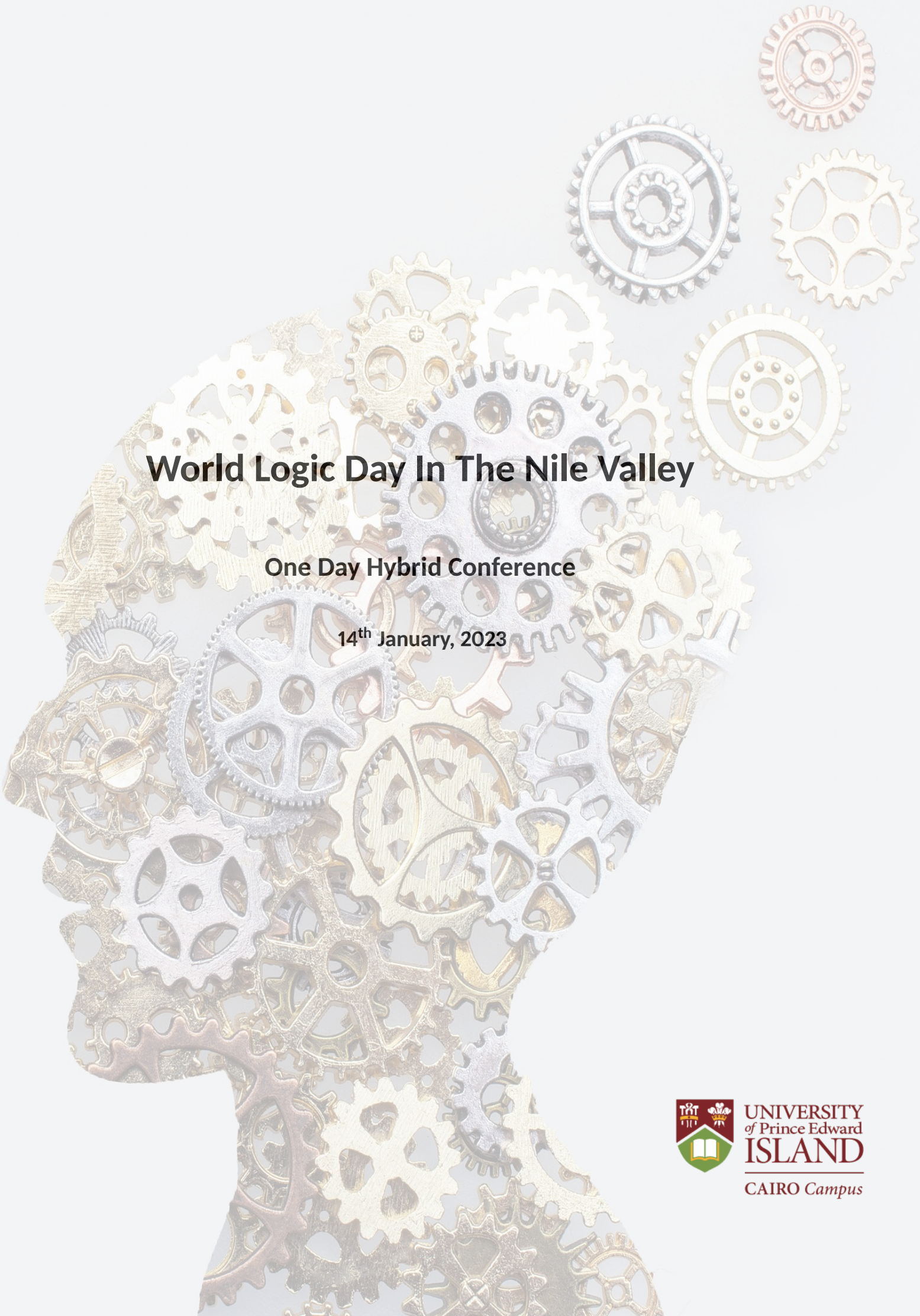

World Logic Day In The Nile Valley

One Day Hybrid Conference

14th January, 2023

UNIVERSITY of Prince Edward ISLAND
CAIRO Campus

Contents

Introduction

About

World Logic Day (WLD) is an international day proclaimed by the UNESCO in November 2019 to be celebrated on 14th of January every year. The date chosen to celebrate this international day corresponds to the date of death of Kurt Gödel and the date of birth of Alfred Tarski, two of the most prominent logicians of the twentieth century.

