This is the title of a thesis submitted to Iowa State University on the first line Note that only the first letter of the first word and proper names are capitalized and this is the second line

by

Alice Wonder

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:
John Smith, Major Professor
Jane Dee
Allen Wrench

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

2024

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. GENERAL INTRODUCTION

This chapter will have the introduction to your thesis as a whole.

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 Overview Two Words

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 (Bui, 2023), abcd.

1.2 Criteria Review

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

1.3 References

Bui, V. (2023, April 13). *Every generating polytope is strongly monotypic*. arXiv: 2210.07690 [math]. Retrieved September 19, 2024, from http://arxiv.org/abs/2210.07690

CHAPTER 2. PAPER 1 TITLE GOES HERE

Authors and Affiliations

Modified from a manuscript to be submitted to/ under review/ published in *Name of the Journal*

2.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the first paper general. You can use the same abstract as your paper here.

2.2 Overview

The construct of this section or any further section is same as the authors paper. 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.

2.3 Introduction

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

(Klee et al., 1963) the definitive model is seen.

2.3.1 Hypothesis

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

A version of this chapter appears in Journal of Discipline, Volume 18, Issue 3

2.3.1.1 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.

2.3.2 Second Hypothesis

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

2.3.2.1 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.

2.4 Criteria Review

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

2.5 Conclusion

The conclusion of the paper goes here. (Bui, 2023)

2.6 References

Bui, V. (2023, April 13). *Every generating polytope is strongly monotypic*. arXiv: 2210.07690 [math]. Retrieved September 19, 2024, from http://arxiv.org/abs/2210.07690

Chen, B., Yau, S.-T., & Yeh, Y.-N. (2001). Graph homotopy and Graham homotopy. *Discrete Mathematics*, *241*(1-3), 153–170. https://doi.org/10.1016/S0012-365X(01)00115-7

Klee, V., Danzer, L., & Grünbaum, B. (1963). Helly's theorem and its relatives. In V. Klee (Ed.), *Convexity* (pp. 101–180, Vol. 7). American Mathematical Society.

2.7 Appendix A: Appendix A Title Goes Here After The Colon

If there is an appendix that needs to go with the paper it can be as a section (Klee et al., 1963)

2.7.1 Procedure details

Details of the paper specific appendix procedures

2.8 Appendix B: Appendix B Title Goes Here After The Colon

If there is an appendix that needs to go with the paper it can be as a section (Chen et al., 2001)

2.8.1 Procedure details

Details of the paper specific appendix procedures

CHAPTER 3. PAPER 2 TITLE GOES HERE

Authors and Affiliations

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3.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the first paper general. You can use the same abstract as your paper here.

3.2 Overview

The construct of this section or any further section is same as the authors paper. 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.

3.3 Introduction

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

did the initial work the definitive model is seen.

3.3.1 Hypothesis

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

A version of this chapter appears in Journal of Discipline, Volume 18, Issue 3

3.3.1.1 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.

3.3.2 Second Hypothesis

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

3.3.2.1 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.

3.4 Criteria Review

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

3.5 Conclusion

The conclusion of the paper goes here.

(Ziegler, 1995)

3.6 References

Ziegler, G. M. (1995). *Lectures on polytopes*. Springer-Verlag.

3.7 Appendix: Appendix Title Goes Here

If there is an appendix that needs to go with the

3.7.1 Procedure details

Details of the paper specific appendix procedures

PART I

Let's have a part page

CHAPTER 4. PAPER 3 TITLE GOES HERE

Authors and Affiliations

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4.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the first paper general. You can use the same abstract as your paper here.

4.2 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.

4.3 Introduction

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

As can be seen in Table 4.1 it is truly obvious what I am saying is true.

4.3.1 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 4.1 that the rest is obvious.

A version of this chapter appears in Journal of Discipline, Volume 18, Issue 3

Table 4.1: 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

Figure 4.1: This table shows a standard empty figure

4.3.1.1 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.

4.3.2 Second Hypothesis

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

4.3.2.1 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.

4.4 Criteria Review

Here certain criteria are explained thus eventually leading to a foregone conclusion as can be seen in Table 4.2.

Table 4.2: This table shows a standard empty table with a limited caption width

4.5 Continuing Tables

4.6 Results

Include any results

4.7 Conclusion

The conclusion of the paper goes here.

(Dochtermann et al., 2023)

4.8 References

Dochtermann, A., Espinoza, J. F., Frías-Armenta, M. E., & Hernández, H. A. (2023). Minimal graphs for contractible and dismantlable properties. *Discrete Mathematics*, *346*(10), 113516. https://doi.org/10.1016/j.disc.2023.113516

Virk, Ž. (2024, August 6). *Contractibility of the Rips complexes of integer lattices via local domination*. arXiv: 2405.09134 [math]. Retrieved August 28, 2024, from http://arxiv.org/abs/2405.09134

4.9 Appendix: Appendix Title Goes Here

If there is an appendix that needs to go with the paper it can be as a section (Virk, 2024)

4.9.1 Procedure details

Details of the paper specific appendix procedures

Table 4.3: This is a two-part table doing things.

