Analysis of the ethical behavior of public accountants in Colombia. A vision from graph theory

Análisis del comportamiento ético de contadores públicos en Colombia. Una visión desde la teoría de grafos

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Abstract

Ethics is the science that deals with the study of human behavior, which is why the main objective of this study was to determine the ethical behavior of public accountants in Colombia during the period 2017-2021 through a mixed-type graph model based on the methodology proposed by authors such as Melo & Meira (2012), who spoke of associativity and centrality in the area of management development because an articulation between the ethical regulatory framework and the behavior of accounting professionals is proposed. As a result, a conceptual and theoretical frame of reference was obtained, which allowed a more solid analysis of the ethics of accountants and the Graph Theory; likewise, the ethical behavior of public accountants in Colombia was evidenced during the period 2017-2021, thus showing ethical behaviors of unethical ones according to the normative principles of the accounting profession. The information provided by the Central Board of Public Accountants of Colombia was a limitation, as it did not specify all the principles that an accountant had violated. This study will have important implications for the actions of accountants due to its ethical and conceptual value in administrative theories and the relevance of affectations that may affect the professional life of each one of them. It is original because there has not been a study on ethics in accountants using Graph Theory. In conclusion, we have identified that the most frequently violated principles of the code of ethics are responsibility, observance of normative dispositions, respect among colleagues, ethical conduct, and integrity, while those that are violated in a smaller proportion are those of objectivity, independence, and confidentiality.
Keywords: Ethics; public accountant; code of ethics; graph theory; IFAC.

Resumen

La Ética es la ciencia que se encarga del estudio del comportamiento del ser humano, es por ello que este estudio tuvo como objetivo central, determinar el comportamiento ético de contadores públicos en Colombia, durante el periodo 2017-2021, mediante un modelo de grafos, de tipo mixto, basado en la metodología propuesta por autores como Melo & Meira (2012), los cuales hablaron de asociatividad y centralidad en el área de desarrollo directivo, debido a que se plantea una articulación entre el marco normativo ético y el comportamiento de profesionales en contaduría. Como resultado se obtuvo un marco de referencia conceptual y teórico, que permitió un análisis más sólido de la ética de los contadores y la Teoría de Grafos; asimismo se evidenció el comportamiento ético de los contadores públicos en Colombia, durante el periodo 2017-2021, mostrando así conductas éticas de las no éticas de acuerdo con los principios normativos de la profesión contable. Como limitantes se tuvo la información ofrecida por la Junta Central de Contadores Públicos de Colombia, toda vez que no especificaban de manera muy clara todos los principios que había infringido un contador. Este estudio tendrá implicaciones importantes en el actuar de los contadores por su valor ético y conceptual en teorías administrativas, y relevancia de afectaciones que pueden llegar a la vida profesional de cada uno de ellos. Es de carácter original debido a que no se ha hecho un estudio sobre ética en contadores usando Teoría de Grafos y como conclusiones se tienen que los principios que más se violan del código de ética son: responsabilidad, observaciones de las disposiciones normativas, respecto entre colegas, conducta ética e integridad; mientras que los que se violan en menor proporción son los de objetividad, independencia, y confidencialidad.
Palabras clave: Ética; contador público; código de ética; teoría de grafos; IFAC.

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INTRODUCTION

Ethics is the science responsible for modeling human behavior in all its dimensions, whether personal, occupational, professional, or coexisting. It materializes in human action through principles, values, and virtues, which in turn make up the construct or solid base on which all human action rests.

The importance of studying ethics for the researcher has repercussions on the strengthening of his abilities to live in society, to act more effectively in his work context based on normative approaches, and, fundamentally, to establish his principles.

Regarding relevance, rationalizing human behavior among accounting professionals poses a challenge for both them and the profession, as institutions are obligated to enforce the regulatory framework for the indirect benefit it provides to society, encompassing social, economic, and political issues.

Likewise, the research's relevance benefits the scientific community, as it strengthens knowledge in fields such as Graph Theory, Ethics, and Accounting. Likewise, it benefits society in general to the extent that good ethical behavior on the part of those responsible for accounting in organizations will lead to an increase in economic benefits to the population, as well as a fundamental aspect for academia, namely an increase in research rates for university institutions.

The research is based on graph theory, utilizing a pictorial representation of a digraph (a graph with direction) that provides a more didactic and comprehensive illustration of the ethical behavior of accounting professionals in Colombia during the period 2017-2021. This representation allows anyone, regardless of their level of study, to understand it. The methodology is based on a documentary review of an inductive-descriptive character, allowing for an understanding of the ethical reality of the accounting profession in Colombia, where only inferences are made about this group of professionals.

Given the above, the praxeology of this research is justified due to the limited studies on ethical behavior among accounting professionals in Colombia, particularly in aspects of graphic illustration, which serve as a means of generating understanding and facilitating easy comprehension among the community. Likewise, the future projection is to offer this tool to other areas of knowledge.

Considering that ethics is the science that evaluates human beings in terms of their behavior and actions in society, if the public accounting professional does not act correctly by the normative frameworks imposed by society and the governing bodies of his professional field, it would be an attack against the principles, values, and institutions themselves.

A professional accountant who lacks ethical principles in their approach will likely reflect that same behavior in their interactions with society and organizations. In Colombia, numerous cases of corruption have occurred within organizations due

to misconduct by both company agents and accountants. These professionals have utilized accounting as a mechanism to support the economic activities of companies, but have also employed this discipline as a facade to conceal their immoral actions.

There is a need for accounting professionals who do not tarnish the accounting discipline and who act honestly toward the community, the State, shareholders, and other indirect beneficiaries who rely on accounting information for informed decision-making. Nowadays, professionals lack these virtues since the State and society itself have forgotten to strengthen the Ethics chairs in the academic cloisters of all levels of knowledge, and even more, parents have neglected to instill values in their children from a very early age that contribute to the strengthening of the moral bases throughout their lives.

Thus, the central objective of the research is to determine the ethical behavior of public accountants in Colombia during the period 2017-2021 using a graph model and specific goals such as identifying regulatory aspects that regulate their ethical behavior, specifying the public accountants that make up the Central Board of Accountants of Colombia in accordance with those who have been reprimanded, and finally, designing a graph model that illustrates the ethical behavior of these professionals.

STATE OF THE ART

Background and current status of the subject

Public Accounting is a discipline that aims to provide information to society, shareholders, investors, creditors, agents, employees, and the State, among others, through the measurement, evaluation, and analysis of organizational and economic records on financial information, performance, and future flows of resources, where beneficiaries of information use such information to make decisions (IFRS, 2018).

In Colombia, the governing body of the accounting profession is the Special Administrative Unit of the Central Board of Accountants-UAEJCC, which has three areas within its mission processes: Disciplinary Tribunal, Registration and Inspection, and Surveillance. The first is a collegiate body made up of 7 officers, which is responsible for conducting disciplinary investigations of public accountants and entities providing accounting services that are registered in it; the second is responsible for making registrations of public accountants and entities providing these services, and the third consists of the supervision of accountants and companies that offer or provide services with the exercise of the accounting profession (UAEJCC, 2022).

For the period from September 18, 1956, to June 8, 2021 (the last Registration Committee conducted by the UAEJCC), there were 282,023 registered public accounting professionals, of which 277,235 are active (98.30%); 4,695 are deceased (1.66%), and 93 have canceled registrations (0.04%) (UAEJCC, 2022).

