### Math 578b: Computational Molecular Biology

Lectures: 11:00-12:20 AM TuTh, Room: KAP 150

Instructors

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| --- | --- | --- | --- |
| Professor Fengzhu Sun  MCB 416H | Phone (213) 740-2413 | Email: fsun@usc.edu | OH: TTh 12:30-2:00 |
|  |  |  |  |
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**Course Content**

Applications of the mathematical and statistics to data from molecular biology. Statistics for genomic sequence data: DNA sequence assembly, significance of alignment scores, hidden Markov models, models of sequence evolution, genetic mapping, and microarray analysis.

**Textbooks**

M.S. Waterman (1995) *Introduction to Computational Biology.* Chapman Hall-CRC Press.

Warren J. Ewens and Gregory Grant (2005) *Statistical Methods in Bioinformatics: An Introduction*. Springer

**Optional Textbooks**

T. Koski (2002) *Hidden Markov Models for Bioinformatics*. Kluwer Academic Publishers.

R. Durbin et al. (1998) *Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids.* Cambridge University Press.

**Grading**

Homework 40%, Midterm 30%, Exam II 30%.

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|  | **Math 578b** | **Computational Molecular Biology** |  |
|  | **Lecture** | **Topic** | **Lecturer** |
| Wk. 1 | 8/21 | Introduction; Markov Chains I | FS |

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| --- | --- | --- | --- |
|  | 8/23 | Markov Chains II | FS |
|  |  |  |  |
| Wk. 2 | 8/28 | Word Counts I | FS |
|  | 8/30 | Word Counts II | FS |
|  |  |  |  |
| Wk. 3 | 9/04 | EM algorithm | FS |
|  | 9/06 | Monte Carlo Markov Chain (MCMC) | FS |
|  |  |  |  |
| Wk. 4 | 9/11 | Sequencing Accuracy | FS |
|  | 9/13 | Motif finding | FS |
|  |  |  |  |
| Wk. 5 | 9/18 | Sequencing Progress I (Lander-Waterman Model) | FS |
|  | 9/20 | Sequence Progress II (Next Generation Sequencing: Chip-Seq) | FS |
|  |  |  |  |
| Wk. 6 | 9/25 | Global Alignment Statistics | FS |
|  | 9/27 | Local Alignment Statistics I | FS |
|  |  |  |  |
| Wk. 7 | 10/02 | Local Alignment Statistics II | FS |
|  | 10/04 | Midterm | FS |
|  |  |  |  |
| Wk. 8 | 10/09 | Evolution Models I | LC |
|  | 10/11 | Evolution Models II | LC |
|  |  |  |  |
| Wk. 9 | 10/16 | Evolution Models III | LC |
|  | 10/18 | HMM Theory I | LC |
|  |  |  |  |
| Wk. 10 | 10/23 | HMM Theory II | LC |
|  | 10/25 | HMM Application I | LC |
|  |  |  |  |
| Wk. 11 | 10/30 | HMM Application II | LC |
|  | 11/01 | Statistical Genetics I | LC |
|  |  |  |  |
| Wk. 12 | 11/06 | Statistical Genetics II | LC |
|  | 11/08 | Statistical Genetics III | LC |
|  |  |  |  |
| Wk. 13 | 11/13 | Multiple Testing and FDR | LC |
|  | 11/15 | Next Generation Sequencing I | LC |
|  |  |  |  |
| Wk. 14 | 11/20 | Next Generation Sequencing II | LC |
|  | 11/22 | THANKSGIVING |  |
|  |  |  |  |
| Wk. 15 | 11/27 | Next Generation Sequencing III | LC |
|  | 11/29 | Exam II | LC |
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