L41: Lab Reports

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Michaelmas Term 2017

The purpose of a *laboratory report*, is to document an experiment, its results, and its interpretation. The exact contents and format of a lab report vary by discipline but the principle is common across both the hard and social sciences, and will generally include: the motivations and starting assumptions of the experiment (to frame later design decisions); the goal of the experiment (i.e., the hypothesis); the experimental setup itself; the results and their interpretation (including sources of error); any conclusions; and a comparison with related work in the field. Computer science, and especially systems research, adopts many of these elements, although not always overtly in the format of a lab report. In L41, we use the genre of the lab report to help impose structure on our experimental work, and as the primary means of assessment.

You will write three lab reports as part of the course: one 'practice run' derived from the I/O tracing exercises in the first submodule, and two assessed reports (weighted at 50% each) describing IPC and networking experiments from the remaining submodules. The first lab report is intended to help you develop and get feedback on your report writing style so that assessment of later reports can focus on experimental setup, data analysis, and conclusions. As the lab reports are the primary form of assessment for the module, it is important that you invest a significant amount of time in writing and refining the report, paying attention to detail and presentation. This is especially true for the 'practice run', which is your opportunity to correct errors and omissions in your approach without an impact on your final mark. Note that submitting the first lab report is not optional.

Contents

For the purposes of L41, we require that lab reports (moderately) faithfully follow this structure, including recommendations on length:

Title page Experiment name; author name; date. A 1-paragraph abstract will provide a succinct summary of the report including the nature of the experiment and conclusions that have been drawn. (1 page)

Introduction Frames the lab report as well as provides its context and motivations. (1–2 paragraphs)

Experimental setup and methodology An exploration of the goals, hypotheses, experimental setup (including platform details), procedure used in the experiment, and details of any steps taken to mitigate potential error or problems; a figure may be appropriate. It is important that the potential impact of probe effect be considered (and ideally directly measured). (1–2 page including figures)

Results and discussion The results obtained, graphs illustrating those results, and an exploration and interpretation of the results including important artefacts, validity of the results, and conclusions they lead us to. Tables and figures required to explain the results should be present in all reports; in most cases, performance graphs will be expected, but in some cases, it may also be suitable to include state-machine diagrams. This is the body of the report. (3–4 pages including figures)

Conclusion A summation of the results and thoughts on potential future directions. (1–2 paragraphs)

References For our purposes, references to material that contextualises the work, as well as to pertinent readings we have done and a brief literature review; outside of this course, we would also expect a review of similar work by others, especially where results or methodology differ. (no length limit)

Appendices Additional material that supplements prior sections – e.g., it might be desirable, in explaining material in the body, to reference content such as scripts to perform experiments, additional data tables, or more detailed illustrations of an experimental setup. (no length limit, but moderation is encouraged)

Lab reports will be 8-10 pages including figures but excluding appendices and references, which should guide the level of detail in the report. Appendices should be included only where they improve understanding of the body of the report – simple DTrace scripts are not appropriate to include, but should they be extended (for example) to mitigate a surprising form of measurement error, it may be appropriate to include them in an appendix that is referenced from discussion in the body.

Only pages within the page limit will be assessed; if the appendicies are long, they will not be read.

Style and presentation

Lab reports must be clearly written, spell checked, and formatted to make them easy for the reader to follow. Given length limitations, they will of necessity be high-level presentations of our experiments, and cannot explore every detail – but instead should focus on **important** and **interesting** results, considering where possible root-cause analyses.

Particular attention should be paid to graphs and tables that will present the results: axes must be labelled, scales should be selected with care to avoid misunderstanding, and if, for example, there are clear artefacts of interest, then an additional graph may be appropriate to explore those in greater detail. All graphs must be described in the body of the text, and also have a suitable (but brief) caption. In general, it will be important to include error bars or other error information, and explain when confidence intervals have been used.

LaTeX will be used, ideally using the **article** document class and 10pt times font; use of the course template for lab reports is recommended, but not required. The precise graphing package is up to you; all graphs must be vector-based rather than raster images, and must be prepared such that they are clear even if printed in black and white. It may be appropriate to use diagramming packages such as **tikz**, code rendering via the **listings** package, and additional tools such as **matplotlib**, **R**, and **graphviz** to analyse and present results.

Students are cautioned that many of these tools are complex and subtle, and when used incautiously have a tendency to consume all available time. If you run into difficulties, seek help from the course instructor or one of the teaching assistants – and when in doubt, avoid exciting-sounding features in LaTeX!

Assessment

$< 60\%$ Below the pass mark: extremely poor (or incomplete) experimental procedure or writeup that might include an incoherent description of the work, poor experimental practice that leads to incorrect results, failure to discuss potential sources of error, omission of analysis of the probe effect, and/or poor data analysis that draws incorrect conclusions despite clear evidence to the contrary. This marking range will also be used if there is insufficient originality.

$>= 60\%$**,** $< 75\%$ Pass but below distinction: adequately performed experimental procedure and writeup, but with a few (but not many) of the following problems: (1) the experimental approach will have been roughly right, but failed to avoid potential sources of error, used inadequate runs to manage variance, or failed to pursue an important behaviour or effect; (2) the writeup will have drawn reasonable conclusions, but failed to make proper use of statistics, failed to explore sources of error, failed to adequately explore the probe effect, or failed to investigate a surprising effect or result; or (3) graphs will present useful results but are unclear or disagree with the experimental analysis.

$>= 75\%$ Pass with distinction; most or all of the following hold: a superior writing style and clarity; strong experimental procedure and error analysis, in which surprising results or artefacts are adequately illustrated via graphs and explained in the text; the probe effect is explicitly considered, measured, and analysed; root-cause analysis is performed, and strong or even new insights into performance are gained.

Collaboration

While collaborating on experimentation itself is permitted (and even encouraged), students must independently write up and submit lab reports. You will need to employ your own discretion, but a reasonable approach might have pairs of students collaborate to understand the target software, work together to develop experimental setups and scripts, and jointly run initial experiments to debug them together. Pairs might then part ways to complete the experiments, analyse the data and actual error, produce any graphs, and write up the results. Data in appendices of reports may indeed turn out to be substantially similar between lab partners as a result of collaboration on the setup and design choices to scripts, but excessive similarity of graphs, text, and analysis may be penalised as plagiarism.