The problems regarding the actions of public accountants in Colombia have been studied on several occasions, including the study conducted by Álvarez (2017), where the sanctions imposed by the UAEJCC in the last six years for the codes of ethics Law 43 of 1990 and the IFAC code of ethics was considered; They concluded that public accounting and auditing are framed in significant risk situations since they represent a higher degree of responsibility and that most of the sanctions are caused by social and economic pressures of the environment.

Likewise, Jara & Londoño (2019), in a study called analysis of the sanctions imposed by the UAEJCC in the years 2013-2018, problematized the way the UAEJCC had been acting in relation to the sanctions applied to the public accountant for behaviors that violated the code of ethics, in this, they concluded that the public accountant must not only have technical accounting knowledge, but also skills, attitudes and ethical values as a basis for the performance of the professional practice.

Theoretical Framework

Ethics

Socrates, one of the greatest thinkers of antiquity and one of the first philosophers who began to talk about ethics, asserted that human beings should

know themselves and that if someone did wrong, it would be because of ignorance. Therefore, he urged society to educate men, and then they would be good (Guthrie, 1962).

For Aristotle, ethics is the structure of human behavior, of a social character, the form in which collective life manifests itself. It is a form of politics (understanding that is reached through experience and life), but its end is not knowledge but action, praxis (Hegel, 1995).

On the other hand, Epicurus of Samos stated that human life is characterized by the coexistence of pain and pleasure, establishing an equivalence between good and pleasure, and evil and pain. This is the reason his thesis was sustained through assertions such as the reason must tend to seek happiness and tranquility, which is, in essence, doing good (Manrique, 2002).

In accordance with what was stated above by the thinkers of antiquity, writers such as Savater (1991), in his book Ethics for Amador, confirm that the science of ethics is the art of coexistence, encompassing the knowledge of how to live. It is the art of thinking and knowing how to scrutinize what is good and what is wrong, trying to choose what is most convenient for human beings in their coexistence.

Likewise, for Dussel (1996), ethics is a science that operates in various fields of reality, crossing over into other sciences, including each of their systems, and is demonstrated as that which governs human actions in terms of principles, values, and virtues.

As it has been shown, ethics is a science that serves humanity in society, seeking a better coexistence so that humans can live in a better way, basing their behaviors on norms imposed by society itself, and that should be inherent virtues. Thus, ethics transcends not only the human being but also the institutions that inhabit society, which is why it is present in all disciplines of knowledge, thereby giving rise to what is known as professional ethics.

Professional ethics

The profession is a vocation or human and social activity through which a service is provided in an institutionalized manner, allowing a group of professionals to protest exclusivity before subjects who wish to exercise it outside the authorized profession (Martínez, 2006). It is to be understood then that the professional, in the exercise of his functions, faces a responsibility before society, given his legitimacy and benefit to it.

Since ethics are found in all areas of knowledge, accounting is no stranger to this knowledge and its actions in society. That is why, in accounting, we speak of the Ethics of the Accountant as a field of action of the accounting professional when performing their accounting activities.

Code of Ethics

According to Galán (1999), a code of ethics is a system that standardizes the moral responsibilities underlying the social role of the professional in a specific area of knowledge and, likewise, determines the expectations that society has the right to demand of them.

On the other hand, Salcedo (1999) states that apart from this, codes of ethics regulate professional activities in the sense that they protect users from professional misconduct of the subjects and also these same professionals in their relationships as colleagues; thus, a code of ethics would become an instrument that allows an evaluation of the actions of professionals in their functions.

Thus, it can be inferred that codes of ethics are postulates that thoroughly define a path for any profession, giving it identity and legitimacy before society, which has legitimized it for the common good from the outset.

Accountant Ethics

The professional public accountant cannot detach himself from his ethical behavior in each of the activities he performs in the name of his profession, for which his professional judgment is indispensable. The raison d'être of the public accountant lies in the Public Faith that he proclaims when signing financial reports in economic organizations, giving society qualities of suitability, integrity, and reliability in his actions; therefore, the accountant must show mental and functional independence in the organizations, giving the guarantee that his signature predicts that the facts recorded and endorsed by him are reliable and reasonable (Pinilla & Álvarez, 2013).

Thus, it is clear to state that the actions of the public accountant are subject to a series of regulations existing in Colombian and international standards, which find their legal basis in Law 43 of 1990 and the Code of Ethics of the International Federation of Accountants (IFAC).

Law 43 of 1990 - Code of Ethics

Article 35 of this law states that Public Accounting is a profession whose purpose is to satisfy the needs of society, whether in the exercise of its private or public functions. It must watch over the economic interests of the community, understood as natural or juridical persons formally organized and society in its holistic scope (Congreso de Colombia, 1990).

Likewise, the same law establishes that public accountants must act with principles of integrity, objectivity, independence, responsibility, confidentiality, observance of regulatory provisions, professional competence and updating, dissemination and collaboration, respect among colleagues, and ethical conduct in the exercise of their functions.

In Colombia, the body in charge of overseeing disciplinary processes in the actions of public accountants is the Special Administrative Unit of the Central Board of Accountants, which, by Resolution 000-0604 of March 17, 2020, adopts the internal procedure for the promotion, processing, and completion of disciplinary investigations conducted by the Disciplinary Tribunal against public accountants and entities that provide accounting services, which may be raised through complaints, reports or ex-officio. (UAEJCC, 2020).

For the UAE Central Board of Accountants, a complaint is a denunciation filed by a citizen against the public accountant(s) or accounting service providers; a report is an action through which a State entity, in the exercise of its competence, warns about the alleged unethical conduct of a professional or company providing accounting services. An ex officio opening is the power of the Disciplinary Tribunal of the UAE Central Board of Accountants to initiate disciplinary action against those who exercise accounting activities when conduct that violates the code of ethics is detected. (UAEJCC, 2020).

Thus, the Resolution mentioned above establishes the principles on which the UAE Central Board of Accountants is based to evaluate the disciplinary proceedings in charge of the Disciplinary Tribunal, which are recognition of human dignity, ownership of the disciplinary power and autonomy of action, legality, purposes of the disciplinary sanction, proportionality and reasonableness of the disciplinary sanction, equality, favorability, culpability, purposes of the disciplinary process, due process, comprehensive investigation, presumption of innocence, right to defense, disciplinary res judicata, free disciplinary proceedings, motivation, consistency, and prevalence of the principles and normative integration.

It should be clarified that the UAE Central Board of Accountants advances a series of stages before delivering a sanctioning verdict to those responsible for

accounting information. Among these stages are the preliminary inquiry stage, the disciplinary investigation stage, the charges stage, the discharge stage, the ruling stage, and finally, the registration and communication of sanctions in the institutional database (UAEJCC, 2020).

IFAC Code of Ethics

The International Federation of Accountants, the leading body in the issuance of international ethical and assurance standards, through its International Ethics Standards Board for Accountants (IESBA), has also issued a Code of Ethics that establishes ethical requirements for accounting professionals to strengthen the profession worldwide, contribute to the development of sound international economies by establishing high-quality standards and promoting adherence to them, foster international convergence, and pronounce on relevant public interest issues. (IESBA, 2009). The code is structured in three parts, as shown in Table 1.

