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**Invited Keynote Lectures** 

## Invited Keynote Lecture



#### Parsa Bakhtary

Senior Product Analyst at YouTube California, USA bakhtary@google.com https://www.linkedin.com/in/bakhtary

#### An Introduction to Data Science in Silicon Valley

**Abstract:** We present some of the most important problems facing large tech companies such as Facebook, Google, Amazon, and Uber that can be solved with data, analysis, and machine learning. Topics will include comment ranking, recommendation algorithms, and peak detection. If time permits, we will also touch on active areas which overlap with advanced mathematics, such as persistent homology in topological data analysis and the use of sheaves in sensor integration.

**Keywords:** Data science; Machine learning; Comment ranking; Peak detection.

## Invited Keynote Lecture



#### Mohamed Amine Khamsi

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#### Distance Revisited and an Application of the Brønsted Order

**Abstract:** In this talk, we will revisit the origin of the abstract definition of a distance. We will talk about the contributions of Frechet which led to the abstract current formulation of a distance given by Hausdorff in 1914. We will discuss the flaws with such abstract formulation and show how the correct abstract formulation is still eluding us. If time allows, we will discuss the Caristi's fixed-point theorem and its equivalence with the Ekeland's Variational Principle via the Brønsted Order. This discussion shows that the known assumptions in both theorems are not optimal.

**Keywords:** Distance; Caristi's Fixed-Point Theorem; Ekeland's Variational Principle; Brønsted Order.

#### Session 1: 12:30-15:30 Chair: Ms. Diana Audi

Time	Speaker	University	Title of the talk			
12:30-12:50	Rasha E. Shat	UAEU	Ovals and Niho Bent Functions in Small Dimensions			
12:55-13:15	Hala Basheer Abusamra	KAU	Chirped Gaussian Pulse excitation of harmonic oscillator: Fourier and wavelet spectra			
13:20-13:40	Valery Lacoste	AUS	Logical Modeling of B-Cell Acute Lymphoblastic Leukemia in Children			
BREAK						
13:55-14:15	Jawaher Lafi Aljohani	KAU	Intelligent Computing through Artificial Neural Networks for Wire Coating Analysis in the bath of Sisko Fluid			
14:20-14:40	Fouzia Shaheen	UAEU	On the Projections and Unitary Groups of Unital C* -Algebras			
14:45-15:05	Reham Q. Aloufi	KAU	New soliton solutions for the longitudinal wave equation in an magneto electro-elastic circular rod			
15:10-15:30	Israa Alhamarna	AUS	Dynamic Network Modeling of Macrophage Signaling Pathways in Atherosclerosis			

#### Ovals and Niho Bent Functions in Small Dimensions

Rasha E. Shat

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**Abstract:** In this talk, hyperovals and ovals are considered in the projective plane PG(2;q),  $q = 2^m$  even. Traditionally these objects are studied algebraically via *o*-polynomials. In our work a different approach is used by means of *g*-functions. These functions also provide a natural description for Niho bent functions. Using *g*-functions, all ovals and Niho bent functions are listed up to equivalency for dimensions  $m \leq 6$ .

**Keywords:** Projective planes; Affine planes; Hyperovals; Ovals; Niho bent functions; Bent functions.

#### Chirped Gaussian Pulse excitation of harmonic oscillator: Fourier and wavelet spectra

#### Hala Basheer Abusamra

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**Abstract:** We investigate the nature of the spectral lines of the emitted radiation due to of a non-dissipative single mode quantized harmonic oscillator (HO) with train of n-chirped Gaussian pulses. Specifically, we analyze the transient emitted spectrum through two window wavelet functions of the radiation detector, namely, the Haar wavelet and Morlet wavelet. Computational display of the exact analytical results show that how the driving pulse parameters (strength and number of pulses, chirping, repetition time) act as control knobs to shape the detected emitted spectrum as desired.

