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RESEARCH CONNECTION

Characterization of extra polyloop and its applications to biological inheritance

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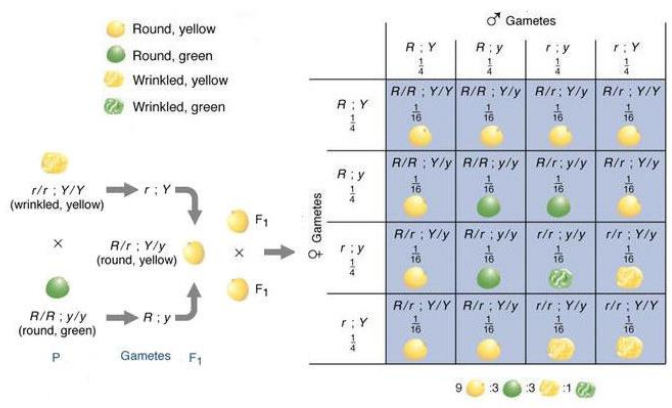

Dihybrid cross.

What you need to know

An algebraic structure is a mathematical structure in which a non-empty set, say G, is equipped with a binary operation. The composition of any two elements in the non-empty set G under the given binary operation is an element that belongs to G. The non-empty set G, together with the binary operation, is said to be an algebraic structure. On the other hand, if a non-empty set G is equipped with a hyperoperation (multi-valued), the composition of any two elements of the non-empty set G is a non-empty set, which is contained in the non-empty set G. Then, a non-empty set G together with at least one multi-valued operation is known as an algebraic hyperstructure.

A non-empty set G together with a binary operation that satisfies well-defined basic algebraic properties is called a group. A non-empty set, say H, which is a subset of G, under the same binary operation as G, and satisfies the basic algebraic properties of G, is called a subgroup. A polyloop is a non-associative algebraic hyperstructure, which is an algebraic hyperstructure that is not necessarily associative. An extra polyloop is a special kind of non-associative algebraic hyperstructure. Our research focuses on the characterization of extra polyloop and its algebraic properties. Extra polyloops have three distinctive identities that characterize some biological inheritance in plants, animals, and humans.

Why this research is important

This research is vital because it gives birth to a new notion of non-associative algebraic hyperstructures called "extra polyloop." Furthermore, some notable algebraic properties in the classical sense of algebraic structures, such as flexibility, left alternative, right alternative, and power associativity, were established on this special kind of algebraic hyperstructures. These algebraic properties were studied and applied to different biological inheritances. It also helps characterize the different biological inheritances based on the identities of the extra polyloop and its algebraic properties that were satisfied by these biological inheritances.

How the research was conducted

Using different strategies, such as investigating the theorems and algebraic properties of a classical extra loop structure, we investigated the algebraic properties satisfied by an extra polyloop. Additionally, we studied the identities of an extra loop, a classical algebraic structure, then examined the extent to which algebraic properties were satisfied and established the distinction between them. We adopted the extra identities in loop to axiomatize extra polyloop. Concrete examples of loops in the classical non-associative algebraic structures were used to construct notable examples of polyloops with corresponding order. We studied existing literature on algebraic hyperstructure and its applications to biological inheritance; further, we applied the extra identities to genetic interactions to measure the precise level of non-associativity.

What the researchers found

Using various strategies, we have axiomatized the extra identities satisfied by extra polyloop in the algebraic hyperstructure sense. Furthermore, we also showed that each of the three extra identities in classical algebraic structures would have seven extra equivalent identities in the algebraic hyperstructures. By investigating and applying these extra identities to some biological inheritances, we could measure the significant level of non-associativity in some examples of weakly associative inheritance structures. We also discovered that algebraic hyperstructures with genetic realization are not necessarily associative but may be weakly associative. We found out that the order in which populations mate is both significant and logical; that is, if parents A and B mate and then the resulting progenies mate with C, the resulting progeny is not the same as the offsprings resulting if parents A mate with the progenies obtained from the mating of parents B and C.

How this research can be used

This research can be used in various ways. We have used the extra identities in classical non-associative algebraic structures to axiomatize an extra polyloop and applied the algebraic properties to biological inheritance. The notion of multi-valued operation can be extended to other classical algebraic structures, and the algebraic properties studied here can also be investigated about the resulting algebraic hyperstructures.

About the researchers

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Keywords

Polyloop, extra polyloop, left alternative property (LAP), right alternative property (RAP), flexibility, power associativity, genetic

Publication based on this research

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