SYLLABUS BIO 592 & CSC 591 SPRING 2026 (3 CREDIT HOURS)
ALGORITHMIC ASPECTS OF BIOINFORMATICS

Sections	When?	Where
BIO 592 031 & CSC 591 031	F 10:15 am - 1:15 pm	02015 EB I

COURSE DESCRIPTION

This course focuses on algorithmic techniques in bioinformatics combined with hands-on practice that allows students to experience algorithms in action. The course is tailored for students with a basic background in computer science and molecular biology, aiming to deepen their understanding of how algorithms are applied to biological data analysis. Topics include

- A Molecular Biology Primer: DNA, RNA, proteins
- Algorithms and Complexity: What is an algorithm? Basic algorithm analysis, tractable problems, NP-completeness.
- Graph Algorithms: De Bruijn graphs, Hamiltonian cycles, Eulerian cycles, genome assembly
- Exhaustive Search: regulatory motifs in DNA sequences, the motif finding problem.
- Dynamic Programming: edit distance and pairwise alignments, local and global alignments, HMMs, gene annotation.
- Greedy Algorithms: genome rearrangements, sorting by reversals.
- Combinatorial Pattern Matching: exact pattern matching, approximate pattern matching, BLAST, and related programs

This is an approximate list. We will add or omit topics if necessary.

PREREQUISITES

Calculus and Linear Algebra, Introduction to Computing, Introduction to Statistics, and Introduction to Genetics.

LEARNING OUTCOMES

You will learn

- how to formulate the computational problems that underlie important bioinformatics tasks,
- how to describe and analyze algorithms for solving these problems, and
- how to implement simple algorithms and algorithm design techniques for solving practical problems in biology.

TEXTBOOK (REQUIRED)

Bioinformatics Algorithms An Active Learning Approach by Phillip Compeau & Pavel A. Pevzner. 3rd Edition. Additional useful information about the book may be found at: http://bioinformaticsalgorithms.com/

The textbook is required.

INSTRUCTORS

The class will be co-taught by

Louis-Marie Bobay
Email: ljbobay@ncsu.edu
Office Location: Ricks 344
Office hours: by appointment
Zoom: by appointment

Steffen Heber
Email: sheber@ncsu.edu
Office Location: 2306 EB2
Office Hours: in person on Wednesday, 2:00-3:00 PM in 2306 EB2, or by appointment
Zoom: PMI 694 362 4188; please schedule a meeting.

COURSE STRUCTURE AND POLICIES

The coursework includes lectures, readings, in-class activities, paper presentations, a team project, a midterm, and a final exam.

- Lectures and in-class activities might depart from our textbook. Some material presented in class might not be available through the lecture notes or textbook. You are responsible for all material presented or discussed in class.
- Readings will be taken from our textbook with possible supplements from the literature.
- Each student must plan and implement a research project. Please submit written milestone reports partway through the semester and a final paper at the end.

- Teams of 2(-3) students will present a paper on a lecture topic during the semester.
- We will have one midterm and one final exam. All exams are closed-book exams. The exams might include material from lectures and readings.
- We will perform in-class quizzes and/or literature reviews.

ELECTRONICALLY HOSTED COURSE COMPONENTS

Digital Course Components include Moodle, Zoom, Google Suite, Panopto, and Piazza. Students may be required to disclose personally identifiable information to other students in the course via electronic tools like email or web postings. Examples include online discussions of class topics and the posting of student coursework. All students are expected to respect each other's privacy by not sharing or using such information outside the course.

We will be using Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself.

- Find our class signup link at https://piazza.com/ncsu/spring2026/bio592csc591.
- Rather than emailing questions to the teaching staff, please post your questions on Piazza. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself.
- For questions about personal grades or meeting requests, please contact the instructors or the TA via private piazza post.
- If you have any problems or feedback for the developers, email team@piazza.com.

GRADING

Grades will be computed with a weighted average using the weights shown below.

