Take-Home Exam 28 June 2008

Please submit your solutions to this exam by Mon, 14 July 2008, 23:59:59 GMT+2 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. All answers need to be given in your own words. Do not copy text from my notes or from any other source.

Problem 1 ($5 \times 5 = 25$ marks) Answer the following questions as briefly and accurately as possible, based on your knowledge of the course material.

(a) How can the analysis of RTDs can help to improve the performance of a Las Vegas algorithm?

(b) What is the role of SQT curves in the empirical analysis of deterministic optimisation algorithms?

(c) What is the difference between a QRTD and an SQD of a randomised optimisation algorithm?

(d) What is an asymptotic SQD and in which context is it useful?

(e) Under which conditions and how can multiple independent runs be used to reduce the error probability of a Monte-Carlo algorithm?

Problem 2 ($5 + 4 \times 10 = 45$ marks) Read the paper "A Theoretician's Guide to the Experimental Analysis of Algorithms" by David S. Johnson (linked from the course web page) and answer the following questions briefly and accurately.

(a) What is the difference between what Johnson calls a 'horse-race paper' and an 'experimental analysis paper'?

(b) Briefly explain how one of the techniques you learned in the course could be useful in an 'experimental analysis paper'.

(c) Explain how the criticism voiced by Johnson in 'Pet Peeve 34' can be addressed using techniques you learned in the course.

(d) Carefully consider 'Pet Peeve 10'. Based on what we have covered in the course, how would you address this issue?

(e) Considering Johnson's discussion of anomalies, elaborate on his arguments why anomalous results can be very important.

Problem 3 (Bonus problem; no marks, just good karma)

Are there any suggestions or pet peeves in Johnson's paper that, in your opinion, should be modified or amended? Are there any arguments or suggestions you disagree with? Can you see any important issues that the paper does not address?

Problem 4 (70 marks) Perform an empirical performance comparison of two randomised decision algorithms or deterministic optimisation algorithms of your choice on a set of at least 10 benchmark instances, using the methods and techniques you've learned in the course. (If you'd like, you can also use randomised optimisation algorithms.) The algorithms can be from the literature (with implementations made available by the original authors or re-implementations you have done) or from your own research. You answer should include a brief, high-level description (about 1–2 paragraphs) of the problem and algorithms chosen, as well as references to the literature as appropriate. You should include URLs for Linux executables of the code and for all benchmark instances used in your study (these will be kept confidential and not used for any purposes other than evaluating your solution to this problem).

You are not expected to perform any scaling analysis or analysis of parameter response. (Of course, you may include such optional analysis, if you'd like.)

If you don't have specific algorithms you'd like to study, you may use two of the randomised SAT algorithms implemented in UBCSAT (`www.satlib.org/UBCSAT`) and benchmark instances from SATLIB (`www.satlib.org`).