Table 1.

Structure Code of Ethics - IFAC

Part A	GENERAL APPLICATION OF THE CODE
100	Introduction and Fundamental Principles
110	Integrity
120	Objectivity
130	Professional competence and diligence
140	Confidentiality
150	Professional behavior
Part B	PRACTICING ACCOUNTING PROFESSIONALS
200	Introduction
210	Professional appointment
220	Conflict of interest
230	Second opinions
240	Fees and other types of remuneration
240	Professional Services Marketing
260	Gifts and invitations
270	Custody of a client's assets
280	Objectivity - All Services
290	Independence - Audit and Review Engagements
291	Independence - Other assignments that provide a degree of security
Part C	ACCOUNTING PROFESSIONALS IN THE COMPANY
300	Introduction
310	Potential conflicts
320	Preparation and presentation of information
330	Acting with sufficient specialization
340	Financial interests
350	Incentives

Source: Author elaboration

Consistency between Law 43 of the 1990 and the IFAC Code of Ethics

In Colombia, Decree 302 of 2015, unified in Decree 2420 of the same year, stipulated that public accounting professionals should be governed by the International Code of Ethics, meaning they should adhere to two codes of ethics in the development of their functions (MinCIT, 2015).

Considering the provisions of Law 43 of 1990 and the IFAC code, national regulations are inherently incorporated into the international model. Therefore, it would be logical to assume that applying the international code would result in satisfactory compliance with the IFAC regulations. This is evident in Table 2.

Table 2.

Concordance of Law 43 of 1990 vs. IFAC Code of Ethics

N.	Principles	Law 43 of 1990 - Code of Ethics Colombia / Articles)	IFAC Code of Ethics (Section)
1	Integrity	37.1, 42, 54, 55, 68, 69, 71	100.5, 110, 310-320
2	Objectivity	37.2, 47, 48, 49, 50, 51, 61, 39	100.5, 120, 280, 220, 260
3	Independence	37.3,	290, 291
4	Responsibility	37.4, 45, 46	100.5
5	Confidentiality	37.5, 63, 64, 65, 66, 67	100.5, 140, 140.7, 100.21
6	Observations on regulatory provisions	37.6, 70,	150
7	Competence and professional updating	37.7, 43	100.5, 130, 130.2, 130.5-6, 330
8	Dissemination and collaboration	37.8	100.5
9	Respect among colleagues and ethical conduct	37.9, 52, 53, 55-62	100.2, 150.2, 240, 150

Source: Authors' elaboration with data taken from (Sosa, 2016).

Once the concepts of ethics and professional ethics in the accounting profession have been introduced, given that these fields of knowledge are grounded in reality, it is possible to analyze the ethical behavior of public accountants in Colombia through a pictorial representation that facilitates a deeper understanding of such behavior, using Graph Theory.

Graph Theory

When talking about graphs, it is necessary to think about the origin of Mathematical Graph Theory. It was first used in the Social Sciences in the 1960s, when sociologists sought to identify relationships between individuals and groups within societies (Scott, 2012; Wassermann & Faust, 1994; Wilson, 1979).

Euler (1707-1782) is considered the father of graph theory for having used this theory to solve topology problems that were characterized by their difficulty. Later, in 1736, he applied this theory to solve a problem known as The Seven Bridges of Konigsberg, which involved crossing each of them only once and returning to the

starting point. Euler proved that this was not possible. After that, many mathematicians from the eighteenth and nineteenth centuries made valuable contributions to this theory, including Vandermonde, Cauchy, Cayley, Hamilton, Kempe, Tait, Heawood, Kirchhoff, and Petersen, among others. (Menéndez, 1998) (See Figure 1)

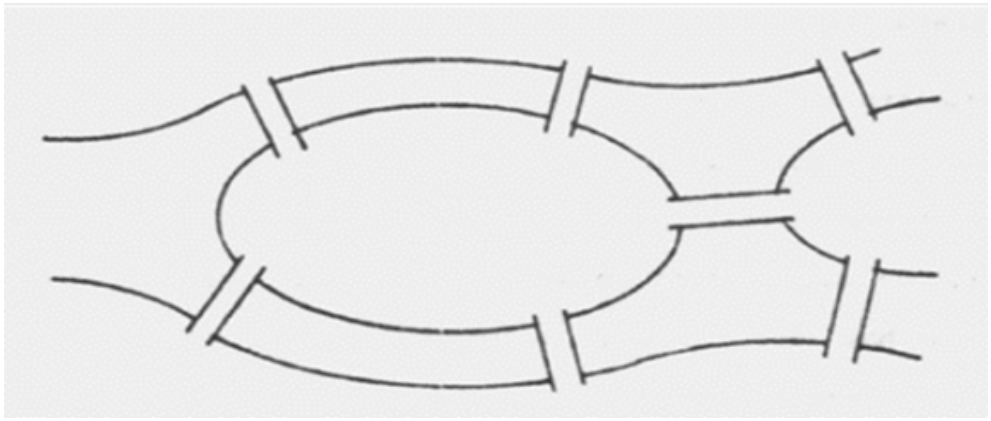


Figure 1. Illustration of the seven bridges of the city of Königsberg.
Source: Wilson, R. J. (1979)

Due to the computer revolution, the graph model gained greater recognition and expanded into other disciplines during the 20th century, including Economics, Theoretical Physics, Psychology, Nuclear Physics, Linguistics, Sociology, Zoology, Technology, Anthropology, Computer Science, Biology, Engineering, and Chemistry (Golumbic, 2004).

The purpose of graph theory is to analyze a structured and abstract representation of the relationships between individuals or objects in a group. To create an effective graph, the data must be of interest, complex ideas must be conveyed clearly to the user, a large number of ideas or agents must be effectively represented in a small space, and finally, the data must be reliable. (Trujillo *et al.,* 2010).

Graph Theory offers a theoretical and practical approach, as it utilizes models or structures that facilitate the user's understanding of the information's entirety, whether qualitative or quantitative, in abstract figures. This approach generates timely solutions (Septiem & Martin-Rios, 2017).

Having a graph as an aid that allows for quick and agile identification of the level of articulation, integrality, and centrality of the different agents involved in such a: graph would become an innovation in knowledge management for entrepreneurs, institutions, the scientific community, and society in general. (Tonta & Darvish, 2010)

However, a graph that reflects the reality of articulation and centrality would help us better understand which node has a greater concentration of edges and identify the nodes with a greater recurrence in arrival.

According to Mena (2012), sociologist Jacob Levi Moreno intended to visually illustrate the relationships between a group of people, as shown in Figure 2.

