) listed on this page are the plan(s) that are in effect during the 2023-24 academic year. To access previous years' suggested academic plans, please visit the archive (<https://bulletins.psu.edu/undergraduate/archive/>) to view the appropriate Undergraduate Bulletin edition (*Note: the archive only contains suggested academic plans beginning with the 2018-19 edition of the Undergraduate Bulletin*).

Computer Science, B.S. at Erie Campus

The course series listed below provides **only one** of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an **Academic Requirements** or **What If** report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

First Year

Fall	Credits	Spring	Credits
CMPSC 121 ^{*#†}	3	CMPSC 122 ^{*#}	3
ENGL 15 or 30H ^{††}	4	MATH 141 ^{*†#†}	4
MATH 140 ^{*†#†}	4	Science Sequence Course ^{†3}	4

PSU 7	1 General Education Course	3
Science Sequence Course (GN) ^{#†3}	4 General Education Course (GHW)	1.5
		15

Second Year

Fall	Credits	Spring	Credits
CAS 100 ^{††}	3	CMPSC 360 [*]	3
CMPSC 221	3	ENGL 202C ^{††}	3
MATH 220	2	STAT 318 [*]	3
Science Sequence Course ^{†3}	2-3	Computer Science and Science Elective	3
General Education Course	3	General Education Course	3
General Education Course (GHW)	1.5		
		11.5-12.5	15

Third Year

Fall	Credits	Spring	Credits
CMPSC 312 ^{*1}	3	CMPSC 421 ^{*2}	3
CMPSC 335 ^{*1}	3	CMPSC 431W ²	3
CMPSC 465 [*]	3	CMPSC 474 [*]	3
SWENG 411 (Computing Elective) [*]	3	Computer Science and Science Elective	3
Computer Science and Science Elective	3	Supporting and Related Area	3
		15	15

Fourth Year

Fall	Credits	Spring	Credits
CMPSC 461 ^{*1}	3	CMPSC 485W ^{*2}	3
CMPSC 484 ^{*1}	2	Computing Elective	3
Computing Elective or Computer Science and Science Elective	3	Computer Science and Science Elective	3
General Education Selection (GA/GH/GS)	3	General Education Course	3
Computer Science and Science Elective	3	General Education Course	3
Supporting and Related Area	3		
		17	15

Total Credits 119-120

- * Course requires a grade of C or better for the major
- ‡ Course requires a grade of C or better for General Education
- # Course is an Entrance to Major requirement
- † Course satisfies General Education and degree requirement

¹ This course is only offered in the **FALL SEMESTER**

² This course is only offered in the **SPRING SEMESTER**

³ Students need to complete one of the following three semester science (GN) course sequences, which will also count toward their general education.

- Biology: CHEM 110, BIOL 110S, and BIOL 220W or BIOL 230W or BIOL 240W

- Chemistry: CHEM 110, CHEM 111, CHEM 112, CHEM 113, and CHEM 210
- Physics: PHYS 211, PHYS 212, and PHYS 213 or PHYS 214

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy Cultural Diversity Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

General Education includes Foundations (GWS and GQ), Knowledge Domains (GHW, GN, GA, GH, GS) and Integrative Studies (Inter-domain) requirements. N or Q (Honors) is the suffix at the end of a course number used to help identify an Inter-domain course, but the inter-domain attribute is used to fill audit requirements. Foundations courses (GWS and GQ) require a grade of 'C' or better.

School-Approved Electives for Computer Science and Science Electives (15 credits):

Students may choose one of the below options in Computer Science (9 credits):

- Cyber Security – CMPSC 440, CMPSC 443 and SWENG 455
- Artificial Intelligence and Data Science – CMPSC 440, CMPSC 441 and CMPSC 445
- Web Services and Applications – CMPEN 461, CMPSC 475 and SWENG 465

Students may choose from the following courses in Natural Science, MATH, STAT or other CMPSC courses (6 credits):

- 300 and 400-level courses in CMPSC
- ASTRO 291 or higher; BIOL 110 or higher; CHEM 110 or higher
- GEOG 160 or higher, MATH 200-level or higher (Not MATH 311), METEO 101 or higher
- PHYS 211 or higher, except PHYS 250 or PHYS 251
- STAT 300-level or higher

NOTE: Students who take the Chemistry Science Sequence will need to include one course with Natural Science (GN) credit.

School-Approved Computing Electives (9 credits):

Students may choose any courses from:

- Software Engineering: SWENG 411 or higher
- Computer Engineering: CMPEN 270 or higher (except CMPEN 441)
- IE 418
- Other CMPSC 400-level courses

School-Approved Supporting and Related Area Courses (6 credits):

Students may choose from the following:

- 300- and 400-level courses in GAME, MIS, ACCTG, ECON, FIN, PSYCH and ROTC (except MIS 336)
- CMPSC 494 – Research, CMPSC 495 – Internship, and/or CMPSC 496 – Independent Study

- 300 and 400-level courses in CMPSC, CMPEN (except for CMPEN 441), and SWENG (except SWENG 311)

Career Paths

Typical beginning careers for B.S. in Computer Science graduates include applications programmer, systems programmer, systems analyst, systems administrator, and network administrator. You also can prepare for emerging careers in data science, cognitive computing, and artificial intelligence. Penn State Behrend has a comprehensive support system to help you identify and achieve your goals for college and beyond. Meet with your academic adviser often and take advantage of the services offered by the Academic and Career Planning Center beginning in your first semester.

Careers

Students entering the workforce with a degree in computer science will find many opportunities in business, industry, government, and academia, and particularly in organizations with a science emphasis. These include traditional and emerging careers such as application programming, systems programming, systems analysis, systems administration, bioinformatics, network administration, and computer modeling. Employers of recent Behrend B.S. in Computer Science graduates include Amazon, Erie Insurance, Genesys, IBM, Larson Texts, Lockheed Martin, and Northrop Grumman.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE COMPUTER SCIENCE PROGRAM (<https://behrend.psu.edu/school-of-engineering/academic-programs/computer-science/>)

Opportunities for Graduate Studies

Graduate programs in computer science often delve more deeply into the intersections of computer science and the natural sciences, leading to careers in bioinformatics, computational chemistry or physics, or scientific visualization. Or, you can use a master's degree to learn management skills; Penn State Behrend offers a Master of Manufacturing Management (M.M.M) degree program for aspiring organizational leaders.

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (<https://behrend.psu.edu/school-of-engineering/academic-programs/master-of-manufacturing-management/>)

Professional Resources

- ABET (<https://www.abet.org/>)
- Institution of Electrical and Electronics Engineers (IEEE) Computer Society (<https://www.computer.org/>)
- Association for Computing Machinery (<https://www.acm.org/>)
- Society of Women Engineers (<https://swe.org>)
- National Society of Black Engineers (<https://www.nsbe.org>)

Accreditation

The Bachelor of Science in Computer Science at Penn State Behrend is accredited by the Computing Accreditation Commission of ABET, <https://www.abet.org>, under the General Criteria and the Computer Science Program Criteria.

Contact

Erie

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