**Keywords:** Chirped Gaussian Laser Pulses; Haar and Morlet wavelet spectra; Harmonic Oscillator.

#### Logical Modeling of B-Cell Acute Lymphoblastic Leukemia in Children Valery Lacoste

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Abstract: Cancer is considered a world health issue, especially for children. B-cell acute lymphoblastic leukemia is a type of blood cancer that affects the body's immune system and creates immature B-cells that no longer fulfill their designated role. Different experiments have tried to narrow down the origins of this disease, however these methods are expensive and can lead to conflicting results. There have been attempts to create a logical model that could resolve some of these issues, however they lack some key elements needed to make a complete system. This talk will look at some of the potential improvements that are needed to resolve this issue by creating a boolean logical model based on two previous models and adding in new important nodes.

**Keywords:** Acute Lymphoblastic Leukemia; Notch Pathway; Logical Modeling; B-Cells.

#### Intelligent Computing through Artificial Neural Networks for Wire Coating Analysis in the bath of Sisko Fluid Jawaher Lafi Aljohani Mathematics Department, King Abdulaziz University, KSA. *iewelslafi@amail.com*

**Abstract:** In the artificial neural networks domain, the Levenberg-Marguardt technique is novel with convergent stability and generates a numerical solution of the wire coating system for Sisko fluid ow (WCS-SFF) through regression plots, histogram representations, state transition measures, and mean square errors. In this paper, the analysis of fluid flow problem based on WCS-SFF is studied with a new application of intelligent computing system via supervised learning mechanism using the efficacy of neural networks trained by Levenberg-Marguardt algorithm (NN-TLMA). The original mathematical formulation in terms of PDEs for WCS-SFF is converted into dimensionless nonlinear ODEs. The data collection for the projected NN-TLMA is produced for parameters associated with the system model WCS-SFF influencing the velocity using the explicit Runge-Kutta technique. The training, validation, and testing processes of NN-TLMA are utilized to evaluate the obtained results of WCS-SFF for various cases, and a comparison of the obtained results is performed with reference data set to check the accuracy and effectiveness of the proposed algorithm NN-TLMA for the analysis of non- Newtonian fluid problem-related WCS-SFF. The proposed NN-TLMA for solving the WCS-SFF is effectively confirmed through state transition dynamics, mean square error, regression analyses, and error histogram studies. The powerful consistency of suggested outcomes with reference solutions indicates the validity of the framework. and the accuracy of  $10^{-8}$  to  $10^{-6}$  is also achieved.

**Keywords:** Wire coating, Sisko fluid, Levenberg-Marquardt, Intelligent computing, Artificial neural networks

#### On the Projections and Unitary Groups of Unital C\*-Algebras

**Fouzia Shaheen** and Ahmed Al-Rawashdeh Mathematical Sciences Department, United Arab Emirates University, UAE. 201990173@uaeu.ac.ae

Abstract: The classification of operator algebras is an important topic in the field, and K-Theory is an essential tool that has been used for The unitary groups play a significant role in the classificathis task. tions of unital  $C^*$ -algebras. In 1954, Dye proved that the discrete unitary group in a factor determines the algebraic type of the factor. In 2012, Al-Rawashdeh, Booth, and Giordano proved that if the unitary groups of two simple unital AH-algebras of real rank zero are isomorphic as abstract groups, then their  $K_0$ -groups are isomorphic as scaled ordered groups and we proved that such  $C^*$ -Algebras are isomorphic if and only if their unitary groups are isomorphic as topological groups. Also, for simple unital purely infinite  $C^*$ -algebras, we showed that two unital Kirchberg algebras are \*-isomorphic if and only if their unitary groups are isomorphic, as abstract groups. An isomorphism between unitary groups induces a bijection between the projections. For many  $C^*$ -algebras, this induced mapping preserves orthogonality of projections (orthoisomorphism), but in a certain type of UHF-algebras, the induced mapping need not be an orthoisomorphism. If  $\varphi$  is a continuous isomorphism, then  $\varphi$  is implemented by a linear or conjugate linear \*-automorphism. In this project, we aim to extend the results of Al-Rawashdeh-Booth-Giordano to a larger class of simple unital  $C^*$ -algebras, by investigating properties of unitaries and projections, as well as properties of invertible elements and symmetries. Moreover, in a different approach, we will investigate the IUG-P (Invariant Unitary Group-Property) for many fundamental properties of  $C^*$ -algebras. indeed we aim to discuss which property is invariant if the unitary groups of  $C^*$ -algebras are isomorphic.