We are pleased to announce that The Universities of Canada in Egypt (UofCanada) is organizing a hybrid conference celebrating the 5th WLD on 14 January 2023. This event aims to gather people who are interested in logic from any of its aspects: mathematical, philosophical, historical, and the relation between logic and other fields, e.g., physics and computer science.

The conference consists of invited talks only, and there will be no parallel sessions.

The website of the conference

The official list of the UNESCO WLD events for 2023

Organizing committee

- Tarek Sayed Ahmed
  Department of Mathematics, Faculty of Science
  Cairo University
  Giza, Egypt

- Mohamed Khaled
  Faculty of Mathematics and Computational Sciences
  University of Prince Edward Island - *Cairo* Campus
  New Administrative Capital, Egypt

Program

9:00–9:30	**Opening**		
9:30–10:00	Online	**Sherif Salem**	Simon Fraser University
10:00–10:30	Campus	**Mohamed Amer**	Cairo University
		Tarek Sayed Ahmed	Cairo University
10:30–11:00	**Coffee Break**		
11:00–11:30	Online	**László Szabó**	Eötvös Loránd University
11:30–12:00	Campus	**Wafik Lotfallah**	American University in Cairo
12:00–12:30	**Coffee Break**		
12:30–13:00	Online	**Felip Manyá**	Artificial Intelligence Research Institute
		Jordi Coll	National Center for Scientific Research
13:00–13:30	Campus	**Botros Nasif**	Universities of Canada in Egypt
13:30–14:30	**Lunch Break**		
14:30–15:00	Online	**Gábor Sági**	Alfréd Rényi Institute of Mathematics
15:00–15:30	Campus	**Tarek Sayed Ahmed**	Cairo University
15:30–16:00	**Coffee Break**		
16:00–16:30	Online	**Hajnal Andréka**	Alfréd Rényi Institute of Mathematics
		István Németi	Alfréd Rényi Institute of Mathematics
16:30–17:00	Campus	**Daoud Siniora**	American University in Cairo
17:00–17:30	**Coffee Break**		
17:30–18:00	Online	**Judit Madarász**	Alfréd Rényi Institute of Mathematics
		Gergely Székely	Alfréd Rényi Institute of Mathematics
18:00–18:30	Campus	**Mohamed Khaled**	Universities of Canada in Egypt

List of Abstracts – Talks

Session I

09:30–10:00

Against the Logicians: Ibn Taymiyya's Rejection of the Aristotelian Theory of Definition

Sherif Salem

Online

Department of Philosophy, Faculty of Arts and Social Sciences
Simon Fraser University
Burnaby, B.C., Canada

This talk aims to briefly explore Ibn Taymiyya's (1263-1328) criticism of the Aristotelian logical tradition, especially his theory of definition. Ibn Taymiyya attempts to prove that based on its unchanging metaphysical principles, Aristotle's logic cannot be a practical tool for dealing with scientific knowledge production as claimed. Some of his arguments are grounded in the principles of relativism and skepticism, while others are grounded in empirical evidence about the function of language. However, we will mainly focus on Ibn Taymiyya's criticism of the Aristotelian theory of definition through the refutation of the following two distinctions: a) essential and accidental attributes, and b) the distinction between quiddity and its existence.

10:00–10:30

Games and Science

***Mohamed Amer* and Tarek Sayed Ahmed**

Campus

Department of Mathematics, Faculty of Science
Cairo University
Giza, Egypt

Frege is commonly accepted to be the founder of modern logic, his important publications spread over about a quarter of a century (1879 -1903). In his last book (1903) he writes:

”Now, it is applicability alone which elevates arithmetic [to generalize, read: a discipline] above a game to a rank of science. Applicability thus necessarily belongs to it [read: to any discipline which is claimed to be a science]”.