Activity	**weight**
Project: Each student must plan and implement a research project. Please provide two milestone reports partway through the semester, a final project presentation, and an accompanying final project paper at the end of the semester. The grades of the project components will be averaged as follows: • two milestone presentations: 5% each (total 10%) • final project presentation 25% • final project paper 45% • program verification & notebook 20%	45%
Exams: we will compute the weighted average of the final exam (2/3) and the midterm exam (1/3).	25%
Paper presentation: each student will present a paper related to a lecture topic.	10%
Participation: we will perform in-class quizzes and/or literature reviews, and we will measure your attendance and participation in class and class activities to compute a participation score.	20%

This Course uses Standard NCSU Letter Grading.

97 ≤ A+ ≤ 100
93 ≤ A < 97
90 ≤ A- < 93
87 ≤ B+ < 90
83 ≤ B < 87
80 ≤ B- < 83
77 ≤ C+ < 80
73 ≤ C < 77
70 ≤ C- < 73
67 ≤ D+ < 70
63 ≤ D < 67
60 ≤ D- < 63
0 ≤ F < 60

- Attendance is mandatory. However, you may miss up to 2 classes. No excuses are necessary! You will lose points for participation if you skip more classes or attend but do not participate adequately.
- We will perform in-class quizzes and/or literature reviews, and we will measure your attendance and participation in class and class activities to compute a participation score.
- Bad grade forgiveness policy: If your final exam score is better than your midterm score, only the final exam will be considered.
- There is a one-week time limit for submission of disputes for exams. The entire exam, not just the disputed question, will be regraded.

ASSIGNMENT & DELIVERABLES POLICIES

- Unless stated otherwise, all assignments in this course are individual work intended to evaluate your own understanding of bioinformatics concepts. Submitting work that is not your own is academic misconduct. Copying text, code, or other content from the internet or any external source is plagiarism. All submissions must be written from scratch in your own words; paraphrased solutions from other sources are not acceptable, even if cited.
- You are expected to complete assignments independently and to properly cite any external sources you consult. **The use of external tools—including AI tools such as chatbots, text generators, paraphrasers, summarizers, or automated problem solvers—is not allowed unless explicitly approved by the instructor.** Work generated in whole or in part using unapproved tools will be treated as academic misconduct. If you are unsure whether a tool or specific use of AI is allowed, ask the instructor *before* submitting your work. Submissions may be reviewed using plagiarism-detection tools such as iThenticate or MOSS.

- Late Policy: All assignments are due by **9:00 PM on the due date**. Late submissions are accepted only for excused absences as defined by university policy (e.g., serious illness or family emergency) and must be properly documented. When possible, arrangements must be made by the day before the due date. Unexcused late work receives a **10% penalty on the first day** and a **40% penalty on the second day** after the deadline; **no credit** is given for work submitted three or more days late.

POLICIES ON INCOMPLETE GRADES

If an extended deadline is not authorized by the Graduate School, an unfinished, incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions) or (b) by the end of 12 months if the student is not enrolled, whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the student's responsibility. The university policy on incomplete grades is described at http://policies.ncsu.edu/regulation/reg-02-50-03; additional information for graduate students can be found in the Graduate Administrative Handbook in Section 3.18.F at http://www.fis.ncsu.edu/grad_publicns/handbook/.

REQUIREMENTS FOR AUDITORS

This class cannot be audited.

N.C. STATE UNIVERSITY POLICIES, REGULATIONS, AND RULES

Students are responsible for reviewing the PRRs which pertain to their course rights and responsibilities. These include http://policies.ncsu.edu/policy/pol-04-25-05 (Equal Opportunity and Non-Discrimination Policy Statement), http://oied.ncsu.edu/oied/policies.php (Office for Institutional Equity and Diversity), http://policies.ncsu.edu/policy/pol-11-35-01 (Code of Student Conduct), and http://policies.ncsu.edu/regulation/reg-02-50-03 (Grades and Grade Point Average).