Keywords: Unital  $C^*$ -algebra; Unitary group; Kirchberg algebra.

#### New soliton solutions for the longitudinal wave equation in an magneto electro-elastic circular rod

Reham Q. Aloufi

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Abstract: The work presents exact solutions and stability analysis of the nonlinear longitudinal wave equation (NLLWE) in a magneto electro-elastic (MEE) circular rod. This equation describes the propagation of optical solutions in a MEE circular rod. Also the dispersion term in this equation is caused by the transverse Poisson's effect in a MEE medium. In addition, the parameters in the latter equation are affected by the material geometry and properties of the rod. The new generalized exponential rational function method (GERFM) has been utilized for finding the analytical solutions of NLLWE in MEE circular rod. It has the capacity to generate different form of solutions. Therefore, it is powerful in extracting new types of solutions in other nonlinear partial differential equations (NLPDEs) that commonly model applications in engineering and mathematical physics. Furthermore, some 2D, 3D graphs are obtained to understand the physical application and phenomena of this longitudinal wave equation and the stability of governing equation is investigated.

**Keywords:** Longitudinal wave equation; Exact solution; Stability analysis; Magneto electro-elastic circular rod; Generalized exponential rational function method

#### Dynamic Network Modeling of Macrophage Signaling Pathways in Atherosclerosis Israa Alhamarna

Department of Mathematics & Statistics, American University of Sharjah, UAE. *ialhamarna@aus.edu* 

Abstract: Atherosclerosis, the major cause of death worldwide is an immunoinflammatory disease in which cholesterol-rich plaques build up inside the arteries. Over time, plaques harden and narrow the arteries. This limits the flow of oxygen-rich blood to the organs and body parts leading to many cardiovascular diseases including stroke and heart attacks. Macrophage cholesterol homeostasis and inflammation are key biological processes in atherogenesis, and several proteins have been implicated in macrophage cholesterol efflux leading to foam cell formation and eventually plaques. Available experimental results provide information about some of the key molecules and strength of the interactions among them. However, the network of interactions among all involved molecules is not completely known, and the pathogenesis of atherosclerosis remains poorly understood. The goal of this project is to construct a predictive, dynamic network model to uncover the role of macrophages in atherosclerosis and to improve our understanding of the potential role of the major factors in such key biological and health conditions. This will guide the development of novel therapeutic approaches toward the prevention and treatment of atherosclerosis.

**Keywords:** Atherosclerosis; Mathematical modeling; Inflammation; Cholesterol; Cardiovascular disease; Macrophage.

#### Session 2: 12:30-15:10 Chair: Dr. Stephen Chan

Time	Speaker	University	Title of the talk		
12:30-12:50	Amjad F. Alyoubi	KAU	On The Generalized Exponential Rational Function Method For Solving Traveling Wave Solution In Ionic Currents Along Microtubules		
12:55-13:15	Sondos M. Syam	UAEU	Few Remarks on Flow of a Class of Quantum Genetic Algebras		
13:20-13:40	Reem Salman	AUS	A Bootstrap Framework for Aggregating within and between Feature Selection Methods		
BREAK					
13:55-14:15	Safa Al Rafai	UAEU	A numerical method for solving fuzzy initial value problems of second order		
14:20-14:40	Abdulrahman Aljassar	KU	$\frac{1}{1-x}$ A Mathematical Joke		
14:45-15:05	Rohan Mitra	AUS	Program To Find The Permutation Matrix That Shows If Two Graphs Are Isomorphic From Their Adjacency Matrices.		

#### On The Generalized Exponential Rational Function Method For Solving Traveling Wave Solution In Ionic Currents Along Microtubules

Amjad F. Alyoubi

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Abstract: In this talk, we introduce a new generalized exponential rational function method (GERFM) which is hired to excerpt new traveling wave solutions for the ionic currents along microtubules dynamical equations that are very interesting in nanobiosciences. It is also used in nanoscience, especially in the transmission of current through nanowires. We also study the stability of the solutions. As a result, a variety of solitary waves are obtained with free parameters such as periodic wave solutions, dark and bright solitary wave solutions. Solutions are plotted using parameter values, into 3D and 2D figures of the exact obtained solutions and are used to describe the physical phenomena of the problem. The equation was solved in a generalized and modern way, which is a concise and direct method and can be applied to other nonlinear equations. The work shows the powerful of GERFM. We found that the used method is effective, powerful, reliable and gives more solutions.