From the context it is understood that ”arithmetic” means real numbers, and the specific application which Frege mentions is applying real numbers to measuring magnitudes (Unlike Dedekind and Cantor, Frege defines real numbers to be ratios of magnitudes). I guess that Frege would accept:

I. Understanding ”applicability” in such a manner which would allow e.g., applying logic to algebra.

II. By interpreting the signs of a discipline differently, the same discipline may be applied to different fields.

Granting this, is it reasonable to say that all mathematics is applied, and that pure mathematics is a myth? In this talk we support the view that pure maths -in the formalist sense- is really a myth. Mathematics is essentially a natural science and variations thereof.

Session II

11:00–11:30

A physicalist response to the Quine-Putnam indispensability argument in the philosophy of mathematics

László Szabó

Online

Department of Logic, Institute of Philosophy
Eötvös Loránd University
Budapest, Hungary

The Quine–Putnam indispensability argument is usually considered the strongest argument for mathematical Platonism; and Hartry Field's *Science Without Numbers* is considered as the most effective counter-argument to the indispensability argument. Field has shown in the case of a simple physical theory that the most basic mathematical entities, numbers, can be eliminated from the formulation of a physical theory, such that the reformulated, so-called "nominalised" theory is no less attractive than the original one.

On the basis of my so called "physico-formalist" account for mathematics and for the role of mathematics in physical theory (*a' la* Carnap, considered as a formal system L with a partial semantics S pointing to the realm U to be described by the theory), I will argue that Field's nominalization project does not resolve the challenge of the indispensability argument against physicalism. For, a nominalized version of a physical theory (L, S, U), say (L', S', U), is, after all, a normal physical theory in which L' is an ordinary formal system. The facts of L' are ordinary logical and mathematical facts—no matter if L' contains only, so called, "physical terms". So, Field's nominalization does not eliminate mathematical objects/structures from physical theories. This doesn't mean, however, that the Quine–Putnam indispensability argument is a valid argument in favor of Platonism. It will be shown that, in a coherent physicalist account, what is actually indispensable in a physical theory (L, S, U) are the *facts* of L—physical facts of a physically existing formal system, in my approach. Consequently, a physical theory (L, S, U) involves ontological commitment only with respect to the physical world U to be described by the theory; the physically existing formal system L; and, as we will see, the physical process producing the correlation between them, which is a necessary requisite for the semantics S of the theory. And, these all are in the physical realm, in accordance with the ontological doctrine of physicalism.

11:30–12:00

Minimal Complete Propositional Natural Deduction Systems

Wafik Lotfallah

Campus

Department of Mathematics and Actuarial Science
The American University in Cairo
Cairo, Egypt

For each truth-functionally complete set of connectives, we construct a sound and complete natural deduction system containing no axioms and the smallest possible number of inference rules, namely one.

Session III

12:30–13:00

Logic in Computer Science

Felip Manyá[1] ***and Jordi Coll***[2]

[1] Artificial Intelligence Research Institute
Spanish National Research Council
Bellaterra, Spain
[2] National Center for Scientific Research
University of Aix-Marseille & University of Toulon
Marseille, France

Online

Boolean Satisfiability (SAT) is the problem of deciding whether a propositional formula in conjunctive normal form admits a satisfying assignment, i.e., a model. This problem is relevant from a problem solving perspective because many NP-complete decision problems can be solved efficiently using SAT technology. In this talk, we first explain how to express a problem as a SAT instance, then how to find a model for the derived SAT instance with a SAT solver and, finally, how to generate a solution for the original problem from the computed model. We use the sudoku problem as a case study and sketch the technology behind the modern SAT solvers.

