



Experiment 22 - Monte Carlo Simulation

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October 27, 2019

Abstract

This document describes what is expected from an engineering laboratory report. While this is not a definitive guide to report-writing, it is intended as a guide to assist in documenting and presenting your experimental work. Appended to this guide are some real examples of common mistakes that should be avoided. It is expected that lab reports are prepared using the \LaTeX typesetting system, adopting one of the standard report templates provided on VITAL.

Declaration

I confirm that I have read and understood the University's definitions of plagiarism and collusion from the Code of Practice on Assessment. I confirm that I have neither committed plagiarism in the completion of this work nor have I colluded with any other party in the preparation and production of this work. The work presented here is my own and in my own words except where I have clearly indicated and acknowledged that I have quoted or used figures from published or unpublished sources (including the web). I understand the consequences of engaging in plagiarism and collusion as described in the Code of Practice on Assessment (Appendix L).

***IMPORTANT:** In a standard technical report, you would need to include here your personal details as the author of the document. However, remember that marking of coursework is anonymous and therefore you should remove this part before submitting your report for Year 2 labs! Do not include your name, student ID, email address or any other personal information.

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1 Introduction

Include a statement of the problem to be investigated, and why is addressing this problem worthwhile or important. This section should also introduce the history and theoretical background of the problem, a brief statement of the general procedure adopted and hint at expected results. This section is sometimes broken down into subsections: Objectives and Theoretical Background.

2 Materials and Methods

To easily simulate penalty kicks events, a simple goal model was established according to the instruction on the lab script[1]. In this experiment, Matlab was utilized to modeling the situation with pseudo random number generated with Monte Carlo algorithm.

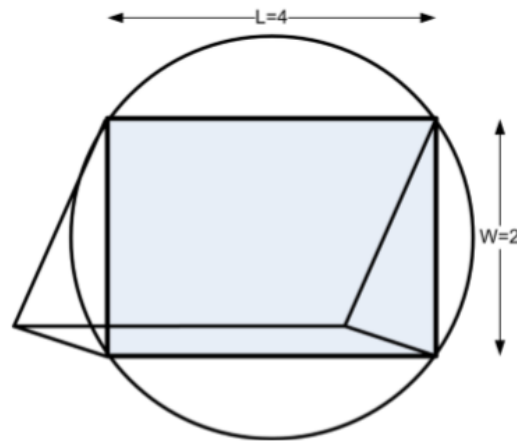


Figure 1: Goal Model (taken from [1])

It is assumed that the ball can be kicked randomly and will only fall in the circle area as it shown in Figure 1. The distribution of balls is expected to follow certain distribution model, such as uniform distribution and normal distribution. In order to explore the distinctions between among different distribution models under diverse conditions, this experiment was designed into two parts. The first part was for the situation with no goalkeepers while the second part focused on the condition that the goalkeeper acted.

2.1 Part 1: No Goalkeeper Tests

The materials list can be a simple list of all the equipment/apparatus used, in as much detail as possible (eg. mention the make/model of things like signal generators, the values of all components, the exact model of any development boards used etc). If you are using software, the name and version of the software is important.[2]

The Method/Procedure section describes the experimental process in chronological order (i.e. in the order in which they happened). If you did not follow the documented procedure for any reason, make sure this is mentioned (e.g. "At step 4 four repetitions were performed instead of three, and the data from the second repetition was ignored. This is due to a circuit

fault that was discovered that called the accuracy of these readings into question.”)

3 Results

3.1 Part 1: No Goalkeeper Tests

This is where you describe the important qualitative and quantitative observations from the experiment. Data should be tabulated and/or graphed. Graphs must always be captioned (as with figures, above), and axes clearly annotated with units. Always follow your graphs with a brief description, demonstrating your understanding of what has been plotted (eg. “The graph in Fig. 4 illustrates the frequency response of this circuit, with a clear resonance peak at 15 kHz.”) as tables and graphs are rarely self-explanatory. If the results differ from what was expected, explain both **how** (i.e. in what way) and **why** (i.e. possible reasons behind this behaviour) when referring to these results.

