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Strengthening Hash Families

Consider an $N \times k$ array A with every cell containing a symbol from an alphabet of size v . When C is a subset of t or fewer columns, and (C_1, \dots, C_ℓ) is a partition of C , the array A *separates* (C_1, \dots, C_ℓ) if there is at least one row in which two columns from C contain the same entry only if the columns belong to the same class of (C_1, \dots, C_ℓ) . Different specifications of partitions of columns to be separated lead to well-known definitions of perfect, separating, and distributing *hash families*. One motivation for studying such hash families arises from their use in 'column replacement' techniques, which have been examined for the construction of covering arrays, and measurement matrices for compressive sensing. In these applications, however, known variants of hash families construct large matrices having the same strength (value of t) as the smaller ingredient matrices. This limits their applicability dramatically. In this talk, we describe how to equip hash families with a *strengthening* property, which underlies column replacement techniques that increase strength. We describe one application of these hash families, and outline methods for their construction. This is joint work with Daniel Horsley (Monash University) and Violet Syrotiuk (Arizona State).