A Customised ASM Thesis for Database Transformations

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Database transformations consist of queries and updates which are two fundamental types of computations in all databases - the first provides the capability to retrieve data and the second is used to maintain databases in light of ever-changing application domains. With the rising popularity of web-based applications and service-oriented architectures, database queries and updates become closely related to each other, e.g., the integration of web-accessible services often requires the composability of queries and updates. Establishing a theoretical framework of database transformations can thus help investigate a broad range of problems arising from extensions of query languages with update facilities. To date, there has been only limited research into a unifying formalisation of database queries and updates. The previous findings reveal that it is a difficult task. In this talk, I will present a characterisation of database transformations, which is inspired by the advent of the sequential Abstract State Machine (ASM) thesis capturing sequential algorithms. I will show that the class of computations described by database transformations can be formalised as algorithms stipulated by five intuitive postulates. Then I will introduce a formal computation model for database transformations, called Abstract Database Transformation Machines (ADTMs). It turns out that every database transformation characterised by the postulates can be behaviourally simulated by an ADTM with the same signature and background, and vice versa.