

## **BIOL/CHEM/CSC8630 Advanced Bioinformatics**

Four credit hours.

Spring 2014

**Instructors:** Dr. Weber, Office PSC585, phone 404 413-5411, e-mail: iweber@gsu.edu  
Dr. Harrison, Office One Park Tower 1440, phone 404 413-5724, e-mail: rwh@gsu.edu

**Lecture:** Monday/Wednesday 11:00-12:45, Room CS400

**Office Hours:** Tuesday 1:00-2:00 pm and by appointment for Dr. Weber; by appointment for Dr. Harrison.

**Course Description:** A "hands-on" approach to learning bioinformatics using PCs, the internet, and computer graphics analysis. Bioinformatics covers the analysis, correlation and extraction of information from biological databases. The course will cover aspects of software engineering and development relevant to modern bioinformatics. This course will emphasize sequence and structure databases for proteins and nucleic acids and introduce the computing skills necessary for bioinformatics. The principles involved in sequence searching and molecular modeling of macromolecules will be described. Practical examples will be given, with time for discussion. Topics include: genomic sequence, sequences and three-dimensional structures of proteins and nucleic acids, the major databases, algorithms for sequence comparison, data mining, and prediction of structure and function. Students will complete a bioinformatics team project incorporating computer programming and sequence/structure analysis.

**Course Objectives:** The goal of the course is to provide practical training in design and application of bioinformatics tools, specifically as applied to the sequence and structure databases for proteins and nucleic acids. Students will perform practical examples using computers and programs available in any laboratory or home setting. This course is multidisciplinary and will incorporate biology, chemistry, computer science and mathematics. This is not a trivial course and regular attendance, completion of reading, homework and written assignments is necessary for success. Students will demonstrate the ability to contribute a computer program to analyze bioinformatics information within the team project.

**Grading:** Each of the two mid-term exams will constitute 20% of the final grade, the project will be 40% based on meeting scheduled deadlines for software development, final demonstration and written report, and the other 20% will be based on attendance, completing the class written and computer assignments and participating in the discussions. You are allowed ONE EXCUSED (with a doctor's note or equivalent) absence. Assignments and exams will be graded and returned in about one week. If it will take longer, we will notify you.

**Nominal Grading Scale:** A+ >97%, A 90-96%, A- 88-89%, B+ 86-87%, B 80-85%, B- 78-79%, C+ 76-77%, C 70-75%, C- 68-69%, D 60-67% and F 0-59%. Grades will be rounded to the nearest whole number. Note that C- is not a passing grade.

**Exams:** Students will be assigned seats for exams. Makeup tests and exams will not be given. If there is a disaster, an accident, or an illness a makeup test can be scheduled provided 1) the instructor is notified promptly and in advance if possible of the reason, and 2) you supply an original letter addressed to me on letterhead from a physician, hospital or relevant authority and signed by the physician, hospital administrator, or relevant authority, stating why you could not make it to the test. Missed tests and assignments will be graded as 0 (zero).

**Programming Exam (first mid-term exam):** The students are expected to develop fluency in the UNIX operating system and the Python scripting language as these will be used for the project(s). A test will be given to evaluate these skills before the withdrawal date (**March 4, 2014**).

If Georgia State University is closed (for example due to a weather emergency), test dates and assignment due dates will be re-scheduled on the next class day.

**Homework:** Suggested exercises will be given in class. These exercises will re-enforce the lectures and be similar to test problems. Performing them will help you get a good grade.

**Assignments:** Graded assignments will include short written reports on the literature or seminars, oral and written reports of the student's contribution to the team project, and demonstrations of the programs or components of the team project. Students are responsible for complying with the University's Policy on Academic Honesty. Students are expected to supply the answers in their own words with appropriate citations; a string of citations, however correct, will only receive partial credit.

**Academic Honesty:** All students should read and comply with the University's Policy on Academic Honesty (Section 409), which is published in the Faculty Affairs Handbook, the On Campus: The Student Handbook, and at <http://www2.gsu.edu/~wwwfhh/sec409.html>.

Failure to follow the policy can result in either or both of the following: academic (grade) penalty and/or disciplinary (notation on transcript, expulsion) penalty.

All work submitted for grading must be the students' own. Students who copy and paste other's work without using quotation marks, students who do not cite sources, and students who do not place the citations in the text of the paper will be considered to be plagiarizing. Plagiarism will be determined by the judgment of the instructors. Plagiarism will result in a score of 0 (zero) for the work or dismissal from the course and notification of the Dean of Students. Do not allow others to copy your work since all students will receive 0 (zero). Students who copy exam answers from another student, use their cell phone during an exam, use additional resources (cheat sheet, notes on hand, etc.), or give answers to another student will be considered to be academically dishonest and will receive a zero for the exam as well as a possible disciplinary penalty.

**Absence from Class:** Students are responsible for the materials covered in class. Should a student be absent, it is their responsibility to get the notes and handouts from that lecture. Most importantly, if there is an assignment given on a missed class, it still must be handed in on the prescribed date. If there is a disaster, an accident, or an illness a makeup assignment can be scheduled provided 1) the instructor is notified promptly and in advance if possible of the reason, and 2) you supply an original letter addressed to me on letterhead from a physician, hospital or relevant authority and signed by the physician, hospital administrator, or relevant authority, stating why you could not complete the assignment.

**Accommodation for disability:** Students who wish to request accommodation for a disability may do so by registering with the Office of Disability Services. Students may only be accommodated upon issuance by the Office of Disability Services of a signed Accommodation Plan and are responsible for providing a copy of that plan to instructors of all classes in which an accommodation is sought.

**Student evaluation of course:** Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take time to fill out the online course evaluation.

**Course website:**

**<http://asterix.cs.gsu.edu/~weber/links.html> for major public databases and bioinformatics servers.**

**Tentative Topic Schedule**

Introduction to UNIX/LINUX operating system

PYTHON programming language

Chemistry of Amino Acids

Public sequence and structure databases

Protein-ligand interactions

Molecular mechanics representation of proteins

Calculation of molecular properties.

Algorithm design

Principles of database design

Server architecture

Sequence alignment: Dynamic programming algorithm and related approaches.

Assessment of Significance in bioinformatics predictions

Prediction of function from genomic sequences

Prediction of function from sequence information

Prediction of protein structure

Prediction of function from structural models

Discussion of class projects and relevant literature will be interspersed with these topics.

Note: The course syllabus provides a general plan for the course; deviations may be necessary.