A Tree Branch Path Solution to the Collatz Conjecture

Luo, David

The Collatz Conjecture is a worldwide math problem that has been unproven for nearly 80 years. The Conjecture starts by taking any positive integer n. If n is even, divide it by 2 to get n / 2. If n is odd, multiply it by 3 and add 1 to obtain 3n + 1. If the process were to be repeated indefinitely, no matter which natural number is started with, it will always converge to 1. To investigate the conjecture, a tree-branch path graphic method has been introduced, and a fundamental graphic structure for this problem was found. Every tree branch path is formed by a set of positive discrete integers generated by a given positive odd number N that has a geometric sequence form (2^k)N, where k=0, 1, 2, 3… and each tree branch is denoted by the set of numbers (2^k)N, with N being the first point. All tree branches can be cataloged into three different types of branches based on their odd number N: type zero if (N mod 3 = 0), type one if (N mod 3 = 1), and type two if (N mod 3 = 2). Every odd number can be written in a geometric sequence form corresponding to their tree branch type. There are two types of movement involved with the tree branch path: downwards movement and horizontal movement. The points move in a downwards fashion when being divided by 2. The points move horizontally according to their odd number orientation in relation to their tree branch type. The movement of the conjecture has fully been determined and a new way to attack the conjecture has been revealed. Seven theorems have been obtained through the tree branch diagram and new number theory techniques and methods have been introduced.

Awards Won:
National Taiwan Science Education Center: First Award of $2,500