

**This is the title of a thesis submitted to Iowa State University on the first line.**

**Second line, only the first letter of the first word and names are capitalized**

by

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A dissertation submitted to the graduate faculty  
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Mathematics

Program of Study Committee:

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The student author, whose presentation of the scholarship herein was approved by the program of study committee, is solely responsible for the content of this dissertation. The Graduate College will ensure this dissertation is globally accessible and will not permit alterations after a degree is conferred.

Iowa State University

Ames, Iowa

2025

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## **DEDICATION**

I would like to dedicate this thesis to my wife Glenda and to my daughter Alice without whose support I would not have been able to complete this work.

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## **ACKNOWLEDGMENTS**

I would like to take this opportunity to express my thanks to those who helped me with various aspects of conducting research and the writing of this thesis. First and foremost, Dr. Susan D. Ross for her guidance, patience and support throughout this research and the writing of this thesis. Her insights and words of encouragement have often inspired me and renewed my hopes for completing my graduate education. I would also like to thank my committee members for their efforts and contributions to this work: Dr. August Tanner and Dr. Lewis Hargrave. I would additionally like to thank Dr. Tanner for his guidance throughout the initial stages of my graduate career and Dr. Hargrave for his inspirational teaching style.

## **ABSTRACT**

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in general and the heading and style match the rest of the document.



## **CHAPTER 1. OVERVIEW**

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

### **1.1 Introduction**

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

#### **1.1.1 Hypothesis**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

##### **1.1.1.1 Parts of the hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

#### **1.1.2 Second Hypothesis**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

### **1.1.2.1 Parts of the second hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

## **1.2 Criteria Review**

Here certain criteria are explained thus eventually leading to a foregone conclusion.

(Correa, Hantoute, and López, [n.d.](#)),(Klee, Danzer, and Grünbaum, [1963](#))

## **CHAPTER 2. REVIEW OF LITERATURE**

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

### **2.1 Introduction**

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

did the initial work in this area. But in Struss' work (Bui, [2023](#)) the definitive model is seen.

#### **2.1.1 Hypothesis**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

##### **2.1.1.1 Parts of the hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

#### **2.1.2 Second Hypothesis**

##### **Heading**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

**Even smaller heading**

Another sentence.

**2.1.2.1 Parts of the second hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

**2.2 Criteria Review**

Here certain criteria are explained thus eventually leading to a foregone conclusion.

**2.3 Continuing Tables**

Note, tables with cells spanning multiple columns work automatically, but cells spanning multiple rows require extra tagging.

Table 2.1: This is a two-part table that also has cells spanning multiple rows.

k	q	p+	p-	s1	s2	s3	RHS
2	2	2	1	1	0	0	1
-T	0	1	1	0	1	0	0
T	-1	0	1	0	0	1	0
-1	1	-1	1				
2(T+1)	2	0	1	1	-2	0	1
-T	0	1	1	0	1	0	0
T	-1	0	1	0	0	1	0
-(T+1)	1	0	1	0	1	0	
0	2+2(T+1)/T	0	1	1	-2	-2(T+1)/T	1
0	-1	1	1	0	1	1	0
1	-1/T	0	1	0	0	1/T	0
0	1-(T+1)/T	0	1	0	1	(T+1)/T	
0	2(2T+1)/T	0	1	1	-2	-2(T+1)/T	1
0	-1	1	1	0	1	1	0
1	-1/T	0	1	0	0	1/T	0
0	-1/T	0	1	0	1	(T+1)/T	
0	1	0	1	T/2(2T+1)	-T/(2T+1)	-1	T/2(2T+1)
0	0	1	1	T/2(2T+1)	1-T/(2T+1)	0	T/2(2T+1)
1	0	0	1	1/2(2T+1)	-1/(2T+1)	0	1/2(2T+1)
0	0	0	1	1/2(2T+1)	1-1/(2T+1)	-1+(T+1)/TT	
0	0	0	1	1/2(2T+1)	1-1/(2T+1)	-1+(T+1)/TT	
0	0	0	0				
0	0	0	0				
0	0	0	0				
0	0	0	0	1/2(2T+1)	1/2(2T+1)	1/2(2T+1)	
0	0	0	0				
0	0	0	0				
0	0	0	0				

