Decomposing Fractions into the Sum of Distinct Unit Fractions and Their Correlating Patterns; Year 2

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Egyptian Fractions can be defined as the series of distinct unit fractions that can be summed to equal a proper fraction. Any fraction can be expressed in this way, and the Egyptians had a method of converting fractions to the sum, but only for fractions with 2 in the numerator or 10 in the denominator; and the methods for other varying fractions were left undiscovered. Later, the Greedy Algorithm was discovered, in which the largest unit fraction possible is removed each time until nothing remains. While it was thought that the Greedy Algorithm would produce the shortest list, this isn't always true, nor is it always the most effective method. During the course of this project, a different algorithm was developed that deals with the binary expansion of the numerator. Then, an equation was formulated that produced results similar to those found on the Rhind Papyrus. This algorithm was developed by starting with the simplest fraction, 2/d, and then building upon it with increasingly larger numerators and denominators. After developing the algorithm on paper, it was programed and refined, then tested against the Greedy Algorithm. Testing proved it to be more efficient in some cases, meaning fractions were generally of a smaller denominator. These cases were best observed with perfect numbers in the denominator. Overall, the decomposition of fractions using the method developed for this project found its roots in the relations between the binary system, Perfect Numbers, Mersenne Numbers, and Mersenne Primes.

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