

Lab Exercises

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The purpose of our Lab Exercises (including the first Practice Exercise) is to direct a set of investigations intended to reveal (sometimes surprising) underlying systems behaviours. Unlike a complete lab report, you will not be expected to independently develop hypotheses and a complete document. Instead the lab exercises guide you through specific instrumentation, data collection, data analysis, data presentation, and documentation of these to develop your answers.

The initial Practice Exercise has low weighting: It familiarises you with the platform, and teaches specific skills, but requires relatively little analysis. You should carefully consider (and iterate on) your instrumentation and data collection, and take the time to present data carefully to ensure that the delivery directly answers the questions that are asked. Digging deeper on results, to understand the root causes of interesting artifacts or observations, is rewarded in the marking, whereas answering unanswered questions or including details of unsuccessful investigations is not. All graphs should be clear, be carefully labeled, and be accompanied by descriptive text rather than presented in isolation.

Style and presentation

- **Presentation:** Lab exercise answers should be clearly written, spell checked, and formatted to make them easy for the reader to follow.
- **Focus:** Given the potential open endedness of the questions, it is important to keep answers focused. Don't write a journal of all the things you tried on the way to the answer; instead, focus on key points that are **important** or **interesting**, considering where possible root-cause analyses.
- **Length:** No specific maximum length is prescribed, but if excessive plots, data, script source code, and/or other elements are included, then they will be disregarded for the purposes of marking. Submissions should be succinct, answering the question in adequate detail, but avoiding detours or unnecessary detail or elaboration.
- **Figures and data tables:** Do include succinct and clearly labeled figures and summary statistics where they improve clarity of explanation, but avoid presenting voluminous data sets unless they are essential to your explanation.
- **Graphs:** Particular attention should be paid to graphs that 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. Where comparisons of graphs are important to the argument being made, it may be useful to align the plots as well as share axis ranges and scales to make the visual comparison easier.
- **Graph descriptions:** All graphs must be described in the body of the text, and if not adjacent to that text, must also have a suitable (but brief) descriptive caption. Don't describe every detail of the graph: Instead help the reader understand how the graph supports the argument you are making.
- **Error:** In general, it will be important to include error bars or other error information, and explain when confidence intervals have been used.

Using the tools

- Assignments must be submitted using the lab exercise template provided, and as described in the assignment. This will usually mean printing to PDF using JupyterLab's print feature, which works fine but is notoriously slow.
- Review the PDF for submission carefully before submitting, and try to keep it as succinct as possible. Remove or hide unneeded data, workings, and intermediate results.
- Graphs should be prepared using **matplotlib**, and any coderendering via the **listings** package.
- Students are cautioned that many of the tools used by systems researchers for data collection, analysis, and presentation are complex and subtle. 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, or for that matter deep diving on **R**!

Collaboration

While collaborating on experimentation itself is permitted (and even encouraged), students must independently analyse data, write up, and submit lab exercises. 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. Excessive similarity of graphs, text, and analysis may be penalised as plagiarism.

Please see the Syllabus for the course policy on using AI for submitted work.

Assessment: Practical Exercise (10%)

This lab assignment is marked out of 10, considering four areas:

Marks	Aspect
2.5	Performed the work described in the assignment – e.g., plotted the right plots and answered the questions as assigned
2.5	Used appropriate instrumentation techniques to capture high quality data – e.g., captured system-call timing histogram data well, did flame graphs on <code>sys_read()</code> rather than total execution)
2.5	Prepared high-quality plots that contained the data as expected, was clearly labeled and described, and presented the data in a compelling way – e.g., scaled for readability, with a nice visual comparison.
2.5	Was well presented – e.g., concise in answering only the questions answered, showing suitable work, well formatted, and written clearly. Extraneous data, code, text, and figures will be penalised.

Assessment: Labs 2 and 3 (40% and 50% of module mark)

Each lab assignment is marked out of 100:

< 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. The submission may contain extraneous data, code, text, or figures that do not usefully and succinctly contribute to the answer.

>= 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. The content is succinct in presenting any required data, code, text, or figures.