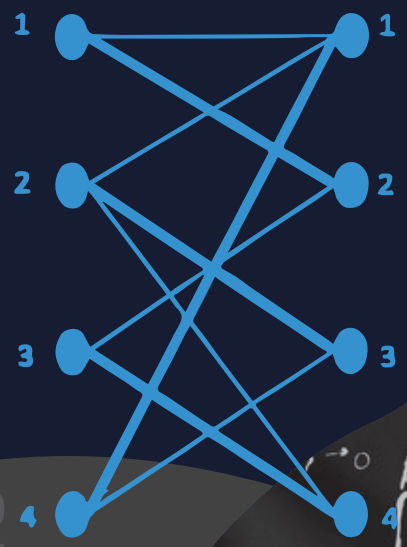

$$H_n(x) = \sum_{HamCycle\ c} \left(x_{c(1)c(2)} \cdot x_{c(2)c(3)} \cdot \cdots \cdot x_{c(n)c(1)} \right)$$

$$(x+a)^p$$

ALGORITHMS

CRYPTOGRAPHY

ALGEBRAIC COMPLEXITY THEORY

THEORETICAL COMPUTER SCIENCE

STATISTICS

Algorithms rule the world

Algorithms. They are everywhere. But what are they? Put simply, algorithms are a sequence of instructions that help perform a task. In the case of computers and computation, algorithms are a sequence of instructions that tell the computer what to do. So, how does one arrive at an algorithm?

Although the language of algorithms is mathematics, it isn't easy to understand algorithms simply with math. Enter computational complexity theory.

Complexity theory is the exploration of the dynamics of complex systems like economies, the climate, the human brain, and others. In computation, complexity theory examines how algorithms function.

Dr. Neeraj Kayal works on algebraic complexity theory, which is a sub-field that examines how computational problems can be solved as efficiently as possible using the most elegant algorithms.

Among Dr. Kayal's contributions to algebraic complexity theory are his foundational contributions to lower bounds. Computational lower bounds are fundamental laws that recognize that at least a certain amount of resources such as running time, memory, communication are needed to solve a given problem. Lower bounds are similar to physical laws like the law of conservation of energy.

Neeraj Kayal was part of a team that devised an algorithm that could efficiently identify if any given number was a prime. This was a significant development in a problem that has fascinated mathematicians since the beginning of time. In an age when algorithms rule the world, testing for primality plays an important role. For example, secure internet transactions depend on a type of algorithm called RSA algorithm. How secure an RSA algorithm is depends on how difficult it is find a number's prime factors.

Dr. Neeraj Kayal's work has wider applications in fields such as cryptography, statistics, in solving complex problems in theoretical computer science, and many others.