**Keywords:** The ionic currents along microtubules dynamical ; GERFM; Solitary wave solutions; Stability analysis

Few Remarks on Flow of a Class of Quantum Genetic Algebras Sondos M. Syam and Farrukh Mukhamedov Mathematical Sciences Department, United Arab Emirates University, UAE. 201640069@uaeu.ac.ae

**Abstract:** In this talk, we deal with a connection between quantum quadratic operators and quasi quantum quadratic operators on  $M_2(\mathbb{C})$ . We show that quantum quadratic operators and quasi quantum quadratic operators on  $M_2(\mathbb{C})$  coincide in the class of Volterra type of operators. Also, we investigate the flow of a class of quantum genetic algebras. Some important properties for genetic algebras are given such as associativity, Jordan algebra, and idempotent elements.

**Keywords:** Quantum quadratic operator; Quasi quantum quadratic operator; Jordan algebra.

#### A Bootstrap Framework for Aggregating Within and Between Feature Selection Methods

**Reem Salman,** Ayman Alzaatreh, Hana Sulieman and Shaimaa Faisal

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In the past decade, big data has become increasingly preva-Abstract: lent in a large number of applications. As a result, datasets suffering from noise and redundancy issues have necessitated the use of feature selection across multiple domains. However, a common concern in feature selection lies with the fact that different approaches can give very different results when applied to similar datasets. Aggregating the results of different feature selection methods helps resolve this concern and controls the diversity of selected feature subsets. In this work, a general framework for the ensemble of multiple feature selection methods was implemented. Based on diversified datasets generated from the original set of observations, the importance scores generated by multiple feature selection techniques were aggregated using two methods: Within Aggregation Method (WAM) which refers to aggregating importance scores within a single feature selection. and Between Aggregation Method (BAM) which refers to aggregating importance scores between multiple feature selection methods. The proposed framework was applied on 13 real datasets with diverse performance and characteristics. The experimental evaluation shows that WAM provides an effective tool for determining the best feature selection method for a given dataset. WAM has also shown greater stability than BAM in terms of identifying the important features. The computational demands of the two methods appear to be comparable. The results of this work suggest that by applying both WAM and BAM, practitioners can gain deeper understanding of the feature selection process.

**Keywords:** Ensemble learning; Feature selection; Mean aggregation; Entropy; Stability.

#### A numerical method for solving fuzzy initial value problems of second order Safa Al Rafai

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Abstract: In this research work, the optimized one-step method based on the hybrid block method (HBM) is derived for solving second-order fuzzy initial value problems. The off-step points are chosen to minimize the local truncation error of the proposed method. Several theoretical properties of the proposed method, such as stability, convergence, and consistency are investigated. Moreover, the region of absolute stability of the proposed method is plotted. Numerical results indicate that the proposed method has order three and it is stable and convergent. In addition, several numerical examples are presented to show the efficiency and accuracy of the proposed method. Results are compared with the existing ones in the literature. Even though the one off-step point is used, the results of the proposed method are better than the ones obtained by other methods with a less computational cost.

**Keywords:** Second-order fuzzy initial value problem; One-step method; Hybrid block method.

### $\frac{1}{1-x}$ A Mathematical Joke Abdulrahman A. H. Aljassar College of Computing Sciences and Engineering, Kuwait University, Kuwait. *abdulrahman.aljasar@ccse.ku.edu.kw*

**Abstract:** This presentation shows, in a light-hearted manner, the apparent ubiquity of the geometric series-like structures and properties, in seemingly unrelated areas of mathematics. From invertibility of matrices to differential operators.

