## CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgement</td>
<td>i</td>
</tr>
<tr>
<td>Abstract</td>
<td>iii</td>
</tr>
<tr>
<td>List of Abbreviations</td>
<td>x</td>
</tr>
<tr>
<td>List of Figures</td>
<td>xii</td>
</tr>
<tr>
<td>List of Tables</td>
<td>xiv</td>
</tr>
</tbody>
</table>

### CHAPTER 1  INTRODUCTION

1.1 Knowledge Discovery in Database (KDD)  
1.1.1 Stages of KDD  
1.1.2 Types of KDD  
1.2 Data Mining  
1.3 Data Mining Techniques  
1.4 Graph Data Analysis  
1.5 Application Area  
1.6 Motivation  
1.7 Thesis Contributions  
1.7.1 Lift Based Ordering  
1.7.2 Modified Discounted Cumulative Gain (MDCG)  
1.7.3 Graphgain (GG)  
1.7.4 Ranking of Subgraphs  
1.8 Organization of the Thesis  

### CHAPTER 2  LITERATURE SURVEY

2.1 Introduction  
2.2 Association Rule Mining (ARM)
2.3. Frequent Pattern Mining
   2.3.1 With Candidate Generation Approach
   2.3.2 Without Candidate Generation Approach
   2.3.3 Vertical Layout Approach
   2.3.4 Measures and its Types
      2.3.4.1. Subjective Measures
      2.3.4.2. Objective Measures
      2.3.4.3. Semantic Measures
   2.3.5. Role of Measures
   2.3.6. List of Measures
      2.3.6.1. Support
      2.3.6.2. Confidence
      2.3.6.3. Lift
   2.4. Graph Mining
      2.4.1 Graph Database
      2.4.1.1 Conversion of Graph Database
   2.5. Subgraph Mining
      2.5.1 Subgraph Categories
      2.5.2 Problem Statement
      2.5.3 Types of Subgraph Mining
         2.5.3.1 Apriori Algorithm
         2.5.3.2 FP-Growth Pattern Mining Algorithm
         2.5.3.3 Other Related Issues
   2.6. Applications
   2.7. Ranking in Graph
   2.8. Related Works
   2.9 Summary

CHAPTER 3  GRAPHGAIN MEASURE

3.1 Introduction
3.2 Discounted Cumulative Gain (DCG)
3.3 Normalized Discounted Cumulative Gain (nDCG)
3.4 Need for the Proposed Work
CHAPTER 4  APRIORI BASED FREQUENT SUBGRAPH MINING WITH GRAPHGAIN

4.1 Introduction 70
4.2 Apriori Method 71
   4.2.1 Advantages and Disadvantages of Apriori Algorithm 74
4.3 Existing Works 74
4.4 Basic Concept 76
4.5 Proposed Algorithm 76
   4.5.1 Frequent Subgraph Discovery with GraphGain 77
      4.5.1.1 Description of the AFSMG Algorithm 78
4.6 Description with sample dataset 81
4.7 Performance Study and Analysis 86
4.8 Summary 92

CHAPTER 5  FP-GROWTH BASED FREQUENT SUBGRAPH MINING WITH GRAPHGAIN

5.1 Introduction 93
5.2 Existing Works 94
5.3 Basic Concept 96
5.4 Proposed Algorithm
   5.4.1 FP-Growth with GG
      5.4.1.1 Description of the Algorithm of FP-tree Creation
      5.4.1.2 Description of the FPGBG Algorithm
   5.5 Description with sample dataset
   5.6 Experimental Study and Analysis
   5.7 Summary

CHAPTER 6 RESULTS AND DISCUSSION

6.1 Introduction
6.2 AFSMG Algorithm with Chemical and Synthetic Dataset
6.3 FPGBG Algorithm with Chemical and Synthetic Dataset
6.4 Summary

CHAPTER 7 CONCLUSION AND FUTURE WORK

7.1 Summary of Contributions
7.2 Efficiency of Algorithms
7.3 Conciseness of Results
7.4 Future Work

REFERENCES

LIST OF PUBLICATIONS RELATED TO THIS RESEARCH WORK