

Please submit your solutions to this exam by Fri, 24 June 2005, 16:00 GMT+1 as a PDF file (which may be obtained by scanning handwritten pages) via e-mail to hoos@cs.ubc.ca.

Each student is to work out the solutions to these problems individually.

**Problem 1 (10 marks)** In order to investigate the behaviour of an SLS algorithm for a combinatorial optimisation problem on a given problem instances, solution quality traces over  $m$  independent runs are recorded. In each of these runs, the known optimal solution quality for the given instance is reached. Explain how qualified run-time distribution (QRTDs) for various solution quality bounds and solution quality distributions (SQDs) for various run-time bounds can be obtained from these solution quality traces.

**Problem 2 (15 marks)** Study the behaviour of a simple iterated local search algorithm for the TSP (available from [www.sls-book.net](http://www.sls-book.net)) on TSPLIB instance `lin318` (available from TSPLIB, see <http://www.iwr.uni-heidelberg.de/groups/comopt/software/TSPLIB95>). In particular, report and compare the solution quality-distributions (SQDs) for increasingly high run-time bounds. (The provably optimal solution quality for this instance is 42 029.) Describe how the SQDs change with the run-time bounds and explain the reasons underlying this phenomenon.

**Problem 3 (3+5+4+5+3=20 marks)**

Obtain and read the following paper (available from the course webpage):

R. Holte: *Combinatorial Auctions, Knapsack Problems, and Hill-climbing Search*. Lecture Notes in Computer Science, Vol. 2056, Springer Verlag, 2001.

- (a) Briefly summarise the main contributions and results of the paper (in your own words).
- (b) Briefly explain the *N2Norm* and *N2Normx20* algorithms and relate them to generic SLS methods you are familiar with.
- (c) Describe the difference between the algorithms discussed in Section 2 of the paper and the “blind hillclimber” (Section 5).
- (d) Critically assess the empirical methodology used in this paper, based on the knowledge you gained in the course.
- (e) Describe additional experiments that would be useful for a thorough and conclusive assessment of the claims and hypotheses made in this paper.