## Tutorial Weeks 11/12 – Normalisation

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- 1 (a) Define the term **functional dependency** and then describe the problems that might occur if the left hand side of a functional dependency is **not** the primary key of one of the tables in the database.
  - (b) Given the following **Universal Relation** and set of **functional dependencies** U(<u>A, B, C</u>, D, E, F, G, H, I, J, K, L, M)

A,B,C -> D, G A,B -> E,F B, C -> K, L, M B-> H C-> I, J E -> F I -> J M -> L L -> K

Create a second normal form version of the database.

- (c) Create a **third normal form** version of the database.
- (d) List the **foreign keys** in the resulting third normal form database, listing them in the form: Column A of Table T refers to Column B of Table U.
- (e) Give the **SQL** and **Relational Algebra** expressions to rebuild the universal relation from the tables generated by steps (b) and (c) of this question.
- 2 (a) What are the functional dependencies involved in the tables generated from:

a single entity types and its single and multi-valued attributes?

two entity types connected by a binary relationship with each combination of cardinality and participation constraints?

a weak entity type connected by an identifying relationship with a strong entity type?

- (b) Why therefore, is a Relational Schema generated from an ER diagram in Third Normal Form?
- (c) The process of normalisation is intended to improve the design of a relational database. Give two measures of database quality that normalisation is intended to improve.
- (d) Why is not possible to determine the functional dependencies from looking at the data in the tables of a database?
- (e) Why must a relation with only two columns be in Third Normal Form?
- (f) For the relation R(A, B, C), give three examples of primary key selection and functional dependencies, one of which means that the table is in Third Normal Form, one means that the table is only in Second Normal Form and one which means that the table is only in First Normal Form.