

Fonte Labs Podcast - Episode 4  
Theory Math Library

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- One of my recent projects is “Theory”, a math library for the sake of math. It’s not all about conventional math used for programming, but rather it covers some more theoretical areas of mathematics.
- Theory was originally written in JavaScript, but I’ve ported a rough copy to C++, and I’m working on a better version for Java. I hope to finish a VBA version at some point as well, and I’ve finished a few of the functions in VBA already.
- Theory currently covers concepts of set theory, number theory, combinatorics and abstract algebra.
- For set theory, the library can calculate the intersection or union of two sets, decide if all items in a set are unique, or make a set have all unique elements. It can also calculate the cartesian product of two sets, determine if a set is a subset of another set or a proper subset of another set, or tell if two sets are disjoint. It can also calculate the set difference or the complement of two sets, and finally, the symmetric difference of two sets.
- There are two core functions in the library - one for generating sequences, such as the fibonacci sequence, and one function that performs a reduce operation - calculating a value from a set of values.
- For number theory, there are functions to calculate the factors of a number, and one to factorize a number - which returns the factors and their powers to add up to the provided number. There are also GCD and LCM functions - Greatest Common Divisor and Least Common Multiple, respectively.
- For combinatorics, there is a fibonacci sequence generator, a factorial function, partial permutations and combinations. Partial permutations are orderings of a specific number of items from a set of numbers, where ordering matters. The result is the number of orderings possible. For combinations, it’s the same concept, a number of items from a set of numbers, but ordering doesn’t matter.
- There are many functions for abstract algebra. There’s a test if the provided set, operation, and identity are a finite group, there’s a test if a possible group is Abelian, and there’s a test if a subset of a possible group is a finite subgroup. There’s also a function to return the center of a group, and a function that returns the centralizer set for an element in a group. There are a couple of utility functions - one to turn addition into multiplication and multiplication into an exponential operation, and another function to determine the order of an element. The final function generates a cyclic subgroup from an element in the parent group.
- I hope to expand Theory with time, both in terms of the functions available and the platforms it’s ported to. For now my focus is on JavaScript, Java, C++ and to a lesser degree VBA.