

New Course Request SEP 02 2009 Indiana University Indianapolis Campus

Check Appropriate Boxes: Undergraduate credit Graduate credit Professional credit 98

1. School/Division Science, Biostatistics 2. Academic Subject Code BIOS

3. Course Number S531 (must be cleared with University Enrollment Services) 4. Instructor Y Liu

5. Course Title Sequence Analysis

Recommended Abbreviation (Optional) (Limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Fall 2009

7. Credit Hours: Fixed at 3.0 or Variable from to

8. Is this course to be graded S-F (only)? Yes No X

9. Is variable title approval being requested? Yes No X

10. Course description (not to exceed 50 words) for Bulletin publication: P: BIOS S530. This course is designed to develop students' skills in sequence analyses and communications through multiple real life projects covering pairwise alignment, multiple alignment, evolution and phylogeny, and cis-regulatory analysis.

11. Lecture Contact Hours: Fixed at 3 or Variable from to

12. Non-Lecture Contact Hours: Fixed at or Variable from to

13. Estimated enrollment: 5-10 of which 100 percent are expected to be graduate students.

14. Frequency of scheduling: TBD Will this course be required for majors? elective

15. Justification for new course: course for new biostatistics Ph.D. program

16. Are the necessary reading materials currently available in the appropriate library? Yes

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant.

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by: Beth Baber Date 3/17/09 Department Chairman/Division Director

Approved by: James M. Murphy Date 4/17/2009 Dean

Dean of Graduate School (when required) Date

Cherry L. Queener Date 8/10/09 Chancellor/Vice-President

Jackie O'Palmer Date 6/18/09 CURRICULUM COMMITTEE

University Enrollment Services Date

After School/Division approval, forward the last copy (without attachments) to University Enrollment Services for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

**BIOS S531 (3 cr.)
Sequence Analysis**

Syllabus

A. Instructors

Lang Li, PhD, Associate Professor
Yunlong Liu, PhD, Assistant Professor
Changyu Shen, PhD, Assistant Professor

Contact information:

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Division of Biostatistics
Indiana University School of Medicine
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Indianapolis, IN 46202

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B. Prerequisites

Students are assumed to have completed BIOS S530 (Statistical Methods in Bioinformatics) and can efficiently program. Students who are uncertain about their levels of preparation are encouraged to contact the instructors.

C. Course Description and Rationale

Sequence analysis is very useful in practice. When and how to apply different methods and the interpretations of the data analysis results are heavily driven by the experiences. This course is designed to train students' skills in sequence analyses and communications through multiple real life projects. The projects will cover pairwise alignment; multiple alignment, evolution and phylogeny, and cis-regulatory analysis. The course's primary audiences include are graduate students in biostatistics and bioinformatics.

The most important feature of the course is the intended balance among algorithm, statistics and application. At the end of this course, we expect that the students can understand the basic sequence analysis methods and tools, and can apply these methods and tools for practical problems. The course is part of the Biostatistics Ph.D. curriculum.

Course material will be covered by lectures. Knowledge gained will be reinforced by homework assignments and programming exercises.

D. Course Description for Bulletin

P: BIOS S530. This course is designed to develop students' skills in sequence analyses and communications through multiple real life projects covering pairwise alignment, multiple alignment, evolution and phylogeny, and cis-regulatory analysis.

E. Educational Objectives

Students will receive a balanced training in algorithm, statistics and their application. By participating in the course, they will acquire hands on experience for implementing sequence analysis. We will assess students' achievement towards these objectives by homework exercises and in-class or take home examinations.

F. Course Content

1. Pairwise alignment (week 1-5)
 - Dynamic programming
 - The Needleman-Wunsch algorithm
 - The Smith-Waterman algorithm
 - Linear-space alignment
 - Four-Russian Algorithm
 - Blast and its variants
2. Multiple alignment (week 6-7)
 - Star algorithm
 - Server and Software
3. Evolution and phylogeny (week 8-9)
 - Neighborhood-joining
 - Maximal likelihood estimation
 - Software
4. Cis-regulatory analysis (week 10-13)
 - Gibbs Sampler
 - MEME.
 - Cis-regulatory analysis in multiple species
5. Final exam (week 14).

G. Required and Recommended Texts:

The course will use the following textbook:

Biological sequence analysis by Durbin, Eddy, Krogh, Mitchinson

Chapters 1-4, 6, (7-8), (9-10)

Algorithms on strings, trees, and sequences by Gusfield

Chapters (5-7), 11-12, (13), 14, (17)

We will not necessarily follow the order of the original chapters in the book. We will supplement the textbook with instructors' own lecture notes.

H. Evaluation and Grading

Student's performance will be evaluated through homework exercises and in-class/take home exams. The homework assignment will account for 40% of the course grade. Two exams will

each contribute 30% to the overall course score, which ranges from 0 to 100. Letter grades for the course are assigned using the following scale: A: 90-100; B: 80-89; C: 70-79; D: 60-69; F: less than 60. Within each letter grade, "+" and "-" will be assigned if the numeric score is in the top and bottom quintiles, respectively.

I. Bibliography:

N/A

J. Cheating and Plagiarism:

Academic misconduct will *not* be tolerated and all cases will be reported. Examine the IU Code of Student Rights, Responsibilities, and Conduct at <http://www.iupui.edu/code> and in particular examine the rules regarding academic misconduct at http://www.iupui.edu/code/#P2_G. Violations of these rules will result in a grade of "F" (or 0%) for the assignment in question, and may result in an "F" for the course or even expulsion from the university (see <http://life.iupui.edu/rights/undergrad/sanctions.html>).

K. Americans with Disabilities Act

If you need any special accommodations due to a disability, please contact Adaptive Educational Services at (317)-274-3241 or Joseph T. Taylor Hall (UC), Room 137.