**Keywords:** Geometric series, Matrices, Rings, Differential operators, Formal languages.

#### Program To Find The Permutation Matrix That Shows If Two Graphs Are Isomorphic From Their Adjacency Matrices Rohan Mitra

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Abstract: Two graphs are isomorphic, if they have the same properties but can be represented in different ways. A more mathematical definition is that two graphs, having adjacency matrices  $A_1$  and  $A_2$  respectively, are isomorphic if and only if there exists a permutation matrix P, such that  $A_1P = PA_2$  or  $PA_1 = A_2P$ . A permutation matrix is a matrix where each distinct row and column has exactly one 1, and contains 0 everywhere else. There are a few algorithms that can help find such a matrix, but they can get exceptionally tedious for us to compute for large graphs. Hence, I wrote a program (in Python) to help compute this matrix P (if it exists). This program takes in as input the two adjacency matrices  $A_1$  and  $A_2$ , and finds a matrix P such that  $PA_1 = A_2P$  if such a matrix exists. If not, it prompts the user that the graphs are not isomorphic.

Keywords: Graph; Isomorphic; Adjacency matrix; Permutation matrix.

#### Session 3: 12:30-15:10 Chair: Dr. Cristian Enache

Time	Speaker	University	Title of the talk			
12:30-12:50	Maryam Almalki	UQU	Intelligent Computing Technique based supervised learning for Squeezing Flow Model			
12:55-13:15	Waleed Al-Qallaf	KU	On a duality between Time and Space Cones			
13:20-13:40	Doha A. Abulhamil	KAU	Linear Maps which are Anti-derivable at Zero			
BREAK						
13:55-14:15	Jumanah Darwish	KAU	On a Bivariate Transmuted Family of Distributions			
14:20-14:40	Mubarak Alsaidi	KU	How we Define Numbers? Axiomatism Vs. Constructionism.			
14:45-15:05	Alaa El-Sakran	AUS	Impacts of Emergency Remote Teaching on College Students amid COVID-19 in the UAE			

Intelligent Computing Technique based supervised learning for Squeezing Flow Model Maryam Mabrook Almalki, Eman Salem Alaidarous, Dalal Maturi, Muhammad Asif Zahoor Raja, and Muhammad Shoaib Department of Mathematics, Faculty of Science, Umm Al-Qura University, KSA. mmmalki@uqu.edu.sa

**Abstract:** We investigate the unsteady squeezing flow between infinite parallel plates (USF-IPP) through the intelligent computing paradigm of Levenberg-Marquard backpropagation neural networks (LMBNN). Similarity transformation introduces the fluidic system of the governing partial differential equations (PDEs) into nonlinear ordinary differential equations (ODEs). A dataset is generated based on squeezing fluid flow system USF-IPP for the LMBNN through the Runge-Kutta method by the suitable variations of Reynolds number and volume flow rate. To attain approximation solutions for USF-IPP to different scenarios and cases of LMBNN, the operations of training, testing, and validation are prepared and then the outcomes are compared with reference data set to ensure the suggested model's accuracy. The output of LMBNN is discussed by the mean square error, dynamics of state transition, analysis of error histograms, and regression illustrations.

**Keywords:** Squeezing flow; Intelligent computing; Levenberg-Marquard backpropagation; Neural networks; Similarity transformation.

#### On a duality between Time and Space Cones

Waleed Al-Qallaf and Kyriakos Papadopoulos Department of Mathematics, Kuwait University, Kuwait. waleed.alqallaf@ccse.ku.edu.kw

**Abstract:** We give an exact mathematical construction of a spacelike order <, which is dual to the standard chronological order  $\ll$  in the *n*-dimensional Minkowski space  $M^n$ , and we discuss its order-theoretic, geometrical as well as its topological implications, conjecturing a possible extension to curved spacetimes.

**Keywords:** Chronological order; order on space cone; spacelike and timelike duality; weak interval topologies; n-dimensional Minkowski space.

#### Linear Maps which are Anti-derivable at Zero Doha A. Abulhamil

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**Abstract:** Derivation is an important field of research, and have been studied and applied extensively both in theory and applications.

The study of derivations on  $C^*$ -algebras goes back to the early stages of this theory. An (associative) *derivation* from an (associative) Banach. In S. Sakai proved that every derivation on a  $C^*$ -algebra is continuous. Some years later, A. Kishimoto established that every \*-derivation on a  $C^*$ -algebra A is dissipative, and hence continuous.

