BCB 5200: Introduction to BIOINFORMATICS I

Catalog Description:

"Introduce the broad frontiers of bioinformatics topics from fundamental algorithms to practical tools. The main objective of the course is to provide the student with a solid foundation for conducting further research in bioinformatics."

Class Meeting Time/Location:

Time: Tue, Thu 12:45 - 2:00pm
Location: 115 Ritter Hall (Linux Classroom)

Instructor:

Tae-Hyuk (Ted) Ahn, PhD
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Office Hour: Thu 2:30pm-4:00pm or by appointment

Credits/Pre-requisites:

Credits: 3 Credits
Pre-requisites: Undergraduate course in Genetics are required.

Detailed Course Description:

Introduction to Bioinformatics I and II are designed to introduce senior/graduate students to the fundamental concepts, methods, and research topics in Bioinformatics for analyzing large and complex biological data. Introduction to Bioinformatics I course will cover introduction of Bioinformatics, Bioinformatics database, sequence alignment, database similarity search, phylogenetic analysis, gene expression analysis, genomics, RNA-Seq analysis. Introduction to Bioinformatics II will intensely cover protein structural analysis/modeling, molecular docking and dynamics, modeling and simulation of biological pathways. In the Introduction to Bioinformatics II course, students will be divided into groups and work on their selected projects. Exciting cutting-edge research topics in Bioinformatics research fields will be proposed to students. Students also can propose and proceed their own ideas.

Topical Outline:

- Introduction of Bioinformatics
- Bioinformatics database
- Sequence alignment
- Phylogenetic analysis
- Genome assembly
- Gene prediction
- Metagenomics
- RNA-Seq Analysis

Student Learning Outcomes:
    After successfully complete this course, students are expected:
- Know fundamental concepts of bioinformatics
- Understand underlying basic bioinformatics algorithms
- Run bioinformatics applications and tools to study diverse and complex omics data
- Recognize how to apply different bioinformatics tools
- Understand cutting edge bioinformatics research topics
- Write pipeline scripts to automate existing applications
- Increase the ability to propose new algorithms and implement software tools

Course Textbook and Resources:
    No textbook is required for this course. Assigned materials will be posted on class website. Optional reference books are as below:
- Bioinformatics and Functional Genomics 2nd or 3rd Edition by Jonathan Pevsner (Hoboken, N.J., Wiley-Blackwell, c2009)
- Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids by Richard Durbin et al. (1st Edition)
- R Cookbook by Paul Teetor (O'Reilly Cookbooks)
- Bioinformatics Programming Using Python: Practical Programming for Biological Data (O'Reilly)
- Bioinformatics Data Skills: Reproducible and Robust Research with Open Source Tools 1st Edition by Vince Buffalo (O'Reilly)
- An Introduction to Bioinformatics Algorithms (Computational Molecular Biology) 1st Edition by Neil C. Jones (Cambridge, Mass, MIT Press, c2004)
- Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology 1st Edition by Dan Gusfield (Univ. of Cambridge)

    Blackboard will be used to
- Post lectures and other materials
- Assign and submit homework
- Grade and post homework and exam scores

    Email with Instructor
        Face-to-face contact in class and in office hours is most desirable. Yet email is a convenient form of communication as well. We will try to respond to email promptly, including at least once each evening when possible.

        If your question involves your progress on a current programming assignment, our response will be more informative if you can point out the specific problem you have encountered, and if we are able to see all of your source code. Therefore I strongly suggest that you either attach all relevant files to the email.

Computer and Cell Phone Policy
    Computers will be an integral part of this course, both inside and outside of class. However, out of courtesy to both the instructor and other students, please do not use the lab computers for non-class

related activity. In particular, you do not need to be using a computer unless an exercise or in class activity requiring them is in progress.

You are unlikely to need cell phones during the course of lecture. Please ensure that your cell phone is set to vibrate or silent during lecture, and do not send text messages of any kind.

Grading:

Homework Assignments (60%)

There will be 6~10 assignments in a variety of format such as (but not exclusively) in-class assignments, online assignments, and take home assignments.

We will usually give you a week time frame to submit the homework. Check the due in the online system.

Exams (40%)

- First Exam (20%), Tuesday, 17 October 2017, 9:00-9:50am (tentative)
- Final Exam (20%), Thursday, 7 December 2017, 8:00-9:50am (tentative)

Attendance to all exams is mandatory. If you must miss an exam you must contact the instructor and submit a written request for a makeup exam prior to the exam. Your written request should include detailed information about the conflict and provide documentation of the conflict and any relevant contact information. Legitimate conflicts and excuses are limited to death or near-death instances in the immediate family, a student's illness that requires immediate doctor's care, a University sponsored event (not club sports) and regularly scheduled religious obligations. Excuses that will **NOT** be considered include personal travel arrangements, non-University sponsored events, a conflicting appointment, a previous illness that interfered with your study time or an illness that does not prevent you from coming to the exam. Unexcused exam absences will be counted as zero in the calculation of your final grade.

Extra Credit

There is no extra credit. Students who are seriously concerned about improving their overall grade would be best advise to focus all efforts on doing as well as possible on the required work and in preparing for exams.

Grading Scale:

Final grades for the course will be based on the following scale. The instructor reserve the right to make adjustments to grades based on overall performance in the course. There will be **no opportunity for "extra credit" to improve grades that have already been earned**. Bargaining for grades will not be tolerated.

