Name of Student

NetID

Lab Partner:

TA: Ben Walt

Section: Thursday 9AM

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# Introduction

You will be writing lab reports for all the labs in ECE 470. The purpose of these lab reports is to show your understanding of the material and to practice expressing your ideas in a formal way. This document will help you format and structure your lab report correctly. It will explain many techniques and requirements and give examples of how to accomplish it in Microsoft Word. Everyone in this class should have some experience with lab reports, but the extent of this experience varies widely with department and classes taken. Our goal is that by the end of the semester, you will be comfortable writing lab reports without the need for a rubric or template. It is not possible to cover every situation in a document such as this, so when in doubt you should always ask yourself:

1. Is it clearly written?
2. Is it concisely written?
3. Is it consistently written?

If you can answer yes to all these questions, it should be fine.

# Sections

A lab report is like a journal paper in that it typically has the following sections:

* Introduction
	+ Explain the background of the lab
	+ Should include the objective or goal of the lab
* Method
	+ Explain how you did it
	+ This is not a rehash of the lab manual, but explains how you accomplished the steps in the lab manual
* Data and Results
	+ Analyze the data you collected
	+ Should include an error analysis and discussion of sources of error
* Conclusion
	+ Summarize what you did and the results of your data
	+ Discuss what you learned from the lab
* References
	+ List of references
* Appendix
	+ Additional information if needed

You are free to combine, split or rename these sections as needed or desired, as long as the final structure is clear and well organized. The reader should still be able to find all this information easily. Not all sections are needed in every report (e.g. Lab 1.5 has no data to analyze.). If a section is not needed, leave it out of the report.

# Style and Formatting

Consistent and clear style and formatting are necessary for effective communication. This document tries to present a simple but effective style. There are many official style guidelines such as ALA, MLA and IEEE. This guide does not specifically follow any of them, but they can be a good resource if you are not sure how to handle some situation.

## Style

Your lab report should be written in formal language and be clearly and concisely written in full sentences in paragraph form and not as a series of bullet points. Bullet points are fine for clarity, but not for organizing and structuring your entire report. You are free to write in the active or passive voice, as long as you are consistent. No one will be grading you on your English grammar, punctuation and usage, but excessive problems will inhibit clear communication.

## Formatting

Your report must be typed, but you are free to use Microsoft Word, Latex or any similar program. Ensure that your report is formatted to be easy to read. This typically means 12-pt Times New Roman font on a page with 1” margins. We do not count pages, so there is no reason to adjust this. Do **not** include a cover page, but include the following on the top of the first page:

* Lab Title (ECE 470: Lab 1- The Teach Pendant)
* Your name
* NetID
* Partner’s Name
* TA: Ben Walt
* Section: Thursday 9AM
* Date Submitted

As reports will be submitted electronically, make appropriate use of color to make your figures, tables, etc. as clear as possible. However, your report should not be a rainbow explosion. Sections and sub-sections should be clearly marked and numbered. The format of this document is one such method. In Microsoft Word, this is done using the Styles tools – Heading 1, Heading 2, etc. This document is an excellent template for writing your report and Latex template can be found [here](https://www.overleaf.com/read/scthpgjnnbkj).

## Figures, Equations, Tables, Etc.

Figures, equations, tables, etc. are a key part of any lab report. It is important to properly format your figures, equations and tables. This document includes some guidance on how to do this in Microsoft Word. Please read through it carefully so you fully understand the requirements.

###  Figures

Figures should be photos or drawings made on a computer. You may use the drawing tools of Microsoft Word or any drawing software to create your figures. Do not use hand drawn figures – note that this includes drawings made with tablet and stylus. Figures should be center-aligned and captions should appear below them. The captions should also be center-aligned. **All figures must be described in the body of the report by text that (a) references the figure by number and (b) explains the content of the figure**. In Microsoft Word, it is advisable to place each figure and its caption inside a simple borderless text box or picture box, as in Figure 1. By clicking on the text of the Figure 1 caption, the text box will become visible. After inserting the text or picture box, click on its border and select a layout option with “top and bottom” text wrapping. Then, insert the figure image file into the box and write the caption below it. The figure can easily be moved by clicking the border of the box and dragging it where it fits best in the document. Make sure to reference each figure included in the body of the report. Don’t add figures without explaining them in the report text.



Figure 1. If a text box is used for both the figure and its caption, they will never be separated by a page break.

### Variables, Numbers, and Equations

When using Microsoft Word, you can use a 3×1 table with no borders to format an equation. The table should be as wide as the paragraph text (6.5”), left and right cells in the table should each be approximately 0.5” wide, leaving plenty of space for the equation in the middle cell. The left cell should contain no text and the right cell should contain the equation number in parentheses, aligned to the right side of the cell. Use centered alignment for the equation in the middle cell. Remember to use appropriate punctuation after the equation, if necessary. Be aware that Microsoft Word automatically capitalizes the first word in the next line, which often is not appropriate when introducing equations. For example, the bipolar coordinate system is defined by:

|  |  |  |
| --- | --- | --- |
|  | $$x=(a sin⁡v)/(cosh⁡v-cos⁡u )$$ | (1) |

and

|  |  |  |
| --- | --- | --- |
|  | $$y=(a sinh⁡u)/(cosh⁡v-cos⁡u ),$$ | (2) |

where *a* gives one-half of the distance between poles. Note that a comma is necessary after Eq. 2 but not after Eq. 1 and that the words "and' and "where" are not (and should not be) capitalized.

