Ain Shams University
University College For Women
Department Of Mathematics

On some new graphs and their variation

THESIS
SUBMITTED IN PARTIAL
FULFILLMENT OF REQUIREMENTS
FOR THE DEGREE
OF
MASTER OF SCIENCE
(PURE MATHEMATICS)
BY

NAJAT MOUSA AL OBAIDI

Department of mathematics
University College For Women
Ain Shams University

SUPERVISORS

Prof. Dr. Samia Said EL-Azab
Professor of Applied mathematics
University College of women
Ain Shams University

Prof. Dr. Mabrouk M.S. El-ghoul
Professor of pure mathematics
Faculty Of Science
Tanta University

2012

Ain Shams University
University College for Women
Mathematics Department

COURSES

The student has passed the following courses in partial fulfillment of requirements for M.Sc. degree:

1-Algebric Topology.	2h per week
2-Difference Equations.	2h per week
3-Numerical treatment of differential equations.	2h per week
4-Differential Geometry.	2h per week
5-Theory of differential equations.	2h per week
6- English language	2h per week

Head of Mathematics Department

Ain Shams University
University College for Women
Mathematics Department

M.SC THESIS
(PURE MATHEMATICS)

TITLE OF THESIS:

ON SOME NEW GRAPHS AND THEIR VARIATION

THESIS SUPERVISORS :

Prof. Dr. Samia Said EL-Azab
Professor of Applied mathematics
University College of women
Ain Shams University

Prof. Dr. Mabrouk M. S. El-ghoul
Professor of pure mathematics
Faculty Of Science
Tanta University

جامعة عين شمس
كلية البنات للأداب والعلوم والتربية
قسم الرياضـيات

عن بعض أنواع المخططات الجديدة وتغيرها

رساله مقدمة من الطالبة

نجاة موسى حسين العبيدي
قسم الرياضيات - كلية البنات
جامعة عين شمس

للحصول على درجة الماجستير
في العلوم
(رياضبات بحتة)
نظام الدراسة والبحث

المشرفون

أ.د/سامية سعيد العزب
أستاذة الرياضيات التطبيقية
كلية البنات- جامعة عين شمس

أ.د/مبروك محمد سالم الغول
أستاذ الرياضيات البحتة
كلية العلوم- جامعة طنطا

٢٠١٢

SUMMARY

The project of this thesis concerns a field of mathematics called geometric topology.

The main purpose of this thesis is to study some new graphs and their variations.

The thesis is divided into five chapters:

Chapter One: Basic concepts

In chapter (1) is an introduction and presents a brief survey of main important definitions that help us in our work.

Chapter two: The Graph Of Simplex Vertices

In chapter (2) we will introduce a new types of graph. The representation of the new graph by adjacent and incidence matrices will be obtained. Some geometric transformations(Folding) on the new graphs are described.

The results of this chapter were published in "Journal of Mathematics research" (Vol. 4, No. 1; February 2012) In Canada.

Chapter three: The Retraction Of Graph with simplex Vertices.

In chapter (3) we will discuss the retraction of new graph in which its vertices are simplexes. The limit of these retractions is obtained . Some theorems related to these transformations are proved. The effect of retraction on adjacent and incident matrices will be deduced.

The results of this chapter are accepted for publication in "International Journal Of Computational And Applied Mathematics". In India.

Chapter four: Neighborhoods Of The Undirected Graph With Simplex Vertices.

In chapter (4) we will compute first and second neighborhood for new undirected graph with simplex vertices. Some theorems related to this subject are obtained. We also introduced some examples on 0-simplex,1-simplex,2-simplex and n-simplex.

The results of this chapter are accepted for publication in "International Journal Of Applied Science and Technology". In United States Of America.

Chapter five: Neighborhoods Of Directed Simplex Graph.

In chapter (5) we will compute first and second neighborhood for directed simplex graph. Some theorems related to this subject are obtained. We also introduced some examples on 0-simplex,1-simplex,2-simplex and n-simplex.

The results of this chapter were published in "International Journal Of Mathematics Archive "(Vol. 3, No. 4; April 2012) In India.

CONTENTS

Chapter 5

Acknowledgment

In the first place, I should express my thankfulness to my god for his Guidance, Blessings and Help, and for aiding me to achieve this work.
I am very thankful and heartily grateful to wards my supervisor Prof. Dr. Samia Said EL-Azab, Professor of Applied Mathematics, College of Women, Ain Shams University, for her unlimited support, open-handedness, warm encouragement and faithful help.

