Hashmaps: Efficiency, Mechanism, and Modern Applications

Researcher: Shahaf Dan
Institution: Las Positas College
Class: CS17 - Discrete Mathematical Structures
Level: Lower Division Undergraduate, Honors Project

Research Focus: Apply mathematical concepts about hashmaps and cardinality in research about modern applications of data structures. Design and structure of different various hashmaps algorithms and functions. The understanding of mathematical cardinality and the pigeon-hole principle.

Abstract:

As the class's material includes a section about hashmaps and cardinality, this research project discusses, explores, and determines the applications of hashmaps and similar data structure in modern technological applications. The paper defines and explores concepts such as the pigeonholing, bijection relationship, and hashing. Along with the research, a simple hashmap of basic hashing algorithms is done and compared in its efficiency and effectiveness. The paper discusses the use of special keys in hashmaps, as well as their technique, and applications in the software development industry, specifically discussing how hashmaps are used in subjects such as cybersecurity, cryptocurrency, and information encryption. Both mathematically, and programmingly, the paper addresses the issue of having repeating keys in hash maps, and how a programmer should design software to overcome issues of incorrect cardinality ratio. The research will include the programming of multiple hashing algorithms, and determining the effectiveness of primary numbers in the design of such algorithms.