Bioinformatics Algorithms

(Fundamental Algorithms, module 2)

Zsuzsanna Lipták

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

Organisation

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?

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

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

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

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)