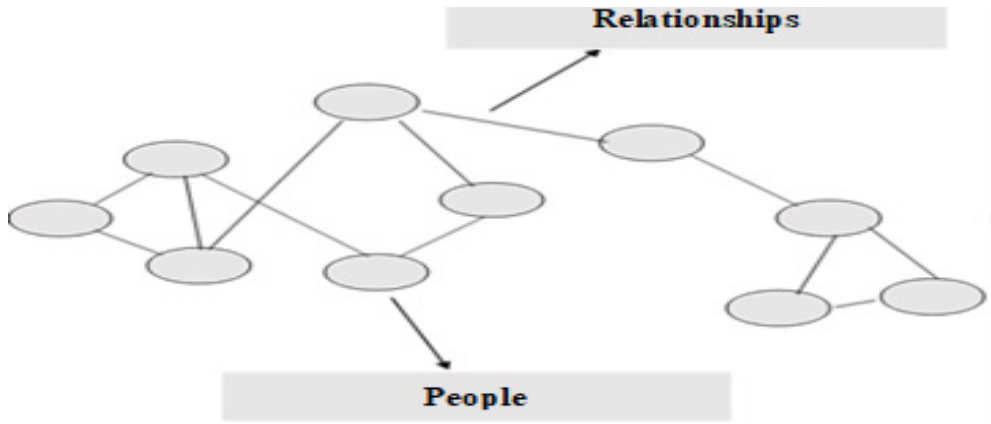
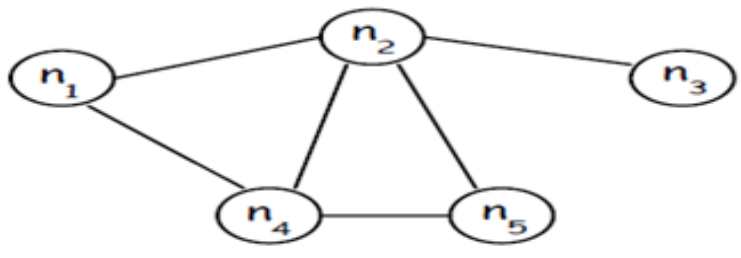


Figure 2. Relationships within a group of people
Source: Mena (2012)

A graph illustrates the spatial organization of nodes and the ease of access each node has to the rest of the nodes in the network, utilizing indexes and matrices to provide a more structured understanding for users and facilitate the identification of levels of centrality and connections between nodes. Taking into account the structuring of the graph as a tool with high expressive capacity, which becomes essential when modeling structures with a high degree of complexity, such as that of the social sciences (Almagro & Sancho, 2017).

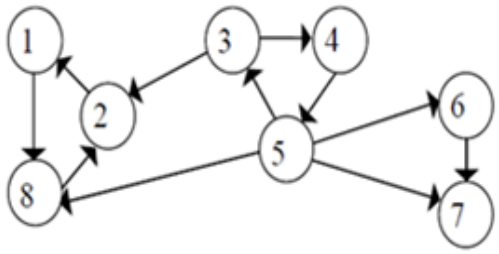
Considering that a graph is composed of nodes and edges, it is said that the symbolic representation for it would be G= (N, A), making it clear that, under this thesis, only graphs with finite N and A are considered. It is also worth noting that, in a graph, the order is established according to the number of nodes (N) and the size, measured by the number of edges (A). The easiest and most practical way to represent a graph is to use circles or points to characterize the nodes and lines to represent the edges. (Berge, 1967).



Where,

G = (N, A) with:
N = {n1, n2, n3, n4, n5}
A = {(n1, n2), (n1, n4), (n2, n3), (n2, n4), (n2, n5), (n4, n5)}

Figure 3. Graphical representation of an undirected network
Source: Berge (1967)



Where,

G = (N, A) with:
N = {1, 2, 3, 4, 5, 6, 7, 8}
A = {(1, 8), (2, 1), (3, 2), (3, 4), (4, 5), (5, 3), (5, 6), (5, 7), (5, 8), (6, 7), (8, 2)}

Figure 4. Graphical representation of a directed graph
Source: Berge (1967)

Given the above representations, it is feasible to illustrate the ethical behavior of accountants in Colombia reported by the Central Board of Accountants for conduct contrary to the code of ethics, where the nodes will be represented by each ethical principle of the regulations and the edges for each violating action of the accountants concerning each principle established in the code of ethics and referenced by the UAE Central Board of Accountants.

Given the bibliography consulted, the graph theory has the purpose not only of illustrating the graphical reality of ethical behavior in accountants but also of determining the behavior that each accountant has had concerning the principles of ethical regulations, to study their incidence and propose corrective solutions to violations of the ethical code, to develop good practices in accounting professionals. That is why the concepts of associativity, accessibility, and centrality are found in Graph Theory. For this study, only the idea of centrality will be considered.

Centrality in graphs

The construction of a network reflects its importance in terms of the value it holds for a community and its contribution to societal development. Associativity is related to the links between agents, accessibility, and centrality, which is determined by the number of entries that reach a node (Bautista, 2018). For this research, the concepts of associativity and centrality will be taken into account.

It refers to the location or concentration of the nodes, i.e., the number of arrivals each node receives through its edges. This degree of measurement stipulates which node has the highest number of arrivals (Almagro & Sancho, 2017). Not all nodes have the same level of concurrency; everything depends on the communicative potential of inputs and outputs.

The centrality measures aim to determine the recurrence of nodes to assess their influence within the specified area. The efficient measure to calculate this weight of inputs is given by measuring the degree of centrality, which can be either an input or an output. The concentration can be seen at a glance once the graph is drawn about the number of edges that are concentrated in a node.

Not all actors have the same communicative potential, i.e., the potential for inputs and outputs, but this is relative to the actor's location in the network and the relationships with others.

According to Insaurralde & Cardozo (2010), centrality measures aim to determine the recurrence of nodes to determine their influence on the surrounding area. High values will characterize a potential or recurrent node, while minimum values will denote low potential or less recurrent nodes.

Degree: is the number of edges incident on that node.

The formula for determining this grade is as follows:

Formula 1. Degree of centrality

$$C = Ay/n \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where,

Ay = # of incoming edges at each node

n = number of nodes

Previous research in Graph Theory

Graph Theory has been applied in various fields of research across different areas of knowledge, including agriculture, geographic information systems, transportation engineering, medicine, sociology, computer science, business administration, project management, and tourism, among others. In economics, the works of Montes (2017) stand out, where they conducted a regional economic analysis of water as a productive factor in Andalusia, Spain. In this study, water is evidenced as a factor involved in production, accessible from any path, using linear equations.

There is also the work of Morilas (1995), in which he analyzed changes in the intersectoral relationships of the Andalusian economy in the 1980s, concluding that a sector of the economy can influence the more centrally it is positioned in the network. On the other hand, Rodriguez (2019) simulates a linear economic model for a fishing community in Colombia, determining that it creates dependence on the substitutability of agents in the network, whether it has a single or multiple equilibria. In mathematics, the work of Ramírez (2001) established an extension of the graph coloring problem, proposing partial numbering algorithms.

Criticism of the findings. Advantages and disadvantages

Given the above, the premise is that there is no study on ethics using Graph Theory, much less on the ethical behavior of public accountants, to illustrate the contextual realities of the accounting discipline. Now, according to this framework of actions presented, as an advantage, we can highlight the fact of becoming a new unexploited field of research and at the same time as a disadvantage due to the almost null information as background in this context; the present research will undoubtedly add one more ingredient to the study of ethics in the accounting

discipline. Therefore, a scheme based on Graph Theory and an analysis grounded in ethical regulations is proposed, where the behavior of accountants will be examined by the laws governing ethics in the accounting profession.

METHODOLOGY

Methodology in research refers to providing a detailed explanation of how the procedure was followed to achieve a comprehensive study of the object of study outlined in the general objective, which led to the testing of the study's hypotheses.