I would like to say that words are not enough and incapable to express exactly my own inner feelings towards my supervisor Prof. Dr. Mabrouk M S EL-ghoul, Professor of Pure Mathematics, Faculty of Science, Tanta University for suggesting the subject matter of this thesis, his sincere supervisions, valuable discussions and extreme patience. His valuable advice and his constructive criticisms have been most helpful at all stages.

My passion, love, gratitude to my parents, my brothers, and my kids (Malak- Monther-hussen-yazan-ghassan) for being so patience and supportive through all the years that I have been busy from them. And especially my husband: Fisal AL-harbi for his unlimited help, everlasting encouragement and moral support.

I wish to express my great thanks for head and all the staff members of mathematics Department, Faculty of Science, Ain Shams University for interest and facilities they offered.
May God reward them good for all what they have done to me.

Najat AL-Obaidi

بسم الله الرحمن الرحيم

{ يَرْفَعِ اللَّهُ الَّذِينَ آَمَنُوا مِنكُمْ
وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ
وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ }

صدق الله العظيم

Chapter1

Basic Concepts

In this chapter we will review briefly the basic topological and geometric concepts and results relevant to this work. We adapted these concepts to fit coherently into the framework of this thesis.

1.1 Graph:

There are many physical systems their performance depends not only on the characteristics of the components but also on the relative locations of the elements. An obvious example is an electrical network. If we change a resistor to a capacitor, generally some of the properties (such as an input impedance of the network) also change. This indicates that the performance of a system depends on the characteristics of the components. If, on the other hand, we change the location of one resistor, the input impedance again may change, which shows that the topology of the system is influencing the system's performance. There are systems constructed of only one kind of component so that the system's performance depends only on its topology. An example of such a system is a single-contact switching circuit. Similar situations can be seen in nonphysical systems such as structures of administration.Hence it is important to represent a system so that its topology can be visualized clearly.

One simple way of displaing a structure of a system is to draw a diagram consisting of points called "vertices" and line segments called "edges" which connect these vertices so that such vertices and edges indicate components and relationships between these components. Such a diagram is called a "Linear graph" whose name depends on the kind of physical system we deal with. This means that it may be called a network, a net, a circuit, a graph, a diagram, a structure, and so on.

Instead of indicating the physical strusture of a system, we frequently indicate its mathematical model or its abstract model by a "Linear graph". Under such a circumstance, a linear graph is referred to as a flow graph, a signal flow graph, a flow chart, a state diagram, a simplicial complex, a sociogram, an organization diagram, and so forth.The earliest known paper on linear graph theory, in 1736, is due to "Euler" who gave a solution to the " Konisberger" bridge problem by introducing the concept of linear graphs. In 1847, " Krichhoff"employed linear graph theory for an analysis of electrical networks,known today as the topological formulas for driving point impedance and transfer admittances. This probably is the first paper that applies the theory of linear graphs to engineering problems. However, it is not "Krichhoff's paper" but "Mobins conjecture", about 1840, concerning the four-color problem that seems to attract many scholars to devote themselves to linear graph theory.

In the past few years, graph theory has established itself as an important mathematical tool in a wide variety of subjects, ranging from operational research and linguistics to chemistry and genetics; at the same time it has also emerged as a worthwhile mathematical discipline in its own right[4]. The graph theory is being applied in many different fields such as engineering system science, social science and human relations, business administration and scientific management, political science, physical and organization systems, the electrical circuits and networks, route maps, architectural floor plans, chemistry, ecology,transportation theory, system diagnosis, music,.... [1].

1.2 An Abstract graph:

An "abstract" graph G is a diagram consisting of a finite nonempty set of elements, called "vertices" denoted by $V(G)$ together with a set of unordered pairs of these elements, called "edges" denoted by $E(G)$.The set of vertices of the graph G is called "the vertiex-set of G" and the list of the edges is called "the edge-list of G". In other words, an "abstract" graph G is a pair $(V(G);E(G))$ is a . . . nite set and$E(G)$ a set of unordered pairs of distinct elements of $V(G)$. Thus an element of $E(G)$ is of the form $(v_i\ ,v_{i+1})$where v_i and v_{i+1} belong to $V(G)$and $v_i \neq v_{i+1}$ The elements of $V(G)$are called :vertices" and the element $(v_i;v_{i+1})$ of $E(G)$ is called the "edges" joining v_i and v_{i+1}(or $v_{i+1}$and v_i) . The positions of the vertices and the length of the edges do not concern us; what is important is the number of vertices and the pairs of vertices which are connected by an edge[6].Also the word "graph" , here, refers to a diagram of points interconnected by lines,as shown in Fig (1.1), rather than to a picture representing a function[4].