13:00–13:30

Quantum Logic

Botros Nasif

Campus

Faculty of Mathematics and Computational Sciences
University of Prince Edward Island - Cairo Campus
New Administrative Capital, Egypt

Emerging from human intuition, logic has enabled us to construct computational devices that have revolutionized the world. Through technological advancements, the computational power of these devices has experienced exponential growth over the years, enabling us to tackle more computational problems and find more useful applications. Nowadays, these devices have become indispensable in all aspects of life, ranging from daily life to understanding the fundamental structure of our world to exploring outer space and other forms of life. Unfortunately, however, these devices are doomed to failure in attempting to solve certain types of problems in an efficient manner. Inspired by the elegance of nature, Feynman proposed the construction of a fundamentally different type of computer based on natural logic, referred to as quantum logic. These quantum computers utilize natural phenomena, such as superposition, entanglement, and interference, to efficiently solve problems that would otherwise take more than the age of the universe. Empowered by the laws of nature, this new model of computation opens the door to a new realm of possibilities, giving us the opportunity to re-examine what we think is impossible. Whilst the quantum advantage has been theoretically proven, quantum information processing devices are still in their infancy. Indeed, it is a long way of challenges to build a large-scale, fault-tolerant quantum computer. To learn more about quantum logic, come and join us at the World Logic Day in The Nile Valley.

Session IV

14:30–15:00

On finite substructures and automorphism groups of homogeneous structures

Gábor Sági

Online

Alfréd Rényi Institute of Mathematics
Eötvös Loránd Research Network
Budapest, Hungary

Recall that a first order structure A is defined to be homogeneous iff isomorphisms between its finite substructures can be extended to automorphisms of A. The automorphism group Aut(A) of A can be naturally endowed by a topology.

We will investigate Aut(A) as a topological group. Special emphasis will be made on compact subgroups and dense, locally finite subgroups of Aut(A). Studying these subgroups may provide information on the existence of finite substructures of A with further interesting features, like different versions of Hrushovski's Extension Property. We will illustrate this by presenting some classical and more recent related results.

15:00–15:30

Atom-canonicity in varieties of relation and cylindric algebras with applications to omitting types in multi-modal logic

Tarek Sayed Ahmed

Campus

Department of Mathematics, Faculty of Science
Cairo University
Giza, Egypt

Various omitting types Theorems for finite variable fragments of first order logic endowed with various semantics are investigated. Both positive and negative ideas are obtained. The proofs use ”coloured” graphs and combinatorial game theory whilst checking atom-canonicity (an important persistent property in modal logic) for varieties of relation and cylindric algebras.

Session V

16:00–16:30

Propositional versus predicate logics: an application of universal algebraic logic

Hajnal Andréka and István Németi

Online

Alfréd Rényi Institute of Mathematics
Eötvös Loránd Research Network
Budapest, Hungary

In a propositional logic, atomic formulas stand for arbitrary formulas of the logic, this is expressed in the so-called substitutional property.: A logic is called substitutional if whenever a formula is valid, all of the formulas obtained from it by substituting arbitrary formulas in the place of atomic ones are valid, too. In other words, a formula is valid iff it is valid as a formula scheme. Propositional logics are the subject of investigation of Abstract Algebraic Logic, see [1].

As opposed to propositional logics, in a predicate logic the atomic formulas do not stand for arbitrary formulas. For example, in first-order logic (FOL), the atomic formula R(x) stands for an arbitrary formula with one free variable x. This is expressed in the notion of conditional substitutional property ([2], Def.3.3.14). Not all logics are conditionally substitutional. We call logics that satisfy the cond. substitutional property predicate logics. The theory of predicate logics is richer than the theory of propositional logics. For example, in a predicate logic, the notions of formulas and formula schemes are separated.

Each predicate logic has a well-defined propositional core, a propositional logic that can be called the sentential level of the logic. Using theorems from [2], we will show the following. The propositional core of FOL is the so-called type-free logic (see, e.g., [3] and [4, sec.4.3]). This core is not compact. We also show that the compact propositional core of FOL is the full finitary logic of infinitary relations (see [4] sec.4.3). To our minds, these kinds of investigations show that algebraization of FOL as outlined in [5] and pursued further in [4] and [2] is successful and rich in further possibilities.