For this research context, a mixed type study is proposed, where quantitative and qualitative variables were studied to several agents represented by each normative principle through a documentary review based on the information reported by the UAE Central Board of Accountants, Graph Theory literature, normative ethical frameworks (national and international) and which were analyzed using the construction of matrices. Subsequently, the GRAFOS software was used to analyze and illustrate the reality of ethical behavior among accountants in Colombia, yielding a graph that explains the behavior of each professional with respect to each principle outlined in the standard, thereby facilitating the respective conjectures.

Research design

The research is of a mixed type, as the data collection facilitated the categorization of the reviewed documents, utilizing matrices and graphs, which are relevant aspects of a quantitative nature to be later analyzed qualitatively (Hurtado, 2010).

Qualitative research is understood as any research topic that seeks findings that cannot be reached by means of statistical procedures or any other quantitative methodology. (Sampieri, Collado & Lucio, 2003). Likewise, quantitative research is defined as the most reliable way of verifying and contrasting hypotheses based on existential theoretical knowledge in reality (Ugalde & Balbastre, 2013).

The proposed methodology aligns with that of authors such as Melo & Meira (2012), who discussed associativity and centrality in management development, as it proposes articulation between the ethical regulatory framework and the ethical behavior of accounting professionals.

The research covers an advanced level of depth, taking into account that, as a result of the data collected, it has been feasible to construct a sufficiently structured theoretical and epistemological framework to understand and analyze the situation within the context of the object of study and its variables. To carry out the study, the ethical variables that the accountants infringed were analyzed.

In this study, observation, description, and analysis of documentary information have been employed to find a solution that addresses the hypothesis and explains the study's objective. An inductive methodology is proposed because the results

cannot be generalized to all accountants worldwide, but only to accountants in Colombia.

Once the normative variables were analyzed, the design of the graph that led to the analysis of the ethical behavior of accountants in Colombia for the period 2017-2021 was carried out in order to improve good professional practices in public accounting. The innovation of this research focused on developing a strategic tool, such as designing a graph that facilitates a better understanding of the actions of financial information professionals in organizations, utilizing Graph Theory.

Population and sample

The population was derived from the total number of public accounting professionals in Colombia who, at the time of the investigation, were in violation of the code of ethics and reported by the UAE Central Board of Accountants. At the date of the investigation, the total number of these public accountants was 168.

As explained in the theoretical framework, the UAE Central Board of Accountants-UAEJCC, through its Disciplinary Tribunal, is the entity with the legal authority to determine whether an accounting professional in the UAE has violated the code of ethics. According to Resolution 000-0604 of March 17, 2020, once the due process for each offender is completed, the entity, through its platform, assigns a category of reprimand, refinement, suspension, or cancellation, depending on the seriousness of the offense.

Taking into account the above, it is essential to highlight that, in some events, the UAEJCC did not discriminate for some professionals precisely the principle that had been infringed, only a brief account of the fact in a general way, which is why, for the analysis of the principles infringed, the sample will be of 134 public accountants, which had in a taxative way the affected normative article.

For the UAE Central Board of Accountants, a reprimand is a warning or reprimand for misconduct committed but is considered minor; a fine is misconduct committed by the professional but is not configured as a crime or a serious violation of the code of professional ethics, this can be a maximum of 5 SMMLV; Suspension is a misdemeanor for willful misconduct or negligence and has a minimum duration of 1 month and a maximum of 12 months; cancellation is conduct that generates a criminal conviction, which are generally qualified as willful misconduct, in which case the professional card is definitively suspended (Congreso de Colombia, 1990).

Variables

Some variables will be qualitative, and others will be quantitative. For the qualitative aspect, the principles stipulated in Law 43 of 1990 regarding the code of ethics to be applied by accountants in Colombia were taken into account. Among them are those mentioned in Table 2 of this paper.

Research instruments

The technique employed was a documentary review and database analysis of the UAE Central Board of Accountants, which provides official statistical information for the accounting discipline, based on the methodology used by Hurtado (2010). Data management was carried out using software, and tables were created to organize the information and subsequently analyze it using descriptive and inferential statistics.

Considering the number of accountants in Colombia who violated the ethical regulatory framework from 2017 to 2021, which totaled 168, we grouped the accountants into 15-professional cohorts to facilitate understanding and graph design. This resulted in a total of 12 groups, 11 of 15 professionals, and a group of 3 professionals. Each group was identified by a capital letter of the alphabet, from A to L, in ascending order, as follows: Group A (professionals from 1 to 15), Group B (professionals from 16 to 30), and so on.

For the analysis of the data, the variables of the normative ethical framework, as determined by the principles outlined in Law 43 of 1990, were used, supported by the database of the UAE Central Board of Accountants. Descriptive and inferential statistics were also used through matrices that explained the average and percentage behavior of the norm infringed by each public accountant.

Once the tables of frequencies and indicators were analyzed, a graph was created that reflects the ethical behavior of accountants in Colombia from 2017 to 2021, according to each principle infringed upon.

In the design of the graphs, the software GRAFOS version 1.3.5 was used, which is a platform for constructing, editing, and analyzing graphs (Rodríguez Villalobos, 2006). Each of them represents a principle of the Colombian ethical code (Law 43 of 1990), which are numbered from 1 to 9, as illustrated in Table 2 of the theoretical framework 9, and also identified with the color orange; these nodes are divided by a horizontal line that splits the node in two, in the upper part will be the number of the ethical principle and in the lower part the total number of offenders for that principle. Within the surface above, there will be 12 more blue nodes, which represent the groups of professionals identified with the letters of the alphabet at the top and, at the bottom, the number of professionals with a professional card cancellation offense.

For each node in the group of professionals, edges will appear with addresses to each of the external nodes (principles numbered from 1 to 9), indicating which of them was violated by each professional within the group. Three numbers separated by a semicolon (0;0;0) will appear on each edge; the first number will refer to the total number of professionals reprimanded in that group, the second number will refer to the total number of professionals fined, and finally, the third number will indicate the professionals suspended. However, it should be noted that this reference will only be made for a single edge of the group of professionals, which

will be highlighted in orange for easy identification, given the number of existing edges. As indicated above, the one reflecting the total number of professionals with canceled cards will be at the bottom of the group node.

Since the article infringed was specified for some public accountants and not for others, the matrix analysis will be conducted with the sample, and a general analysis of the categories — reprimand, refinement, suspension, and cancellation — will be conducted with the entire population (168).

Once the graph and matrix of entries for each node have been constructed, we proceed to calculate the degree of centrality, which indicates the node with the most entries. In this case, the principle that public accountants most violated during the period studied is identified.

RESULTS

Through this study, a conceptual and theoretical framework was established, enabling a more rigorous analysis of the ethics of accountants and graph theory. Likewise, to determine the ethical behavior of public accountants in Colombia during the period 2017-2021, thereby highlighting ethical behaviors that outweigh unethical ones, in accordance with the normative principles of the accounting profession. To obtain tools from graph theory that would allow us to illustrate a graph in an intangible way, to reflect the degree of centrality of the ethical norm based on the moral behavior of public accountants.

The research provides new knowledge in the areas of Ethics, Accounting, and Mathematics, contributing to the results in a specific application of the social sciences and inspiring other research in administrative and accounting matters.

Data

Now, considering each specific objective outlined in the research, we proceed to relate the results found in the object of study to a broader perspective, which addresses the question that leads to the achievement of the general objective proposed in the study.

