Data and Its Applications (CS4.301)

Monsoon 2021, IIIT Hyderabad
Project Phase 3

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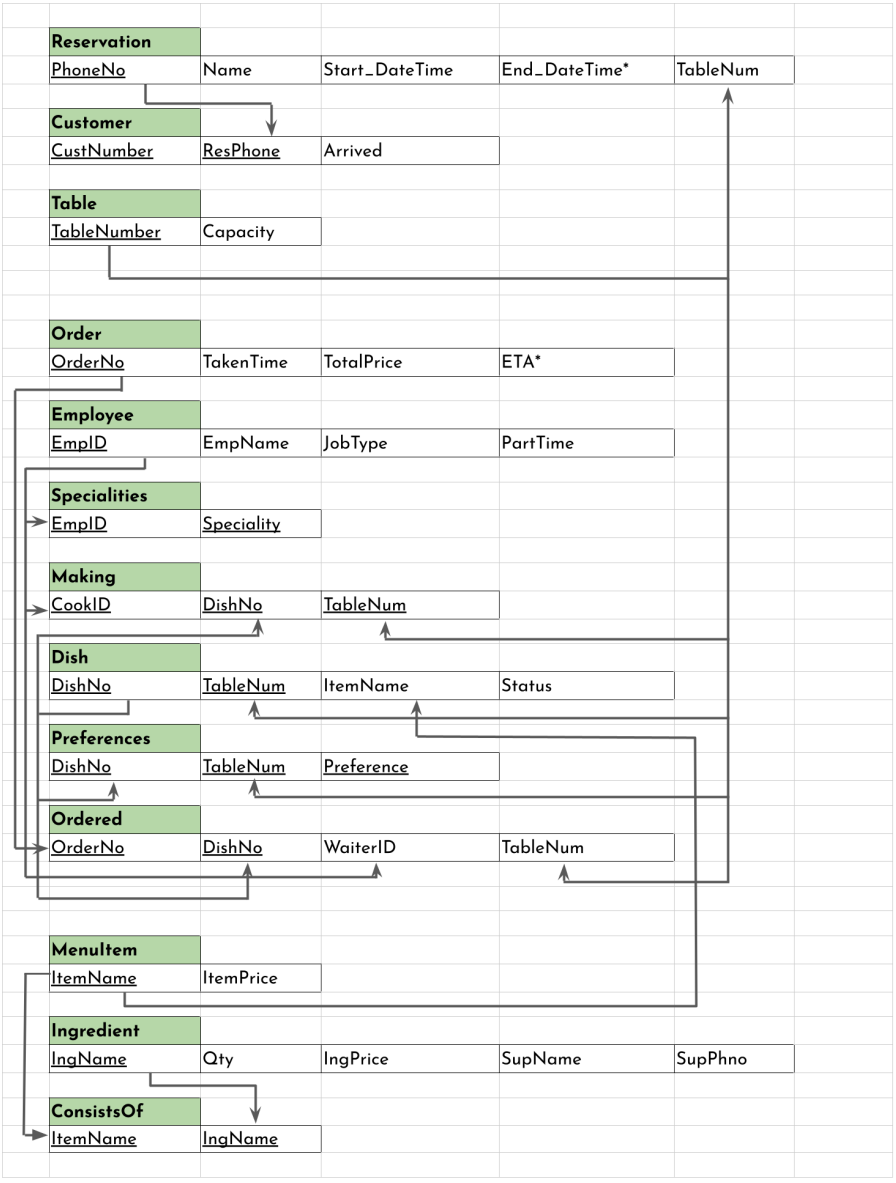
Relational Model

The ER model was converted to a relational model following the given procedure.

The employee $\rightarrow \{\text{waiter}, \text{cook}, \text{cashier}, \dots\}$ specialisation was represented using an attribute in the EMPLOYEE table, named JobType, which can take values like "Waiter", "Cook", etc. Note that the PartTime attribute applies only to waiters and is therefore NULL for all other types of employees.