Recent studies are concerned with maps satisfying an identity related to derivations but only at a certain point(s). More concretely, a linear map T from a Banach algebra  $\mathcal{A}$  to a Banach  $\mathcal{A}$ -bimodule X is said to be a *derivation* at a point z in  $\mathcal{A}$  if the identity

$$T(ab) = T(a)b + aT(b),$$

holds for every a, b in  $\mathcal{A}$  with ab = z.

In our research we gave the complete characterization of (continuous) linear maps from  $\mathcal{A}$  into X or into  $\mathcal{A}^{**}$  which are anti-derivation (\*-anti-derivation) at zero. We also presented a complete characterization of those continuous linear operators which are \*-anti derivable at zero.

We also proved a similar equivalence when X is replaced with  $\mathcal{A}^{**}$ .

Keywords:  $C^*$ -algebra; Banach bimodule; Derivation; Anti-derivation.

## On a Bivariate Transmuted Family of Distributions

#### Jumanah Ahmed Darwish

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**Abstract:** The bivariate distributions are useful in simultaneous modeling of two random variables. These distributions provide a way of modeling complex models. The bivariate families of distributions are not much widely explored and in this research a new family of bivariate distribution is proposed which will extend the univariate transmuted family of distributions. The proposed family of distributions will be helpful in modeling complex joint phenomenon. Statistical properties of the proposed family of distributions are explored which include marginal and conditional distributions. conditional moments, product and ratio moments, bivariate reliability and bivariate hazard rate functions. The maximum likelihood estimation for parameters of the proposed family is also carried out. The proposed family of distributions is capable of generating bivariate transmuted distributions for any baseline distribution. The proposed bivariate family of distributions is studied for the Weibull baseline distributions giving rise to bivariate transmuted Weibull distribution. The proposed bivariate transmuted Weibull distribution is explored in detail with real data applications.

**Keywords:** Bivariate distribution; Univariate distribution; Weibull distribution.

## How we Define Numbers? Axiomatism Vs. Constructionism.

#### Mobarak Alsaidi

Abstract: We will introduce the two primary philosophical approaches in mathematics, the axiomatic approach and the constructive approach, by highlighting the main difference between them and some historical facts. After that, we will present the different approaches in defining the natural numbers (Peano axioms Vs. Von Neumann's construction) and defining the integers and the rational. Then we will spend time discussing the real numbers and the ways it is characterized. We will then present Dedekind's construction of them and close our presentation with the proof of Completeness axiom.

**Keywords:** Peano Axioms; Von Neumann's construction; Dedeckind's construction; Completeness Axiom.

#### Impacts of Emergency Remote Teaching on College Students amid COVID-19 in the UAE.

**Alaa El-Sakran**, Reem Salman and Ayman Alzaatreh Department of Mathematics & Statistics, American University of Sharjah, UAE. *g00042916@alumni.aus.edu* 

Abstract: With the aim of appraising the impact of Emergency Remote Teaching (ERT) amidst COVID-19 pandemic on college students, an online survey was conducted in December (2020) on a total of 588 undergraduate students at the American University of Sharjah in the United Arab Emirates. The purpose of the study was to assess the perceptions of college students regarding their learning process and its influence on their mental health with the abrupt transition from face-to-face classes to ERT in the Spring 2020 semester. A comprehensive analysis is performed using structural equation modeling and other statistical techniques to reveal crucial results associated with the factors that have an effect on the students psychological distress; such as quality of courses, academic performance, and readiness for future work or studies. The Kessler (K10) psychological distress scale was adopted as a measure of the students distress levels. Findings suggest that the students perceived quality of courses under ERT has a significant impact on their academic performance and readiness for future work or studies. Moreover, they indicate that these factors serve as a vital mediating role in provoking psychological distress among the students. The study also shows that gender, previous history of anxiety/distress, and university level significantly affect the students distress levels. In order to ensure and prioritize the well-being of college students during these turbulent times, new strategies are urgently needed to develop and enhance resilient ERT environments in higher education. The study concludes with limitations and suggestions for further research.

**Keywords:** COVID-19; emergency remote teaching; confirmatory factor analysis; structural equation modeling; quality of courses; academic performance; psychological distress; readiness for future work or studies.