Concerning the first specific objective, which consists of identifying the normative aspects that regulate the ethical behavior of public accountants in Colombia, the identification of such aspects was based on the literature of the ethical standard Law 43 of 1990 and the IFAC Code of Ethics, which was illustrated in Table 2 Concordance of Law 43 of 1990 vs. the IFAC Code of Ethics.

Regarding the second specific objective, which consists of specifying the public accountants that make up the Central Board of Public Accountants of Colombia in accordance with those who have been reprimanded during the period 2017-2021, the matrix of each group of accountants is shown concerning the number of times

they violated the ethical standard in terms of principles, which were identified from p1 to p9, as shown in Table 3.

Table 3.

Matrix of ethical behavior in Colombian public accountants during the period 2017-2021

Group	Location according to the UAEJCC database	Sample	Principio infringed # times									Population	Category Offender # Times			
			p1	p2	p3	p4	p5	p6	p7	p8	p9		A	M	S	C
A	1 to 15	7	1	1	1	5	1	6	0	0	2	15	0	0	13	2
B	16 to 30	9	3	0	0	9	0	8	0	0	6	15	1	0	13	1
C	31 to 45	12	7	1	1	11	0	9	0	0	8	15	0	0	12	3
D	46 to 60	14	9	1	1	13	0	14	0	0	13	15	0	0	10	5
E	61 to 75	14	3	0	0	13	0	14	0	0	6	15	1	0	10	4
F	76 to 90	15	3	1	1	15	0	14	0	0	5	15	3	0	11	1
G	91 to 105	12	1	1	0	11	0	11	0	0	6	15	1	3	11	0
H	106 to 120	10	0	2	2	10	0	9	0	0	3	15	1	0	13	1
I	121 to 135	9	0	0	1	8	0	9	0	0	2	15	0	0	15	0
J	136 to 150	15	1	1	2	14	0	11	0	0	5	15	1	0	13	1
K	151 to 165	14	0	0	0	14	0	13	0	0	0	15	0	0	15	0
L	161 to 168	3	0	0	0	3	0	2	0	0	2	3	0	0	3	0
	Total	134	28	8	9	126	1	120	0	0	58	168	8	3	139	18

Source: Author elaboration

Finally, for the fulfillment of the third specific objective, which consists of designing a graph model that illustrates the ethical behavior of public accountantsinColombia during the period2017-2021, a matrix was constructed that showed the number of entries to each node and the degree of centrality of these and which was a fundamental input for the construction of the graph, as shown in Table 4.

Table 4.

Node input matrix

Node	Detail	# Inputs to the node	Degree of centrality
p1	Integrity	28	3,11
p2	Objectivity	8	0,89
p3	Independence	9	1,00
p4	Responsibility	126	14,00
p5	Confidentiality	1	0,11
p6	Comments on the normative provisions	120	13,33
p7	Competence and professional updating	0	0,00
p8	Dissemination and collaboration	0	0,00
p9	Peer Respect and Ethical Conduct	58	6,44
	Total # of nodes	9	

$$C = \frac{Ay}{n}$$

Source: Author elaboration

Data analysis

The following is a detailed analysis of Table 4, constructed using matrices, for each principle that public accounting professionals have infringed upon.

Matrix of Ethical Behavior in Colombian Public Accountants during the Period 2017-2021.

Taking as a reference the sample of 134 professionals, which had a specific description of the normative ethical principle infringed according to the UAE Central Board of Accountants, it can be stated that 28 of them violated the principle of integrity (p1), 8 infringed the principle of objectivity (p2), 9 did not correctly apply the principle of independence (p3), and 126 infringed the principle of responsibility (p4).

Likewise, it is inferred that 1 public accountant violated the principle of confidentiality (p5), 120 professionals violated the principle of observations of regulatory provisions (p6), none violated the principles of competence and professional updating (p7), nor the principle of dissemination and collaboration (p8), which did not occur with the principle of respect among colleagues and ethical conduct (p9), which 58 public accountants misapplied.

Now, taking the population of 168 professionals, that is, the totality of those reported in the database by the UAEJJC and alluding to the categories of reprimanded, fined, sanctioned, and canceled cards to accountants, it can be evidenced that 8 professionals were reprimanded, only 3 were fined, 139 were sanctioned and 18 of these, had their professional card as public accountant canceled, thus not being able to return to practice the profession liberally. If we extrapolate these last data, it can be stated that, of the total population of accountants who violated the code of ethics in Colombia during the period 2017-2021, 82.74% are suspended for a particular time, 10.71% have their professional card canceled, while only 4.76% are reprimanded and 1.79% are fined.

On the other hand, as for the population analysis, which is related to the categorization of infractions, the following is detailed: Group A (0;0;13), contains 0 professionals reprimanded, 0 fined and 13 suspended, and so on for all groups; group B (1;0;13), group C (0;0;12), group D (0;0;0;10), group E (1;0;10), group F (3;0;11), group G (1;3;11), group H (1;0;13), group I (0;0;15), group J (1;0;13), group K (0;0;15) and group L (0;0;3).

Corroborating the above with the number of entries to each node, the degree of centrality is higher in those nodes that have a more significant number of entries, that is, principle of responsibility a degree of centrality of 14, p6 principle of observations of the normative provisions 13.33 and p9 respect among colleagues and ethical conduct with a degree of centrality of 6.44; p1 integrity (3.11), p2 objectivity (0.89), p3 independence (1.00) and p5 confidentiality (0.11) have medium degrees of centrality; with degrees of centrality of 0.00 are the principles of competence and

professional updating and dissemination and collaboration, since there is no entry of edges on them.

According to the data analyzed, we proceed to illustrate the digraph that visually represents the ethical behavior of public accountants in Colombia for the period 2017-2021, as shown in Figure 5.