### Tables

Tables can be very useful for introducing parameters to be tested, comparing small amounts of data, and summarizing findings. There are many ways to organize data in a table but it is vital that you ensure the data presented in the table is easy to understand. One way that tables differ from figures is that the caption should **appear above the table**, as shown in Table 1. Just like figures, any table included should be referenced and discussed in the text.

Table 1. Comparison of characters according to roundness

|  |  |  |  |
| --- | --- | --- | --- |
|  | Round | Both Straight and Round | Straight |
| Vowels | O | U | A, E, I |
| Consonants | C, Q, S | B, D, G, J, P, R | F, H, K, L, M, N, T, V, W, X, Y, Z |
| Numerals | 0, 3, 6, 9 | 2, 5, 8 | 1, 4 |

### Code Snippets

Code snippets are very useful for explaining how you accomplished a given task. They are part of the text and should be short in length. Line numbers are not needed because we are not concerned about how the code snippet fits in the broader code. If you are concerned about how the code fits in the full program, you should include the full text of the code in an appendix and reference it by line number.

# Python program to display the Fibonacci sequence up to n-th term using recursive functions

def recur\_fibo(n):

 """Recursive function to

 print Fibonacci sequence"""

 if n <= 1:

 return n

 else:

 return(recur\_fibo(n-1) + recur\_fibo(n-2))

# Change this value for a different result

nterms = 10

# uncomment to take input from the user

#nterms = int(input("How many terms? "))

# check if the number of terms is valid

if nterms <= 0:

 print("Plese enter a positive integer")

else:

 print("Fibonacci sequence:")

 for i in range(nterms):

 print(recur\_fibo(i))

<https://www.programiz.com/python-programming/examples/fibonacci-recursion>

There are a number of ways to include well formatted code in Microsoft Word. One example is an Add-In called [Easy Code Formatter](https://appsource.microsoft.com/en-us/product/office/WA104382008?src=Office&tab=Reviews). It can be added via **Insert->Add-ins->Get Add-ins** on Office 365. Copy and paste in the required code, then select Easy Code Formatter from the menu bar and Format Text As Code. After formatting, indent the code by 0.5” for clarity. Line numbers can be toggled on and off in the options. Do not use screenshots from a text editor, as they often appear blurry in the final PDF and are difficult to scale consistently.

## References and Citations

When you make use of someone else’s work, it is necessary to acknowledge it. When writing your list of references, you may use any common methodology that you like (e.g. APA, MLA, and IEEE). There are many online resources available to help you format these correctly. Inline citation should be a set of square brackets around a number that refers to the item in the list of references – i.e. [12]. Place the citation at the end of the final sentence associated with that reference. You do not need to cite the lab manual, text book or any provided notes from the professor or TA. You **must** cite everything else. This includes sources for images that you did not create. Remember that the list of references should be in alphabetical order.

# Submission and Grading

When you are done with the lab, please save it as a PDF file and submit it online at [GradeScope](https://www.gradescope.com/). Lab reports are due 1 week after the final session of the lab. They are due **before** the start of your lab session. Extensions and acceptability of alternative submission methods will be up to your TA. Lab reports will be graded by your section’s TA and feedback provided. It is important that you review that feedback because the standards by which you are graded will increase with each lab report.

## Lab Guidelines

Each lab in the lab manual will include a Lab Report section. In this section, you will receive some guidance on what to include in your lab report. This information will only be general with a few hints to send you in the right direction. The amount of guidance will decrease with each lab as you will be expected to determine this on your own. A properly written lab report would allow one of your classmates who missed the lab to understand it and recreate your results. It is not detailed instructions (That is what the lab manual is for), but includes all the thought, effort and understanding that led to your results and conclusions.

## Collaboration

Everyone is required to submit an individual lab report, but you are welcome to work closely with your lab partner to write it. Sharing figures, images and ideas is encouraged, but the individual write-up should be your own work and not a simple rewording of your partners work. Please do not share figures and resources with people other than your lab partner.

# Conclusion

This document should help you create clear and concise lab reports. As the lab reports are often quite simple, much of the focus is on communication and proper technique. Please ask the TA if you have any questions about writing a good lab report and always remember: clear, concise, and consistent!

# Thank you

Thank you to whomever wrote the report guidelines for MechSE design courses, upon which this is based.

**Additional Resources**

<https://writersworkshop.illinois.edu/> - UIUC’s own writing support center. It has many online resources and you can also meet one-on-one to discuss your writing concerns.

<https://owl.purdue.edu/owl/purdue_owl.html> - This has lots of good information about writing all kinds of papers – including lab reports. It is often linked to by other universities and is a top hit on google.

<https://www.engineering.uiowa.edu/current-students/undergradute-students/academic-support-and-tutoring/hanson-center-technical-3> - More engineering specific advice.