Table 2.1: Continued

k	q	p+	p-	s1	s2	s3	RHS
2	2	2	1	1	0	0	1
-T	0	1	1	0	1	0	0
T	-1	0	1	0	0	1	0
-1	1	-1	1				
2(T+1)	2	0	1	1	-2	0	1
-T	0	1	1	0	1	0	0
T	-1	0	1	0	0	1	0
-(T+1)	1	0	1	0	1	0	
0	$2+2(T+1)/T$	0	1	1	-2	$-2(T+1)/T$	1
0	-1	1	1	0	1	1	0
1	$-1/T$	0	1	0	0	$1/T$	0
0	$1-(T+1)/T$	0	1	0	1	$(T+1)/T$	
0	$2(2T+1)/T$	0	1	1	-2	$-2(T+1)/T$	1
0	-1	1	1	0	1	1	0
1	$-1/T$	0	1	0	0	$1/T$	0
0	$-1/T$	0	1	0	1	$(T+1)/T$	
0	1	0	1	$T/2(2T+1)$	$-T/(2T+1)$	-1	$T/2(2T+1)$
0	0	1	1	$T/2(2T+1)$	$1-T/(2T+1)$	0	$T/2(2T+1)$
1	0	0	1	$1/2(2T+1)$	$-1/(2T+1)$	0	$1/2(2T+1)$
0	0	0	0	$1/2(2T+1)$	$1-1/(2T+1)$	$-1+(T+1)/TT$	

## CHAPTER 3. METHODS AND PROCEDURES

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

### 3.1 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

As can be seen in [Table 3.1](#) it is truly obvious what I am saying is true.

Table 3.1: This table shows a standard empty table (Klee, Danzer, and Grünbaum, [1963](#)). Remove the square bracketed information to get longer captions in the LOT/ LOF

#### 3.1.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

This can also be seen in [Figure 3.1](#) that the rest is obvious.



Figure 3.1: This table shows a standard empty figure. Remove the square bracketed information to get longer captions in the LOT/ LOF

#### **3.1.1.1 Parts of the hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

#### **3.1.2 Second Hypothesis**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

#### **3.1.2.1 Parts of the second hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.



## 3.2 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion as can be seen in [Table 3.2](#).

Table 3.2: This table shows a standard table with a limited caption width

Header	head	head
leg	leg	leg
leg	leg	leg
leg	leg	leg

## **PART I**

**Let's have a part page**

## CHAPTER 4. RESULTS

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

### 4.1 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Of course, data on this as seen in [Table 4.1](#) is few and far between.

Table 4.1: Moon Data

Element	Control	Experimental
Moon Rings	1.23	3.38
Moon Tides	2.26	3.12
Moon Walk	3.33	9.29

#### 4.1.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

Or graphically as seen in [Figure 4.1](#) it is certain that my hypothesis is true.

##### 4.1.1.1 Parts of the hypothesis

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.



Figure 4.1: Durham Centre

#### **4.1.2 Second Hypothesis**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

##### **4.1.2.1 Parts of the second hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

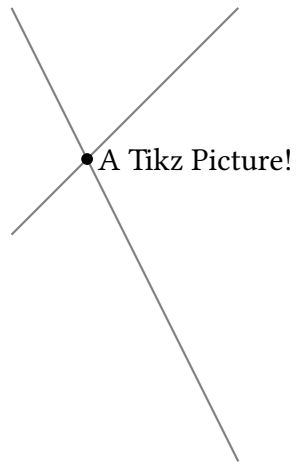


Figure 4.2: A caption for a tikz picture

## 4.2 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion.

## CHAPTER 5. SUMMARY AND DISCUSSION

This is the opening paragraph to my thesis which explains in general terms the concepts and hypothesis which will be used in my thesis.

With more general information given here than really necessary.

### 5.1 Introduction

Here initial concepts and conditions are explained and several hypothesis are mentioned in brief.

Or graphically as seen in [Figure 5.1](#) it is certain that my hypothesis is true.



Figure 5.1: Durham Centre— Another View

### 5.1.1 Hypothesis

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

As can be seen in [Table 5.1](#) it is truly obvious what I am saying is true.

Table 5.1: This table shows almost nothing but is a sideways table and takes up a whole page by itself

Element	Control	Experimental
Moon Rings	1.23	3.38
Moon Tides	2.26	3.12
Moon Walk	3.33	9.29



#### **5.1.1.1 Parts of the hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

#### **5.1.2 Second Hypothesis**

Here one particular hypothesis is explained in depth and is examined in the light of current literature.

#### **5.1.2.1 Parts of the second hypothesis**

Here one particular part of the hypothesis that is currently being explained is examined and particular elements of that part are given careful scrutiny.

### **5.2 Criteria Review**

Here certain criteria are explained thus eventually leading to a foregone conclusion.