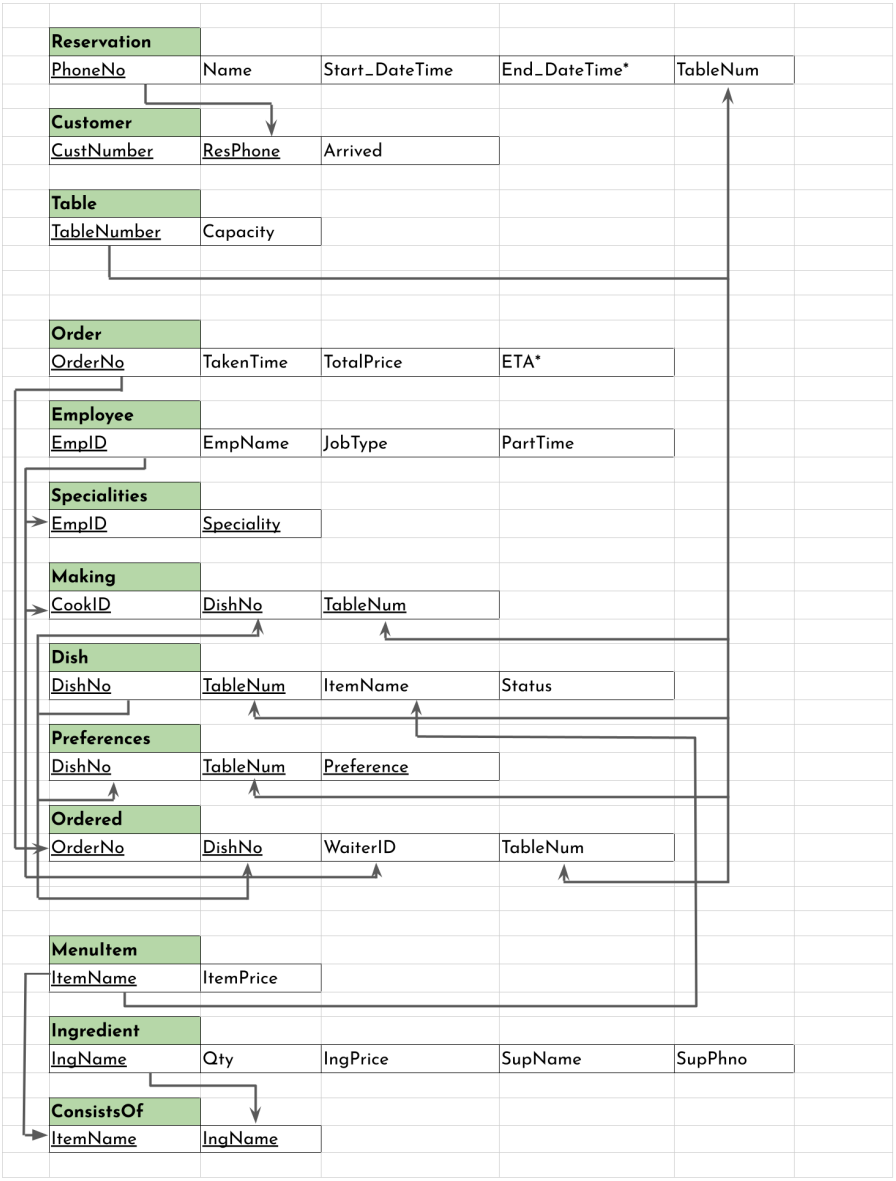
The underlined attributes *together* form a composite key. A star indicates a derived attribute. Candidate keys are unmarked. Arrows go from the primary key to the foreign keys.



Relational Model

First Normal Form

No changes were made to convert the model to first normal form. All the data values are atomic as the multivalued attributes (specialities, preferences) were represented as separate relations.