Letter Grade	F	D	C-	C	C+	B-	B	B+	A-	A
%	<60	≥60 <70	≥70 <73	≥73 <77	≥77 <80	≥80- <83	≥83 <87	≥87 <90	≥90 <93	≥93

Late Policies

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Late homework will suffer a penalty of 20% for every day they are late. For example, homework which is submitted between midnight and 11:59pm next day will be worth at most 80% of the total credit. After five days of the due, submission will get zero point as the formula.

Regrade Requests

I am happy to regrade any assignments, programs, quizzes or exam problems which you think were unfair or incorrect. Please bring me the original assignment, plus a written explanation of your question or complaint, within two weeks of the time the paper in question is graded and returned to you.

Academic Integrity and Honesty

Academic integrity is honesty, truthful and responsible conduct in all academic endeavors. The mission of Saint Louis University is "the pursuit of truth for the greater glory of God and for the service of humanity." Accordingly, all acts of falsehood demean and compromise the corporate endeavors of teaching, research, health care, and community service via which SLU embodies its mission. The University strives to prepare students for lives of personal and professional integrity, and therefore regards all breaches of academic integrity as matters of serious concern.

Students are expected to be honest in their academic work. The University reserves the right to penalize any student whose academic conduct at any time is, in its judgment, detrimental to the University. Such conduct shall include cases of plagiarism, collusion, cheating, giving or receiving or offering or soliciting information in examinations, or the use of previously prepared material in examinations or quizzes. Violations should be reported to your course instructor, who will investigate and adjudicate them according to the policy on academic honesty of the College of Arts and Sciences. If the charges are found to be true, the student may be liable for academic or disciplinary probation, suspension, or expulsion by the University.

The governing University-level Academic Integrity Policy can be accessed on the Academic Polices website (https://www.slu.edu/online/current-students/academic-policies.php#). A more detailed policy statement is given by the College of Arts & Science, also applying to this course (http://www.slu.edu/arts-and-sciences/student-resources/academic-honesty.php)

Any violations of these policies will be dealt with seriously. Penalties will apply as well to a student who is aiding another student. Any such violations will result in a minimum penalty of a zero on the given assignment that cannot be dropped, and severe or repeated violations will result in an immediate failing grade in the course. Furthermore all incidents will be reported in writing to the Department and/or the Dean, as per the College procedure.

Students with Special Needs-Disability Services

In recognition that people learn in a variety of ways and that learning is influenced by multiple factors (e.g., prior experience, study skills, learning disability), resources to support student success are available on campus. Students who think they might benefit from these resources can find out more about:

- Course-level support (e.g., faculty member, departmental resources, etc.) by asking your course instructor.
- University-level support (e.g., tutoring/writing services, Disability Services) by visiting the Student Success Center (BSC 331) or by going to www.slu.edu/success.

Students who believe that, due to a disability, they could benefit from academic accommodations are encouraged to contact Disability Services at 314-977-8885 or visit the Student Success Center. Confidentiality will be observed in all inquiries.

Course instructors support student accommodation requests when an approved letter from Disability Services has been received and when students discuss these accommodations with the instructor after receipt of the approved letter.

Course Content Disclaimer

In this course, students may be required to read text or view materials that they may consider offensive. The ideas expressed in any given text do not necessarily reflect the views of the instructor, the English Department, the Writing Program, or Saint Louis University. Course materials are selected for their historical and/or cultural relevance, or as an example of stylistic and/or rhetorical strategies and techniques. They are meant to be examined in the context of intellectual inquiry of the sort encountered at the university level.

Writing Center

We encourage you to take advantage of the writing services in the Student Success Center; getting feedback benefits writers at all skill levels. Trained writing consultants can help with any writing, multimedia project, or oral presentation. During the one-on-one consultations, you can work on everything from brainstorming and developing ideas to crafting strong sentences and documenting sources. These services do fill up, so please make an appointment! For more information, or to make, change, or cancel an appointment, call 977-3484 or visit.

Tentative schedules

Week	Dates	Topic	Lecturer
1	08/29/2017	Welcome and Introduction	Ahn (Zhang)
	08/31/2017	Bioinformatics Resources	Zhang
2	09/05/2017	NCBI Databases	Zhang
	09/07/2017	NCBI Databases	Zhang
3	09/12/2017	Data Retrieval	Zhang
	09/14/2017	Pairwise Sequence Alignment 1	Zhang
4	09/19/2017	Pairwise sequence alignment 2	Zhang
	09/21/2017	Database similarity search BLAST	Zhang
5	09/26/2017	Multiple sequence alignment	Zhang
	09/28/2017	Sequence alignment lab	Zhang
6	10/03/2017	Phylogenetic analysis 1	Zhang
	10/05/2017	Phylogenetic analysis 2	Zhang
7	10/10/2017	Phylogenetic analysis 3	Zhang
	10/12/2017	Phylogenetic analysis lab 2	Zhang
8	10/17/2017	Midterm Exam (Tentative)	Zhang
	10/19/2017	String match & Suffix Tree	Ahn
9	10/24/2017	Fall Break (No Class)	
	10/26/2017	Genome Assembly	Ahn
10	10/31/2017	Genome Assembly	Ahn
	11/02/2017	Genome Assembly Lab	Ahn

11	11/07/2017	Gene Prediction and Genome Annotation	Ahn
	11/09/2017	Metagenomics	Ahn
12	11/14/2017	Transcriptome analysis overview	Lin
	11/16/2017	Fastq data retrieval and quality control	Lin
13	11/21/2017	Pipleline of RNA-Seq	Ahn
	11/23/2017	Thanksgiving Break (No Class)	
14	11/28/2017	RNA-Seq Lab	Ahn
	11/30/2017	Differential expression	Ahn
15	12/05/2017	Functional analysis	Ahn
	12/07/2017	Final Exam (Tentative)	Ahn