Academic Integrity

You are expected to maintain the highest standards of academic integrity. This includes producing original work, properly citing sources, and refraining from plagiarism or cheating. You are required to comply with the university policy on academic integrity found in the Code of Student Conduct at http://policies.ncsu.edu/policy/pol-11-35-01 and the Pack Pledge.

- Academic integrity is not negotiable. Every piece of work, except team assignments, must be completed individually.
- Academic integrity violations will be handled per the Student Discipline Procedures (NCSU REG 11.35.02).
- If an academic integrity violation occurs, the offending student(s) will be assessed a penalty at least as severe as getting a 0 for the whole assignment for which the violation occurred. The case will always be reported to the Office of Student Conduct.

- Any tool/resource must be approved by the instructor and identified and acknowledged clearly in any work turned in; anything else is plagiarism.

Pack Pledge

Your signature on any test or assignment indicates, "I have neither given nor received unauthorized aid on this test or assignment."

Accommodations for Disabilities

Reasonable accommodations will be made for students with verifiable disabilities. To take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the Academic Accommodations for Students with Disabilities Regulation (NCSU REG 02.20.01) (https://policies.ncsu.edu/regulation/reg-02-20-01/).

Non-Discrimination Policy

NC State provides equal opportunity and affirmative action efforts. It prohibits all forms of unlawful discrimination, harassment, and retaliation ("Prohibited Conduct") that are based upon a person's race, color, religion, sex (including pregnancy), national origin, age (40 or older), disability, gender identity, genetic information, sexual orientation, or veteran status (individually and collectively, "Protected Status"). Additional information on each Protected Status is included in NCSU REG 04.25.02 (Discrimination, Harassment and Retaliation Complaint Procedure). NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at http://policies.ncsu.edu/policy/pol-04-25-05 or https://oied.ncsu.edu/divweb/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Institutional Equity and Diversity (OIED) at 919-515-3148.

COURSE SCHEDULE

Schedule of BIO 592 and CSC 591. The schedule is subject to change. Please review frequently!

Day	Topic	Note	Assignments
01/16 F	Preview, Introduction to Biology	LMB	Read the syllabus and schedule Read *Introduction to Molecular Biology for CS students*
01/16 F	Origin of replication / GC-skew	Chapter 1 – LMB	
01/23 F	Introduction to algorithms	SH	
01/23 F	Introduction to algorithms	SH	
01/30 F	Genome Assembly	Chapter 3 – LMB	

01/30 F	Genome Assembly	Chapter 3 – LMB	
02/06 F	Coding	LMB	
02/06 F	Coding	LMB	
02/13 F	Motifs	Chapter 2 – SH	
02/13 F	Motifs	Chapter 2 – SH	
02/20 F	Motifs	Chapter 2 – SH	
02/20 F	Project mentoring		
02/27 F	Alignments	Chapter 5 – SH	
02/27 F	Alignments	Chapter 5 – SH	
03/06 F	Article Presentations		Three presentations (6 students)
03/06 F	Alignments	Chapter 5 – SH	
03/13 F	Genome rearrangements	Chapter 6 – SH	
03/13 F	Genome rearrangements	Chapter 6 – SH	
03/20 F	**Spring Break**	**No Class**	
03/20 F	**Spring Break**	**No Class**	
03/27 F	Midterm Exam		
03/27 F	Project mentoring		
04/03 F	Phylogeny	Chapter 7 – LMB	
04/03 F	Phylogeny	Chapter 7 – LMB	
04/10 F	Phylogeny	Chapter 7 – LMB	
04/10 F	Article Presentations		Three presentations (6 students)

04/17 F	Combinatorial Pattern Matching	Chapter 9 – LMB	
04/17 F	Combinatorial Pattern Matching	Chapter 9 – LMB	
04/24 M	Project Presentation		
04/24 W	Project Presentation		
5/1 F	Final Exam 8:30 am -11:00 am 02015 EBI		

Note: **The Syllabus and the Course Schedule are subject to change.**