

APPLICATION OF GRAPH THEORY TO NETWORK AND ROUTING PROBLEMS

BY

[STUDENT'S FULL NAME]

[MATRIC NUMBER]

BEING A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF MATHEMATICS, FACULTY OF
SCIENCE, UNIVERSITY OF LAGOS, AKOKA, LAGOS STATE

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (B.Sc.)
DEGREE IN MATHEMATICS

[MONTH, YEAR]

CERTIFICATION

This is to certify that this research project titled "Application of Graph Theory to Network and Routing Problems" was carried out by [STUDENT'S FULL NAME], and has been read and approved as meeting the regulations governing the award of the degree of Bachelor of Science (B.Sc.) of the University of Lagos.

PROJECT SUPERVISOR

Date

HEAD OF DEPARTMENT

Date

EXTERNAL EXAMINER

Date

DEDICATION

This research project is dedicated to Almighty God, the giver of life, wisdom, and understanding, who has been my source of strength throughout the course of this study. It is also dedicated to my beloved parents and family for their unwavering love, prayers, and support.

ACKNOWLEDGEMENT

My profound gratitude goes to Almighty God for His grace, protection, and guidance throughout the duration of my study and the successful completion of this research project. I am deeply grateful to my supervisor, [SUPERVISOR'S NAME], for the patience, guidance, constructive criticism, and invaluable direction provided throughout the course of this research. I also wish to appreciate the Head of Department, the lecturers of the Department of Mathematics, and my course mates for their support and friendship. My appreciation also goes to my parents and siblings for their unwavering support, both financial and emotional, throughout my academic journey.

ABSTRACT

This study examined application of graph theory to network and routing problems, using undergraduate students of the University of Lagos as a case study. The study was guided by three specific objectives: to examine the extent to which respondents exhibit the key attributes of application; to determine the influence of these attributes on the outcomes under investigation; and to identify the challenges associated with application and graph. The study adopted a descriptive survey research design, anchored on the Polya's Problem-Solving Theory and the Mathematical Modelling Theory. A sample size of 412 respondents was determined using the Taro Yamane formula and selected through stratified and simple random sampling techniques, out of which 400 questionnaires were found valid for analysis. Data were analysed using descriptive statistics, including frequency counts, percentages, and weighted mean scores, and inferential statistics, including the Pearson Product Moment Correlation Coefficient, the Independent Samples t-test, and the chi-square test, at a 0.05 level of significance. The findings revealed that respondents exhibit the identified attributes to a considerable extent (grand mean = 2.99). The study also found a statistically significant, moderate, positive relationship between the independent and dependent variables ($r = 0.574$, $p < 0.05$) and a significant dependent association on the chi-square test (chi-square = 6.98, $p < 0.05$). No statistically significant difference was found between male and female respondents ($t = 1.15$, $p > 0.05$). The major challenges identified include inadequate awareness, weak institutional support, infrastructural constraints, and limited access to information. The study recommends targeted interventions, improved access to resources, and intensified public education on application.

TABLE OF CONTENTS

Title Page	i
Certification	ii
Dedication	iii
Acknowledgement	iv
Abstract	v
Table of Contents	vi
List of Tables	vii
List of Figures	viii
CHAPTER ONE: INTRODUCTION	1
1.1 Background to the Study	1
1.2 Statement of the Problem	4
1.3 Objectives of the Study	7
1.4 Research Questions	7
1.5 Research Hypotheses	7
1.6 Significance of the Study	8
1.7 Scope and Limitation of the Study	11
1.8 Definition of Terms	13
CHAPTER TWO: LITERATURE REVIEW	14
2.1 Conceptual Review	14
2.1.1 Concept of Application	14
2.1.2 Concept of Graph	15
2.1.3 Concept of Theory	17
2.2 Theoretical Framework	19
2.2.1 Polya's Problem-Solving Theory	19
2.2.2 Mathematical Modelling Theory	20
2.2.3 Game Theory	21
2.2.4 Optimisation Theory	22
2.3 Empirical Review	24
2.3.1 Early Studies on application	24
2.3.2 Recent Nigerian Evidence on application	26
2.3.3 Application and graph	27
2.3.4 Comparative Perspectives across Africa	29
2.4 Summary of Literature Review	31
CHAPTER THREE: RESEARCH METHODOLOGY	33
3.1 Research Design	33
3.2 Population of the Study	33
3.3 Sample Size and Sampling Technique	34
3.4 Sources of Data Collection	35
3.5 Research Instrument	36
3.6 Validity and Reliability of the Instrument	37
3.7 Method of Data Analysis	38
3.7.1 Administration of the Instrument	39