### **5.3 Results And Discussion**

Here the results can be inserted

## BIBLIOGRAPHY

Bui, Vuong (Apr. 13, 2023). *Every Generating Polytope Is Strongly Monotypic*. arXiv: [2210.07690](https://arxiv.org/abs/2210.07690) [math]. URL: <http://arxiv.org/abs/2210.07690> (visited on 09/19/2024). Pre-published.

Correa, R., A. Hantoute, and M.A. López (n.d.). *Valadier-like Formulas for the Supremum Function II: The Compactly Indexed Case*. arXiv: [1707.03774](https://arxiv.org/abs/1707.03774). Pre-published.

Klee, Victor, Ludwig Danzer, and Branko Grünbaum (1963). “Helly’s Theorem and Its Relatives”. In: *Convexity*. Seventh Symposium in Pure Mathematics. Ed. by Victor Klee. Vol. 7. Proceedings of Symposia in Pure Mathematics ; v. 7. Providence: American Mathematical Society, pp. 101–180.

## APPENDIX A. ADDITIONAL MATERIAL

This is now the same as any other chapter except that all sectioning levels below the chapter level must begin with the \*-form of a sectioning command.

### More stuff

$$x^2 + z = yz \tag{A.1}$$

Table A.1: This table shows a standard empty table. In case of long captions, we want to use the long caption as the description to the table and image but not use it in the table of contents and list of figures/ tables. In order to do this, there are two captions which have been provided, remove the first square bracket options if there is only one small caption. You can use citations like this to

Bach	Cello Suite Number 1
Beethoven	Cello Sonata Number 3
Brahms	Cello Sonata Number 1

Supplemental material.

Figure A.1: Something something.

---

**Algorithm A.1** Score Algorithm
 

---

- 1: **Input:**  $s$  is a sensor
  - 2: **for**  $j \in \{1, 2, \dots, 15\}$  **do**
  - 3:     Randomly choose 5 days
  - 4:     **for**  $x \in \{1, 2, \dots, 1000\}$  **do**
  - 5:         Set  $a$  to be something in this very long state that will have to be wrapped quite possibly around and around and around
- 

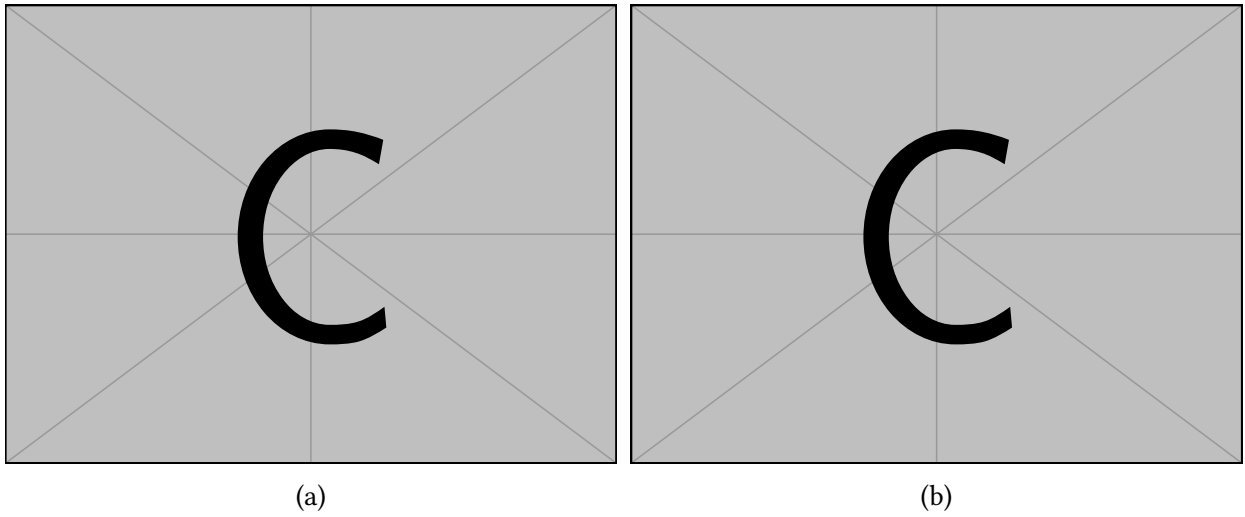


Figure A.2: A figure with two subfigures: (a) first subfigure; (b) second subfigure.

## APPENDIX B. STATISTICAL RESULTS

This is now the same as any other chapter except that all sectioning levels below the chapter level must begin with the \*-form of a sectioning command.

### Supplemental Statistics

More stuff.

$$z^2 - a = 2y \tag{B.1}$$

You see here I reference [Equation B.1](#)

**Theorem B.1.** *Appendices are the best part.*

Now, I reference [Theorem B.1](#).