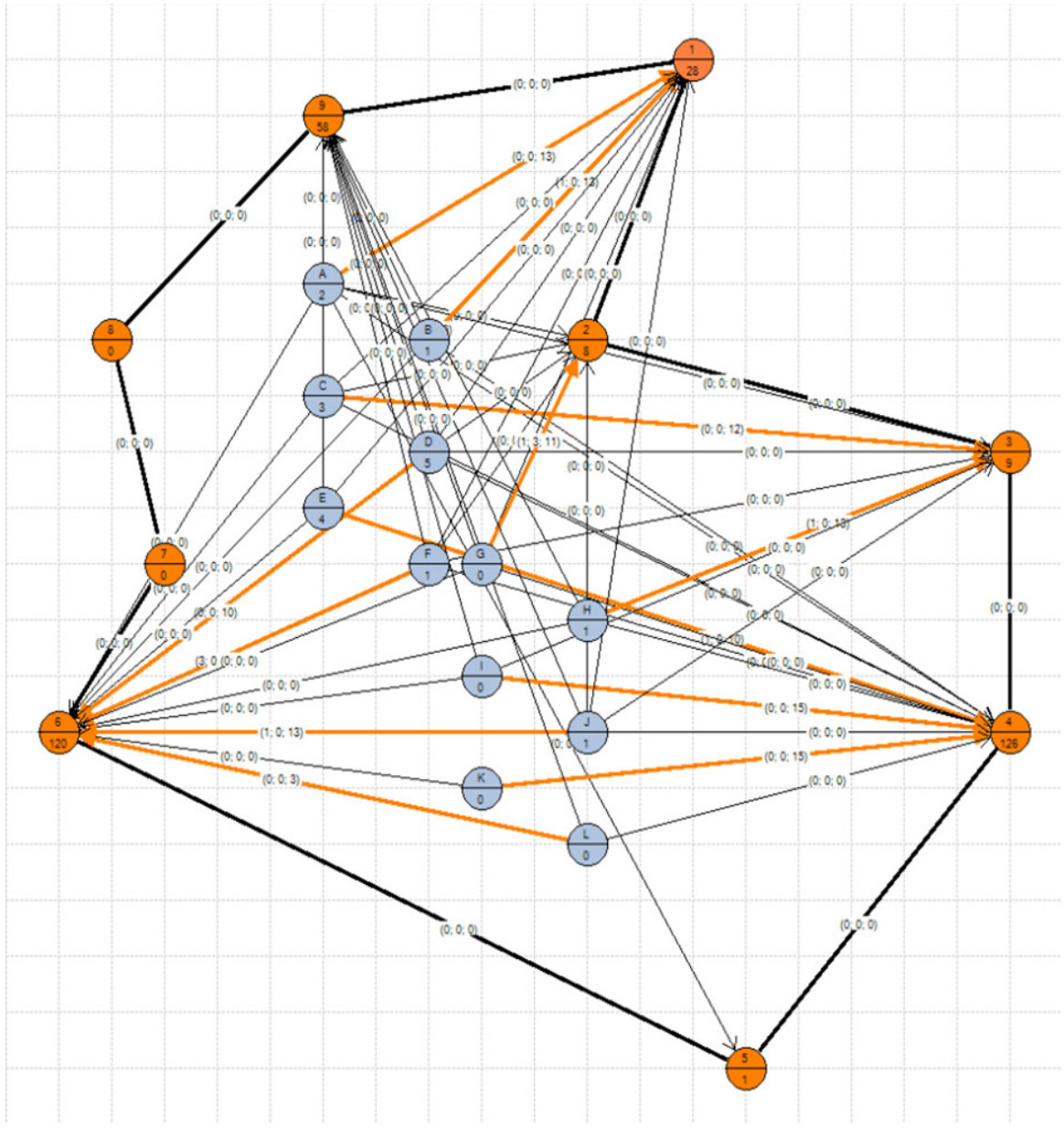


Figure 5. Dígrafo del comportamiento ético en Contadores Públicos colombianos para el periodo 2017-2021.
Source: Author elaboration

DISCUSSION

The graph resulting from the construction of matrices, yields as a result a digraph every time there is a direction of its edges towards the nodes that represent each ethical principle and which are listed in the upper part from 1 to 9 and in orange color, followed by an enumeration in the lower part that identifies the number of total entries of the edges, or what is the same, the number of times that this principle was violated by the public accountants under study, as follows: p1 = node 1/28; p2 = node 2/8, p3 = node 3/9, p4 = node 4/126, p5 = node 5/0, p6 = node 6/120, p7 = node 7/0, p8 = node 8/0 and p9 = node 9/58.

In this context, it can be seen that the principles that were most violated were p4 responsibility, with an equivalent of 94.03%, p6 compliance with regulatory provisions, with 89.55%, and p9 respect among colleagues and ethical conduct, with 43.28%. This reality is evident at a glance in the digraph, simply by examining the number of edges or directional lines that enter these nodes. It is also worth noting that the principles that are violated in the lowest proportion are p1 integrity at 20.90%, p2 objectivity at 5.97%, p3 independence at 6.72%, and p5 confidentiality at 0.75%; in addition to the above, the fact that principles p7 and p8, competence, professional updating and dissemination, and collaboration, respectively, are not violated by the professional community, stand out as a positive value. This is evidenced by the low number of edges that these nodes have.

The central nodes within the digraph, which represented the groups of accountants, each one of 15 and the last one of 3, in the upper part of the node were identified with a letter of the alphabet from “A” to “L” and in the lower part the number of accountants whose professional card had been canceled by that group, as follows: node A/2, node B/1, node C/3, node D/5, node E/4, node F/1, node G/0, node H/1, node I/0, node J/1, node K/0 and node L/0. The above summarizes the number of professional accountants whose professional card was revoked, in which case they could not practice their profession. The sum of these is equivalent to a total of 18, which corresponds to 10.71% of the population.

Similarly, the orange edges, which are thicker than the others, identify the summary or synthesis of the categories: warning, refined, and suspended of the offenders for each group, which are detailed below: Group A (0;0;13), Group B (1;0;13), Group C (0;0;12), Group D (0;0;10), Group E (1;0;10), Group F (3;0;11), Group G (1;3;11), Group H (1;0;13), Group I (0;0;15), Group J (1;0;13), Group K (0;0;15) and Group L (0;0;3). From this classification, it is evident that the majority of professionals who violate ethical principles are suspended from their positions for a specified period, while the categories that are imposed the least by the UAEJCC are reprimanded and fined.

The nodes and edges that are on the outside, that is, those that delimit the digraph, are joined by undirected edges since it is understood that the ethical norm

is articulated and associated in itself as a whole. The union of these is what gives the formality of the normative.

CONCLUSIONS

Once this study has been carried out, the following conclusions can be drawn:

Professional ethics serves as the roadmap for evaluating the legal and regulatory compliance of public accounting professionals' actions and their various areas of expertise.

- The Colombian code of ethics and the one presented by the international entity IFAC contain a variety of principles that are concordant at the moment of putting into practice the practice of the accounting profession; thus, it can be inferred that the use of one intrinsically contains the other.
- The public accounting professionals reported in the database of the UAE Central Board of Accountants' platform as violators of the code of ethics are not reported in their totality, discriminating exactly the ethical principle that they violate, which makes it impossible to analyze better the ethical behavior of such professionals in its holistic aspect.
- The ethical principles that are most frequently violated are responsibility, compliance with regulatory provisions, respect among colleagues, ethical conduct, and integrity. In contrast, those that are violated to a lesser extent are objectivity, independence, and confidentiality. The principles that are not violated, such as competence and professional development through dissemination and collaboration, also stand out.
- It is essential to point out to the reader that a quick and easy way to understand the digraph would be to see the number of edges or lines that reach the nodes and, thus, detect more quickly the centrality in these since getting carried away by the lines at first glance would become confusing with the first impression.
- Every situation that exists in reality can be illustrated pictorially using a graph, thus determining degrees of centrality.

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Muñoz Guzmán: Conceptualization, methodology, graph design in software, validation, formal analysis, research, resources, data curation, original draft writing, writing, revision and editing, visualization, and supervision.

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REFERENCES

Almagro-Blanco, P., y Sancho-Caparrini, F. (2017). Generalized graph pattern matching. arXiv preprint arXiv:1708.03734. https://doi.org/10.48550/arXiv.1708.03734

Álvarez, D. (2017). *Análisis de las sanciones impuestas por la junta central de contadores en los últimos seis años, a la luz del código de ética del contador público contemplado en la ley 43 de 1990 y del código de ética emitido por la IFAC*. (Trabajo de grado) Universidad Pedagógica y Tecnológica de Colombia, Sogamoso, Colombia. http://repositorio.uptc.edu.co/handle/001/2522

Bautista, A. F. (2018). Análisis de accesibilidad y conectividad de la red vial intermunicipal en el microsistema regional de la provincia Centro en Boyacá, Colombia. *Perspectiva Geográfica, 23*(1), 123-141. https://doi.org/10.19053/01233769.8058

Berge, C. 1. (1967). *Teoría de las redes y sus aplicaciones*. México: CECSA.