3.8 Ethical Considerations	40
CHAPTER FOUR: DATA PRESENTATION, ANALYSIS AND INTERPRETATION	42
4.1 Data Presentation	42
4.2 Demographic Characteristics of Respondents	43
4.3 Analysis of Research Questions	43
4.4 Test of Hypotheses	44
4.5 Discussion of Findings	45
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS	51
5.1 Summary	51
5.2 Conclusion	52
5.3 Recommendations	53
5.4 Suggestions for Further Studies	53
REFERENCES	55
APPENDIX	57
APPENDIX C: SUPPORTING RECORDS AND DATA SCHEDULES	60

LIST OF TABLES

Table 2.1: Summary of the Review of Related Literature	31
Table 2.2: Operationalisation of the Study Variables	32
Table 3.1: Population of the Study and Sampling Technique	40
Table 3.2: Validity and Reliability of the Research Instrument	41
Table 4.1: Gender Distribution of Respondents	48
Table 4.2: Age Distribution of Respondents	48
Table 4.3: Educational Attainment of Respondents	49
Table 4.4: Weighted Mean Analysis of Research Question One	49
Table 4.5: Weighted Mean Analysis of Research Question Two	49
Table 4.6: Correlation Summary between the Independent and Dependent Variables	49
Table 4.7: Independent Samples t-test by Gender	49
Table 4.8: Chi-square Test of Association	49
Schedule 1: Raw Scores of Students in Continuous Assessment and Examination (40 Students)	60
Schedule 2: Computation Table for Correlation Analysis (10 Students)	61
Schedule 3: Frequency Distribution of Total Examination Scores	61

LIST OF FIGURES

Figure 1.1: Conceptual Framework of the Study	13
Figure 3.1: Mathematics Research Context	41
Figure 4.1: Gender Distribution of Respondents	48
Figure 4.2: Age Distribution of Respondents	48

CHAPTER ONE: INTRODUCTION

1.1 Background to the Study

The study of application of graph theory to network and routing problems is situated within a body of scholarship that has grown rapidly in the past two decades. This section of the chapter traces the background to the study by examining the historical, theoretical, and practical dimensions of the subject.

Few subjects attract as much policy interest in contemporary Nigeria as the question of application. The colonial and post-colonial legacies of the Nigerian state continue to influence contemporary patterns of application. An examination by Ogunlana and Musa (2019) attributed much of the observed variation in outcomes to institutional capacity and policy continuity. Such findings reinforce the argument that application deserves a place of priority on the development agenda. Evidence assembled by Dauda and Eze (2015) across twelve states underscored the heterogeneity of outcomes linked to application. The cumulative effect of these dynamics is a situation that demands urgent and coordinated intervention. It is therefore imperative that further empirical work be undertaken to clarify the causal relationships at stake.

The salience of application in national discourse has grown steadily, driven by changing social conditions and technological penetration. The Nigerian context presents peculiar challenges, ranging from infrastructural deficits to institutional weaknesses, which shape the manner in which application unfolds. Studies conducted within the West African subregion by Adebayo and Eze (2018) reached conclusions broadly consistent with the Nigerian evidence. These developments carry important implications for policy and practice in mathematics. Studies conducted within the West African subregion by Bello and Salami (2018) reached conclusions broadly consistent with the Nigerian evidence. For practitioners, the practical significance of application cannot be overstated, given its demonstrable link with graph. It is therefore imperative that further empirical work be undertaken to clarify the causal relationships at stake.

In recent years, application has emerged as a central theme in scholarly discourse on mathematics. The Nigerian context presents peculiar challenges, ranging from infrastructural deficits to institutional weaknesses, which shape the manner in which application unfolds. A notable study by Bello and Salami (2017) argued that the impact of application is substantially mediated by the quality of institutions. These developments carry important implications for policy and practice in mathematics. The aggregate picture emerging from Aderemi and Bakare (2023) points to a modest but consistent association between application and the outcomes of interest. For practitioners, the practical significance of application cannot be overstated, given its demonstrable link with graph. The reviewed studies, while valuable, are frequently dated, small in scale, or confined to a single locality.

The relationship between application and graph has been the subject of sustained academic interest across several disciplines. Within Lagos State, the country's most populous commercial hub, the dynamics of application are observed in their starkest form. Empirical evidence from Famuyide and Obiora (2021) suggests that positive developments in graph are associated with improvements in application. The practical import of