Exam

Time and Location

The exam date is Friday, January 11th, 2013 (in U49), starting time will be announced 07.01.2013.

The exam is in English. When it is your turn for examination, you will draw a question. Note that you have no preparation time. The list of questions can be found below. Then the actual exam takes place. The whole exam lasts approximately 25 minutes. You should start by presenting material related to the question you drew. Aim for a reasonable high pace and focus on the most interesting material related to the question. You are not supposed to use note material, textbooks, transparencies, computer, etc.

You are allowed to bring keywords for each question, such that you can remember what you want to present during your presentation. As a guideline you are expected to not have more than 10 keywords per question on the list, that you bring to the oral exam. Note that this list is expected to be put on the table during your oral exam.

We, the examinator and the censor, will supplement with specific questions when appropriate, and after a while, we will end the discussion of the exam question that you drew and turn to material from other parts of the curriculum. Note that all of this as well as discussion between examinator and censor about the grade is included in the approx minutes, so do not count on more than 10 minutes for your own presentation.

Some of the questions below are quite broad, so you must select the material you choose to cover. You will of course also be evaluated based on your selection of material. If you only present the simplest material, you limit the grade you can obtain. On the other hand, a good presentation of the simple material is better than a very poor presentation of the harder material. We might of course still ask you questions about material that you have decided to skip.

Curriculum:

The curriculum in the course consists of all the literature referenced on the weekly notes. You can rely on that you will only be examined in the parts of the material that was discussed at lectures. Note that the mandatory assignments are part of the curriculum, too. As your solutions for the mandatory assignments have to be defended at the oral examination, you can count on the fact, that you will be either asked question to the first and/or the second mandatory assignment.

List of questions:

In the following the list questions that you draw from is given. The list of subquestions is incomplete and just a suggestion.

1. (Local and Global) Pairwise Sequence Alignment

   - Smith-Watermann
   - Needleman-Wunsch
   - Scoring Model
   - BLAST and FASTA (incl. suffix trees, hashing, chaining)

2. Substitution and Scoring Matrices

   - PAM
   - BLOSUM
   - Log-Odds Ratio

3. Coevolution

   - Co-evolutionary events
   - Cost model
   - DP approach
   - Statistical Tests
   - Tanglegram Layout Problem (including ILP formulation)

4. Pattern, Profiles, and Multiple Alignments

   - PSSM and PSI-Blast
   - Profiles as Logos (entropy based diagram)
   - Hidden Markov Models
   - Viterbi algorithm, forward algorithm, Baum-Welch EM method

5. Genome Rearrangements

- (Strong) Common Intervals
- PQ-Trees
- Sorting by Preserving Reversals
- Preserving Reversal Median Problem

6. Phylogenetics

- Species and Gene Trees, Homology
- Distance Correction
- Distance based methods
- UPGMA
- Fitch-Margoliash
- Neighbor Joining
- Maximum Parsimony
- Fitch's and Sankoff's algorithm

7. Integer Linear Programming Approaches

- Tanglegram layout problem
- Fixing estimated orthology matrices

In addition to the questions given above you of course might be asked anything that is int the curriculum but not listed above. We won't ask questions on topics that were not discussed during the lectures.