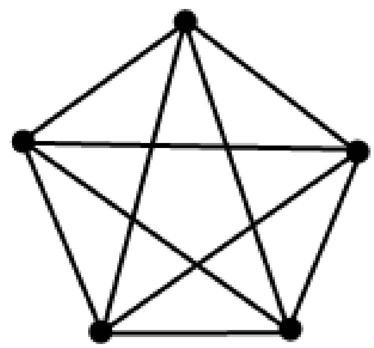

Fig (1.1)

The interconnections between points may refer to bonds between atoms in a chemical molecule,wires between terminals in an electrical network, roads between towns on a map, and so on [1,4].

1.2.1 Example:

Let G be a graph defined by $V(G) = \{v_0, v_1, v_2, v_3\}$ and $E(G) = \{v_0v_1, v_1v_2, v_2v_0, v_0v_3\}$, then G may be represented by either Fig$(1.2.a)$ or $(1.2.b)$ where the later representation is more accurate[9].

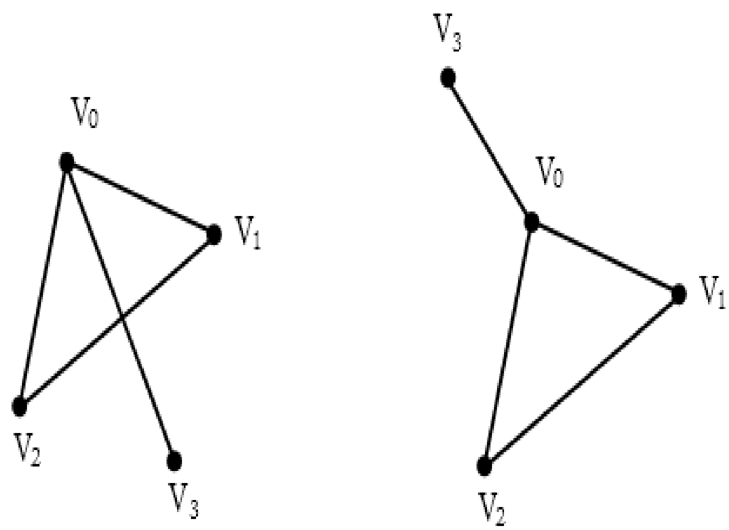

Fig (1.2)

1.3 complete graph :

A graph in which every two distinct vertices are joined by one edge.The complete graph on n vertices is usually denoted by K_n, also K_n has exactly $\frac{1}{2}n(n-1)$ edges .$Fig.(1.3)$ shows the complete graphs K_n for $n = 1.2.3.4$.The graph $K_1$is sometimes called the "trivial graph"[7,4].

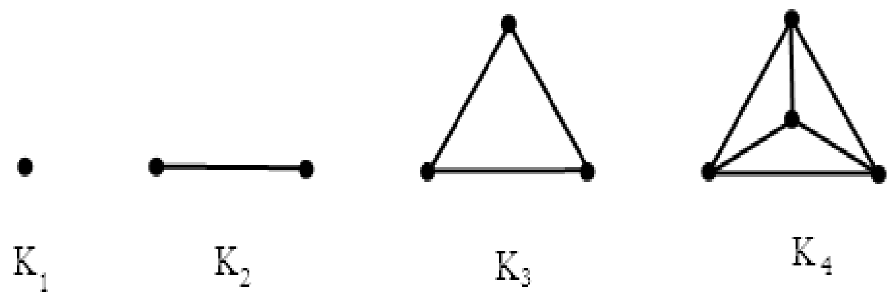

Fig. (1.3)

In other words, the "complete graph" is an abstract graph with the maximum number of edges. The complete abstract graphs with up to four vertices have realization in R^2 ,however it can be realized in R^3 ,as indeed can every abstract graph[1].

1.4 Null graph :

A graph which consists of a set of vertices and no edges is called a null graph[1].

i.e., the set of edges in a null graph is empty, null graph is denoted on n vertices by N_n.

$N_4$is shown in $Fig.(1.4)$, note that each vertex of a null graph is isolated .

Fig.(1.4)

1.5 Path graph:

A path graph is a graph consists of a single path. The path graph with n-vertices is denoted by$P_n, Fig.(1.5)$ [1].

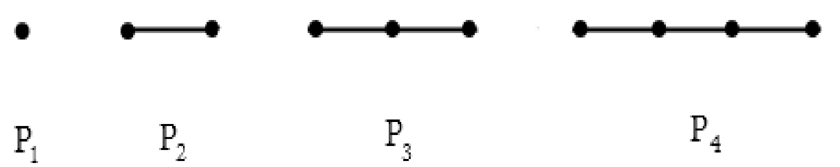

Fig.(1.5)