The summary of the experimental results is presented in Table 1

Table 1: Note that table captions are placed above the tables, not below as for figures

P (W)	V (V)	I (A)
0.0 ± 0.01	0.0 ± 0.01	0.0 ± 0.01
0.1	0.2	0.3
0.1	0.2	0.3
0.1	0.2	0.3

Table 2: Resistance and Temperature of the Filament

R (Ω)	T (K)	$1/T$ (K^{-1})	$\ln P$
151.00 ± 3.92	828.35 ± 23.46	1.2072×10^{-3}	-13.29
157.12 ± 3.71	856.88 ± 22.25	1.1671×10^{-3}	-12.64
162.53 ± 3.49	881.99 ± 21.02	1.1338×10^{-3}	-12.33
166.67 ± 3.33	901.14 ± 20.13	1.1097×10^{-3}	-11.90

4 Discussion

The Discussion section allows you to fully discuss and interpret the results and the results of the any analysis carried out. It is also important here to relate your findings to the experimental objectives, i.e. do your results support the theoretical background, and have the objectives of the experiment been met? Are the results reliable and/or significant?

Mathematical expressions can be included in L^AT_EX documents easily by surrounding them in \$ signs, such as f , δx , Ω_2 , $y = mx + b$ or $\mu = \frac{1}{N} \sum_{i=1}^N x_i$. Numbered equations can be created just as easily using the `equation` environment:

$$\mu = \frac{1}{N} \sum_{i=1}^N x_i. \quad (1)$$

When making reference to the above equation, you simply need to mention the label, as in “...as shown in Equation~\ref{eq:mean}.”, and the Equation number will be inserted automatically. If you need to show several lines of mathematical expressions, you can use the `eqnarray` environment as below:

$$P = IV \quad (2)$$

$$= I^2 R \quad (3)$$

$$= \frac{V^2}{R} \quad (4)$$

Further guidance on writing and manipulating mathematical expressions, symbols and equations can be found online in references such as [3].

5 Conclusions

This final section contains a brief statement to summarise the outcome of the experiment, and a statement outlining to what extent the objectives of the experiment have been met, and what has been learnt as a result of this. In some ways the Conclusions section is a reflection of the Abstract, reiterating what the experiment was aiming to achieve, and summarising the outcomes. It can also be thought of as a summary of the Discussion section.

References

- [1] W Al-Nuaimy, A Al-Ataby, M Lopez-Benitez, “Experiment 22 - monte carlo simulation,” https://vital.liv.ac.uk/bbcswebdav/pid-2008619-dt-content-rid-11366223_1/xid-11366223_1, University of Liverpool, 2019.
- [2] P. Bibby, “How to write a laboratory report,” <http://www.psychology.nottingham.ac.uk/staff/dmr/c81mpr/HOWTOWRITEALABORATORYREPORT.pdf>, University of Nottingham, Sep. 2006.
- [3] WikiBooks, “`LaTeX` advanced mathematics,” http://en.wikibooks.org/wiki/LaTeX/Advanced_Mathematics, 2011.

Appendices

These Appendices are all optional...

A Tables

B Program Listings

Program listings and source code can be neatly incorporated into your reports by including them in a `\lstlisting` environment, as in Listing 1 below, or if you are constantly editing your program, you could import the code directly from the source itself (provided you've uploaded it to your ScribTeX workspace). In this way, whenever you modify the source, all you need to do is recompile the L^AT_EX code and your report document will automatically be updated. The command to use would be something like `\lstinputlisting{MY_CIRCLE.m}`.

Listing 1: This is how to include some source code

```
[x,y] = MY_CIRCLE(x_centre , y_centre , radius)

% MY_CIRCLE.m - A MATLAB function to draw a circle on the screen
% Syntax is:
%           [x,y] = MY_CIRCLE(x_centre , y_centre , radius)
%
% Waleed Al-Nuaimy, 1st July 2011

theta = linspace(0, 2*pi, 200);           % in radians
x      = x_centre + radius*cos(theta);    % radius can be negative!
y      = y_centre + radius*sin(theta);
plot(x,y,'r-')                            % connect using red line
axis('equal')                             % to preserve aspect ratio
ylabel('y')
xlabel('x')
title(['Circle centred at (',num2str(x_centre),',', ...
      num2str(y_centre),') of radius ',num2str(radius)])
```

C Log Book

D Data Sheets