Bibliography

[1] Font, J. M., Abstract Algebraic Logic. An Introductory Textbook. College Publications, 2016.
[2] Andréka, H., Gyenis, Z., Németi, I., Sain, I., Universal Algebraic Logic. Dedicated to the Unity of Science. Birkhauser, 2022.
[3] Simon, A., Finite schema completeness for typeless logic and representable cylindric algebras. In: Algebraic Logic, North-Holland, Amsterdam, 1991. pp.665-670.
[4] Henkin, L, Monk, J. D., Tarski, A., Cylindric Algebras. Parts I-II. North-Holland, 1971 and 1985.
[5] Henkin, L., Tarski, A., Cylindric algebras. In: Lattice Theory, Proc. in Pure Mathematics, 1961. pp.83-113.

16:30 – 17:00

First-order homogeneous structures

Daoud Siniora

Campus

Department of Mathematics and Actuarial Sciences
The American University in Cairo
Cairo, Egypt

A countable homogeneous structure is one in which every isomorphism between its finite substructures extends to a total automorphism of the whole structure. In this talk, we will present some connections between the class of finite substructures embedded in a homogeneous structure and topological properties of its automorphism group.

Session VI

17:30–18:00

On axiomatization of relativity theories

Judit Madarász and Gergely Székely

Online

Alfréd Rényi Institute of Mathematics
Eötvös Loránd Research Network
Budapest, Hungary

In this talk, we are going to overview the Andréka–Németi school's approach for investigating the axiomatic foundations of relativity theories. We will see a streamlined axiom system SpecRel for special relativity, consisting only a few natural axioms. From SpecRel, we are going to derive an axiom system GenRel for general relativity in two simple steps. First, we extend it with accelerated observers and then eliminate the difference between accelerated and inertial observers in the level of axioms. One of the benefits of using axiomatic method is getting a deeper understanding of the role of basic assumptions. Another one is that it helps to reveal hidden assumption. We are going to illustrate this feature of axiomatic method by the twin paradox, which is one of the many surprising consequences of relativity theory.

18:00–18:30

Concept algebras: From George Boole to Alfred Tarski

Mohamed Khaled

Campus

Department of Mathematics and Computational Sciences
University of Prince Edward Island – Cairo Campus
New Administrative Capital, Egypt

Concept algebras are algebras that 'talk' about concepts that one can define on a given structure using its own language. These algebras form an interface between logic, algebra and geometry, with numerous connections with other branches of mathematics. They have been immensely successful in applications to a diversity of fields such as computer science, artificial intelligence, linguistics, etc.

The intrinsic merit of concept algebras is being algebras of relations. The fundamental operations are essentially the most basic operations one can consider on relations. The simplest concept algebras are Boolean algebras, which are algebras of unary relations. These algebras correspond to mathematical structures that are formulated in the elementary propositional logic.

There are a number of algebras that are intended to correspond to relations of higher ranks. These structures are confronted with a simple extension of the Boolean parallelism between logic and algebra. There are alternative possible algebras: relation algebras, cylindric algebras, diagonal-free cylindric algebras, and so on. These algebras can be regarded as multi-dimensional Boolean algebras; algebras of subsets of Cartesian spaces U^{α}, for some ordinal $\alpha \geq 2$.

Cylindric algebras have received most attention; these are algebras correspond to structures that are formalized in first-order logic. In this talk, we are more interested in examples of cylindric algebras; what are the concept algebras of specific first-order structures? It turns out that the intensive literature of these algebras cannot answer this question even for some simple structures. This was pointed out by D. Monk in 2000. We shed light on this research direction; with some beautiful examples and some inspiring results.

Useful Information

How to get to UofCanada

UofCanada will provide transportation with two pick-up points; one in front of Cairo University (Main Gate) and another one in front of The American University in Cairo (Gate 5)[1]. However, participants are free to use any other way to reach UofCanada.

The location of UofCanada: New Administrative Capital City, Plot No. (X1-05)

Conference Hall

Talks will be held at the **Auditorium** room. It is situated on the first floor of Building B.

Important Note

If you wish to attend the conference, then you need to fill in the registration form. It is essential to inform us if you plan to attend the conference on campus or online. In the later case, we will send you the required links by email, and in the former case we will inform the security to give you an easy and smooth entrance at the gate of UofCanada.

[1]More information regarding these transportation will be sent to the registered attendees.