



NANYANG TECHNOLOGICAL UNIVERSITY

SINGAPORE

CY2001 Research Attachment 1

Picture-Hanging Puzzles

SARAH EMILY ONG XIN WEI

U2440124G

Mathematical Sciences

School of Physical and Mathematical Sciences

Academic Year 2025/2026

Second Semester

Abstract

There is nothing wrong with second place. Your best effort is all that anyone's asking for. And if you give your best and you come in second, you come in third, you come in last, it's not about winning or losing. It's about giving it everything you've got. Now, Sam has built a monument to devilry and chaos. I deserve second place, I came in second. The only crime that's been committed here is that Oscar and Ally deserve first. We should be applauding them for getting more points. But in this sick rodeo, this bizarre *fuck*ed up clown festival that Sam's put together, we're here celebrating what I can only describe as the sickness at the core of America. And I'm gonna get him, I'm gonna get Sam.

Acknowledgements

Thank you to my mother for birthing me and for cutting fruit for me to snack on.

Table of Contents

Abstract	i
Acknowledgements	ii
List of Figures.....	v
List of Tables	vi
List of Appendix Figures.....	vii
Chapter 1 Introduction	1
1.1 Motivation for Research.....	1
1.2 Objectives	1
1.3 Scope of Work	1
1.4 Organisation of Report.....	1
Chapter 2 Literature Review	2
2.1 Picture-Hanging Puzzles	2
2.1.1 Connection to (Free) Group Theory.....	2
2.1.2 Connection to Borromean and Brunnian Links.....	2
2.2 Research Gaps	2
Chapter 3 Research Methodology	3
3.1 Independent Parameters	3
3.2 Dependent Parameters	3
3.3 Scope of Investigation	3
Chapter 4 Model Setup	4

Table of Contents

4.1 Heading	4
Chapter 5 Results	5
5.1 Overview of Results	5
Chapter 6 Conclusions and Recommendations	6
6.1 Conclusions.....	6
6.2 Recommendations for Future Work	6
List of References.....	R-1
Appendix A - Heading	A-1
Appendix B - Heading	B-1

List of Figures

List of Tables

List of Appendix Figures

1 Introduction

1.1 Motivation for Research

This research was motivated by the 4AUs it carries (not worth it)

1.2 Objectives

1.3 Scope of Work

1.4 Organisation of Report

2 Literature Review

2.1 Picture-Hanging Puzzles

Ordinarily, when hanging a picture frame, one would simply hang the frame by a singular nail on the wall. Obviously, removing that one nail would cause the picture and its frame to fall.

But what if we were to hang the picture by two nails? Hanging the picture in the simplest way

2.1.1 Connection to (Free) Group Theory

2.1.2 Connection to Borromean and Brunnian Links

2.2 Research Gaps

3 Research Methodology

As is the case with pure mathematical research, the research is conducted analytically.

Firstly, an extensive literature review on the topic of picture-hanging puzzles is conducted to gain pre-requisite knowledge in the field of interest. This review also serves to build an understanding of particularly interesting or impactful open problems that are deserving of greater attention. Having obtained deeper intimacy with the topic, we then apply the theorems and results obtained within the papers reviewed to develop further theories in the field of picture-hanging puzzles that, for example, allow the spectator the most efficient algorithm to remove the fewest nails to fell the picture. We also draw upon the ideas used in proofs to guide our own thoughts.

In the attempt to solve an open problem, we will put forward various approaches and work through each avenue to see if any of them will crack open the problem.

3.1 Independent Parameters

3.2 Dependent Parameters

3.3 Scope of Investigation

4 Model Setup

4.1 Heading

5 Results

5.1 Overview of Results

6 Conclusions and Recommendations

6.1 Conclusions

6.2 Recommendations for Future Work

List of References

Appendix A - Heading

Appendix B - Heading
