582471 Algorithms for segmentation problems
Department of Computer Science, University of Helsinki
Take-home exam, Spring 2005
Heikki Mannila

Answer at most 2 questions.

The answers should be returned in hard-copy form to Heikki Mannila (room A339) no later than March 18, 2005.

You should work independently on the answers. Using existing literature and software is allowed. Writing style and clarity of exposition are factors in the grading. Write in Finnish, Swedish, or English.

If there are questions about the exam, please send me e-mail; if there are generally useful clarifications, I will post them on the web site of the course.

1. Write a 4-5 page summary of one of the papers listed in the page http://www.cs.helsinki.fi/group/aprill/asp/papers. Describe the basic question considered in the paper, the algorithms, and the results, and compare the material against the methods included in the course.

2. Piecewise constant modeling of a given 0-1 sequence can done, e.g., by using the squared error criterion or the loglikelihood criterion, as discussed in the lectures. Perform a small set of experiments that tries to find out in which cases the choice of the error criterion makes a difference. Report your experimental design and results clearly. Some simple programs are given in the course web page.

3. Write a simple version of dynamic programming for piecewise *linear* modeling of time series. Experiment with the program and report your findings.

4. Consider the problem of maintaining a piecewise constant representation of a one-dimensional time series (with respect to the squared error metric) under a sequence of modifications to the points.

   I.e., initially one has the points $a_1, a_2, \ldots, a_n$, and subsequently one receives updates of the form (i, b), meaning that the ith point is to be replace by the value b. Describe a method for maintaining a segmentation for such dynamic sequences and analyze its properties.