Congreso de Colombia. (1990). *Ley 43 de 1990, por la cual se adiciona la Ley 145 de 1960*, reglamentaria de la profesión de contador público y se dictan otras disposiciones. Diario Oficial, (39.602). https://n9.cl/5es1

Dussel, E. (1996). La ética de la liberación ante la ética del discurso. *Isegoría*, (13), 135-149. https://doi.org/10.3989/isegoria.1996.i13.229

Galán, J. P. (1999). *Ética, profesión y medios: la apuesta por la libertad en el éxtasis de la comunicación* (Vol. 9). Universidad Iberoamericana.

Golumbic, M. C. (2004). *Algorithmic graph theory and perfect graphs*. Elsevier.

Guthrie, W. K. C. (1962). *Historia de la Filosofía Griega*: Siglo V Ilustración.

Hegel, F. (1995). *Lecciones sobre la historia de la filosofía I*. México D.F, México: Fondo de Cultura Económica.

Hurtado, J. (2010). *Metodología de la Investigación Holística*. Tercera Edición. Caracas, Venezuela: Editorial Fundación Sypal.

International Ethics Standards Board of Accountants. (2009). *Código de Ética para Profesionales de la Contabilidad*. Londres: International Federation of Accountants (IFAC). https://lc.cx/ypCeHv

International Financial Reporting Standard. (2018). *Marco Conceptual para la Información Financiera*. Londres, Inglaterra: IFRS Foundation. https://n9.cl/s8jzlb

Insaurralde, J. A., y Cardozo, O. D. (2010). Análisis de la red vial de la provincia de Corrientes por medio de la Teoría de Grafos. *Geográfica digital, 7*(13), 1-15. https://doi.org/10.30972/geo.7132376

Jara, E., y Londoño, C. (2019). *Análisis d las sanciones impuestas por la Junta Central de Contadores en los años 2013-2018* . (Trabajo de grado, Universidad ICESI) Recuperado de https://lc.cx/XAxyfq

Manrique, F. (2002). *Teoría de los valores y ética*. Lima: Ed. Rentería.

Martínez, E. (2006). Ética de la profesión: proyecto personal y compromiso de ciudadanía. Veritas. *Revista de Filosofía y Teología, 1*(14), 121-139. https://lc.cx/CaLDBd

Melo, P., y Meira, R. (2012). Redes de cooperación y relacionamiento en el sector turístico. Estudio de casos múltiples en pequeños y medianos hoteles. *Estudios y Perspectivas en Turismo, 21*(6), 1481-1501. https://lc.cx/CEowos

Mena, N. (2012). Redes sociales y Gestión de la Información: un enfoque desde la teoría de grafos. *Ciencias de la Información, 43*(1), 29-37. https://lc.cx/VPlBJ9

Menéndez, A. (1998). Una breve introdución a la teoría de grafos. *Revista SUMA*, pp. 11-26. https://lc.cx/O0eB8y

MinCIT. (2015). (20 de febrero de 2015) *Marco Técnico de las Normas de Aseguramiento de la información (NAI), y demás normas establecidas para regir la profesión contable*. Bogotá D.C: Ministerio de Comercio, Industria y Turismo. https://lc.cx/E7_feh

Montes, M. (2017). *Estrategias asociativas y la competitividad de los productos de palto del distrito de Kaquiabamba, Andahuaylas–2016*. https://hdl.handle.net/20.500.14168/284

Morilas, A. (1995). *Aplicación de la teoría de grafos al estudio de los cambios en las relaciones intersectoriales de la economía andaluza en la década de los 80*. Instituto de Estadística de Andalucía, Tablas input-output y cuentas. https://acortar.link/1EyvsI

Pinilla Bedoya, J., & Álvarez Arroyave, J. (2013). Del Contador Público y la ética profesional: un dilema inmerso en un ambiente saturado de conflictos morales. *Contaduría Universidad de Antioquia*, 63, 127-158. https://revistas.udea.edu.co/index.php/cont/article/view/24102/19727

República de Colombia. Ley 43 of 1990. (1990). Whereby Law 145 of 1960, Code of Ethics of the Public Accountant, is added. Official Gazette No. 39.602. (1990, December 13)

Rodríguez Villalobos, A. (2006). Grafos: Herramienta informática para el aprendizaje y resolución de problemas reales de teoría de grafos. X Congreso de Ingeniería de Organización, pp. 1- 8. https://lc.cx/y7zsh_

Salcedo, D. (1999). *Los Valores en la Práctica del Trabajo Social*. España: Narcea Ediciones. https://lc.cx/96Ey7t

Sampieri, R., Collado, C., y Lucio, P. (2003). *Metodología de la investigación*. México, D.F, México: McGraw Hill Interamericana.

Savater, F. (1991). Ética para amador. Barcelona: Ariel.

Scott, J. (2012). *What is social network analysis?* London, Bloomsbury Academic. https://doi.org/10.5040/9781849668187

Septiem, M., y Martin-Rios, C. (2017). Innovación en gestión de recursos humanos: la relevancia de las redes inter-organizativas de intercambio de conocimiento. *Journal of Technology Management and Innovation, 12*(3), 96-107. https://lc.cx/Lg0LZr

Sosa, J. (2016). *La consonancia del código de ética del contador público colombiano establecido en la Ley 43 de 1990 con el código de ética de IFAC*. Bogotá, D.C: Pontificia Universidad Javeriana - X Encuentro de Profesores de Revisoría Fiscal . https://lc.cx/2EPdDv

Tonta, Y., y Darvish, H. (2010). Diffusion of latent semantic analysis as a research tool: A social network analysis approach. *Journal of Informetrics, 4*(2), 166–174. https://doi.org/10.1016/j.joi.2009.11.003

Trujillo, H. M., Mañas, F. M., & González-Cabrera, J. (2010). Evaluación de la potencia explicativa de los grafos de redes sociales clandestinas con UciNet y NetDraw. *Universitas Psychologica, 9*(1), 67–78. https://doi.org/10.11144/Javeriana.upsy9-1.epeg

Unidad Administrativa Especial Junta Central de Contadores. (2020). *Por medio del cual se adopta el procedimiento interno de los procesos disciplinarios y se deroga la Reolución 000-0667 de 2015*. Bogotá D.C: Unidad Administrativa Especial Junta Central de Contadores . https://lc.cx/DEJlEg

Unidad Administrativa Especial Junta Central de Contadores. (2022). *Página Web Oficial de la Junta Central de Contadores Públicos de Colombia*. Bogotá D.C https://n9.cl/hn8kl5

Ugalde, N., y Balbastre, F. (2013). Investigación cuantitativa e investigación cualitativa: buscando las ventajas de las diferentes metodologías de investigación. *Ciencias Económicas*, pp. 179-187. https://lc.cx/X8wtPY

Wassermann, S., y Faust, K. (1994). *Social network analysis: Methods and applications*.

Wilson, R. J. (1979). *Introduction to graph theory*. Pearson Education India.

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