

Bioinformatics Algorithms

(Fundamental Algorithms, module 2)

Zsuzsanna Lipták

Masters in Medical Bioinformatics
academic year 2017/18, spring term

Organisation

- **course times:** Thu 11:30 - 13:30 (aula G? aula I?), Fri 11:30 - 14:30 (aula C)
- **email:** zsuzsanna.liptak@univr.it
Please include "Bioinformatics Algorithms" and your name in the email
- **office:** CV 2, 1st floor, room 1.79
- **student hours:** Tue 9-11?

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Organisation (cont.)

- **exam:** written and oral, admitted to oral only if you pass the written test (takehome exercises during term, will be discussed but not marked)
- **final grade** for Fundamental Algorithms: 50% mod.1, 50% mod.2

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Organisation (cont.)

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Questions?

Overview (tentative)

- **Part I: Sequence Analysis**
 - Pairwise sequence alignment
 - String distances
 - Pairwise alignment in practice: BLAST, Scoring matrices
 - Multiple sequence alignment
 - (RNA folding)
- **Part II: Sequence assembly algorithms**
 - Shotgun sequencing: SCS and other models
 - Sequencing by Hybridization and NGS: de Bruijn graphs, Euler tours
 - (further practical issues)
- **Part III: Phylogenetics**
 - algorithms for distance-based data: UPGMA, Neighbor Joining
 - character-based data, Perfect Phylogeny
 - Small Parsimony: Fitch's and Hartigan's algorithms
 - Large Parsimony: heuristics

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Books

- **Enno Ohlebusch:** Bioinformatics Algorithms: Sequence Analysis, Genome Rearrangements, and Phylogenetic Reconstruction. Oldenbusch Verlag, 2013.—*recent, detailed, good, but does not cover all topics of this course*
- **H.-J. Böckenhauer and D. Bongartz:** Algorithmic Aspects of Bioinformatics (2010).
- **V. Mäkinen, D. Belazzougui, F. Cunial, A.I. Tomescu:** Genome-Scale Algorithm Design. Cambridge University Press (2015).—*very recent, advanced*
- **Neil C. Jones and Pavel A. Pevzner:** An Introduction to Bioinformatics Algorithms (2004).—3 copies in library
- **David M. Mount:** Bioinformatics: Sequence and Genome Analysis (2004).—*biologically oriented book, very detailed!*
- **João Setubal, João Meidanis:** Introduction to Computational Molecular Biology (1997).—*my old favorite but a bit dated*, 1 copy in library
- **Dan Gusfield:** Algorithms on Strings, Trees, and Sequences (1997).—*the bible of string algorithms, a bit dated now*
- **Joseph Felsenstein:** Inferring Phylogenies (2004).—*important book on phylogenetics, very understandably written*
- **Cormen, Leiserson, Rivest (& Stein):** Introduction to Algorithms (different editions, 1990-onwards).—*the bible of algorithms, a must have for anyone interested in algorithms (buy second hand, old editions are also fine)*

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