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

Table 4.3: Continued

k	q	p+	p-	s1	s2	s3	RHS
2	2	2	-2	1	0	0	1
-T	0	1	-1	0	1	0	0
T	-1	0	0	0	0	1	0
-1	1	-1	1				
2(T+1)	2	0	0	1	-2	0	1
-T	0	1	-1	0	1	0	0
T	-1	0	0	0	0	1	0
-(T+1)	1	0	0	0	1	0	
0	2+2(T+1)/T	0	0	1	-2	-2(T+1)/T	1
0	-1	1	-1	0	1	1	0
1	-1/T	0	0	0	0	1/T	0
0	1-(T+1)/T	0	0	0	1	(T+1)/T	
0	2(2T+1)/T	0	0	1	-2	-2(T+1)/T	1
0	-1	1	-1	0	1	1	0
1	-1/T	0	0	0	0	1/T	0
0	-1/T	0	0	0	1	(T+1)/T	
0	1	0	0	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	0	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 5. PAPER 4 TITLE GOES HERE

Authors and Affiliations

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5.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the first paper general. You can use the same abstract as your paper here.

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.

5.2 Introduction

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

Of course, data on this as seen in Table 5.1 is few and far between.

Table 5.1: Moon Data

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

5.2.1 Hypothesis

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

A version of this chapter appears in Journal of Discipline, Volume 18, Issue 3

Or graphically as seen in Figure 5.1 it is certain that my hypothesis is true.

Figure 5.1: Durham Centre

5.2.1.1 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.

5.2.2 Second Hypothesis

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

5.2.2.1 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.

5.3 Criteria Review

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

5.4 Results

5.5 Conclusion

The conclusion of the paper goes here.

5.6 References

Bui, V. (2023, April 13). *Every generating polytope is strongly monotypic*. arXiv: 2210.07690 [math]. Retrieved September 19, 2024, from http://arxiv.org/abs/2210.07690

Ziegler, G. M. (1995). *Lectures on polytopes*. Springer-Verlag.

5.7 Appendix: Appendix title goes here

If there is an appendix that needs to go with the paper it can be as a section (Ziegler, 1995)

5.7.1 Procedure details

Details of the paper specific appendix procedures

(Bui, 2023)

CHAPTER 6. CHAPTER WITH MATH

Authors and Affiliations

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6.1 Abstract

This is the text of my abstract that is part of the thesis itself. The abstract describes the work in the first paper general. You can use the same abstract as your paper here.

6.2 Proofs and Stuff

Definition 1. *A set A is something.*

Lemma 1. *If cool, then great.*

Proof. Without loss of generality, it works.

$$d(x,y) = d(x,z) + d(z,y) \geq d(x, x - \langle x,n\rangle n) + 0 = \langle x,n\rangle. \tag{6.1}$$

Furthermore,

$$\ell_1(\hat{x},y) = \ell_1(x,y) \tag{6.2}$$

$$= |\ell_1(x,y) - 2\langle x,n\rangle \ell_1(n,0)| \tag{6.3}$$

$$\left(\frac{x+y+z}{2x+y}\right) - (2x^2 - y) \tag{6.4}$$

$$B\left\langle \frac{4}{x} + x^3 \right\rangle \tag{6.5}$$

$$\left(x^2 - 2x\right) \tag{6.6}$$

A version of this chapter appears in Journal of Discipline, Volume 18, Issue 3

From Equation 6.1, it follows

$$\ell_1(\hat{x}, y)\ \ell_1(\hat{x}, y) - 2\langle x, n\rangle \leq$$

□

Then, we should also have some in-line math $B\left(\frac{3x}{2y-x}\right)$ and then $d(x, y)$ if it is alright. We might also have $\sqrt{x^2 + \frac{3}{x}}$.

Theorem 1. *If true, then it all collapses.*

Proof. By Zorn's lemma, Zorn has the best name (Martini et al., 2019). Also, (Chen et al., 2001) and (Dochtermann et al., 2023).

$$x^2 + y^2 + x^2 = 2.$$

□

6.3 Floating Practice

Text here.

Algorithm 1 Score Algorithm

Input: s is a sensor

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

More text here. Now what is we ?

6.4 References

Chen, B., Yau, S.-T., & Yeh, Y.-N. (2001). Graph homotopy and Graham homotopy. *Discrete Mathematics*, *241*(1-3), 153–170. https://doi.org/10.1016/S0012-365X(01)00115-7

Dochtermann, A., Espinoza, J. F., Frías-Armenta, M. E., & Hernández, H. A. (2023). Minimal graphs for contractible and dismantlable properties. *Discrete Mathematics*, *346*(10), 113516. https://doi.org/10.1016/j.disc.2023.113516

Martini, H., Montejano, L., & Oliveros, D. (2019). Complete and Reduced Convex Bodies. In H. Martini, L. Montejano, & D. Oliveros (Eds.), *Bodies of Constant Width: An Introduction to Convex Geometry with Applications* (pp. 143–165). Springer International Publishing. https://doi.org/10.1007/978-3-030-03868-7_7

CHAPTER 7. GENERAL CONCLUSION

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.

7.1 Summary And Discussion

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

7.1.1 Hypothesis

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

As can be seen in Table 7.1 it is truly obvious what I am saying is true.

Table 7.1: 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

7.1.1.1 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. (Chen et al., 2001), (Chen et al., 2001),(Virk, 2024) Here is an equation

$$x^2 + y^2 = 8.$$

7.2 References

Chen, B., Yau, S.-T., & Yeh, Y.-N. (2001). Graph homotopy and Graham homotopy. *Discrete Mathematics*, *241*(1-3), 153–170. https://doi.org/10.1016/S0012-365X(01)00115-7

Virk, Ž. (2024, August 6). *Contractibility of the Rips complexes of integer lattices via local domination*. arXiv: 2405.09134 [math]. Retrieved August 28, 2024, from http://arxiv.org/abs/2405.09134