Assignment 2 12 June 2006

This assignment covers Modules 3+4. It is due on Friday, 16 June 2006, 18:00. Please send me a PDF file (which may be obtained by scanning handwritten pages) via e-mail to hoos@cs.ubc.ca.

Feel free to discuss the problems and solution ideas with other students, but you need to work out and write down the actual solutions on your own.

Keep all answers as concise as possible — all else being equal, short and precise answers will be scored higher.

Problem 1 (5+10=15 marks)

(a) Briefly explain the differences between an SCD and an RTD.

(b) Briefly outline the procedure you would use for empirically comparing the performance of two Las Vegas algorithms on a set of benchmark instances. (Your answer should be no longer than one paragraph.)

Problem 2 (10 marks)

Briefly explain how the shape of the RTDs observed for a given Las Vegas algorithm can indicate weaknesses and suggest improvements of the algorithm. (Your answer should be no longer than one paragraph.)

Problem 3 (10 marks)

What is a ROC curve and how can it be used for the empirical analysis of decision algorithms with error? Please give a precise and concise (brief) answer in your own words. If you like, you can illustrate your answer with drawings (but you don't have to do that). Your answer should be no longer than 1/4–1/2 page.

Problem 4 (5+10+5=20 marks)

Download the RTD data set 'ils-lin318-opt-rtd.dat' and 'mmas-lin318-opt-rtd.dat' from the course home page and perform the following analysis using R (http://www.r-project.org/) and/or Gnuplot (http://www.gnuplot.info/). The second column in each of the two data sets represents the CPU times measured in multiple independent runs of two different algorithms (ILS and MMAS) applied to the same instance of the Travelling Salesperson Problem.

(a) Plot the two RTD graphs and briefly discuss the differences in performance between the two algorithms seen from the RTD plots

(b) Report the median run-time for both RTDs and analyse the statistical significance of the observed valus using an appropriate statistical test. Briefly explain your solution.

(c) Apply an appropriate statistical test to investigate whether the two empirical RTDs are different (the answer is obvious from part (a), but here you should verify this formally using the correct test). Briefly explain your solution.

Problem 5 (Bonus problem; no marks, just good karma)

Discuss whether either of two RTDs from Problem 4 shows evidence for stagnation of the respective algorithm and if so, sketch the RTD that would be obtained when using the respective algorithm with an optimal static restart strategy.