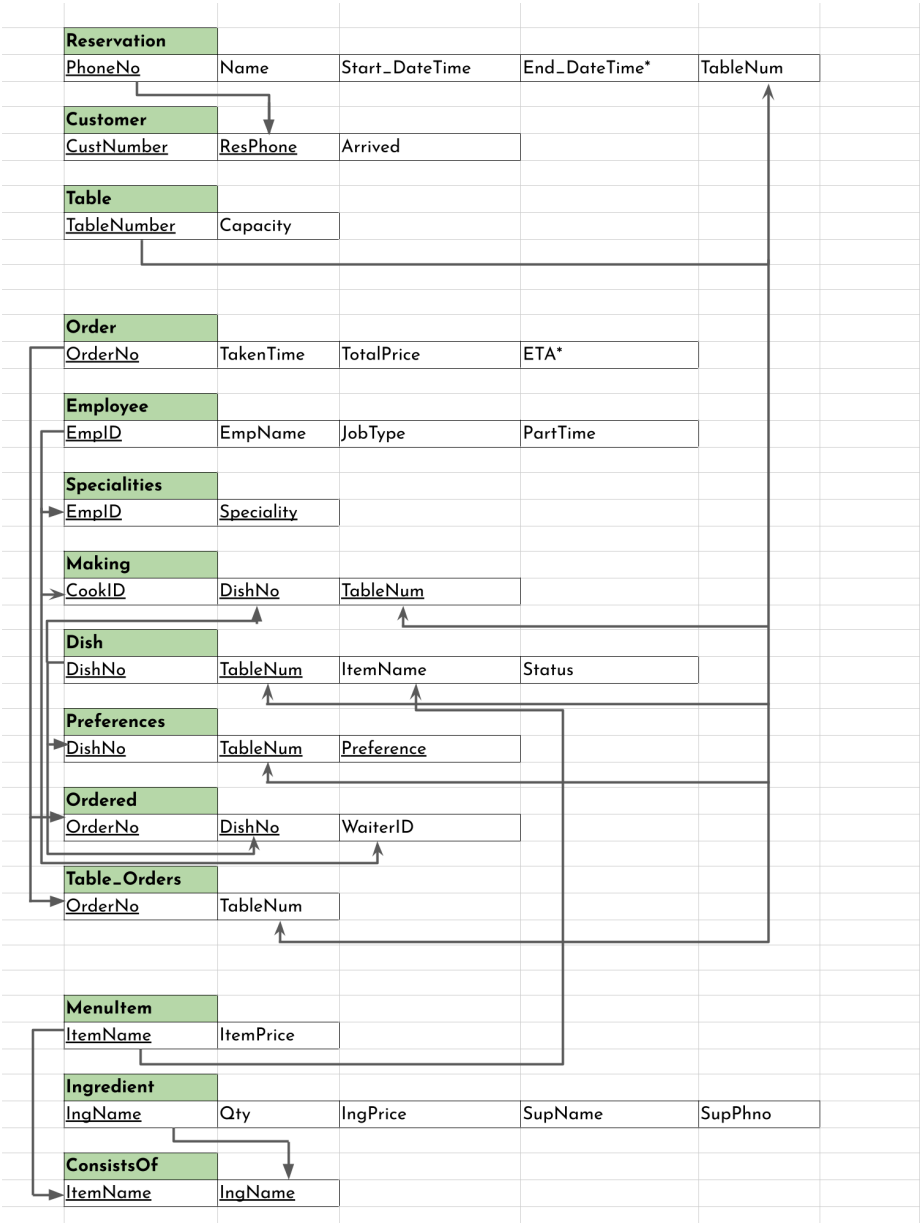


First Normal Form (identical to relational model)

Second Normal Form

The second normal form requires that no non-prime attribute is dependent on a subset of the primary key. Most tables either have a singleton primary key or have no non-prime attributes, and therefore satisfy this normal form.

The only table that needs to be decomposed is ORDERED, in which the dependency OrderNo $\rightarrow$ TableNum exists (the key is $\langle$OrderNo, DishNo$\rangle$).
To solve this, TableNum is removed from ORDERED and a new relation, TABLE_ORDERS, is created. This relation has as its key OrderNo and another attribute, *i.e.*, TableNum. Both these two new tables satisfy 2NF.



Second Normal Form

Third Normal Form

The third normal form requires that all functional dependencies either have a superkey on the LHS, or a non-prime attribute on the RHS, *i.e.*, there are no dependencies from one non-prime attribute to another.

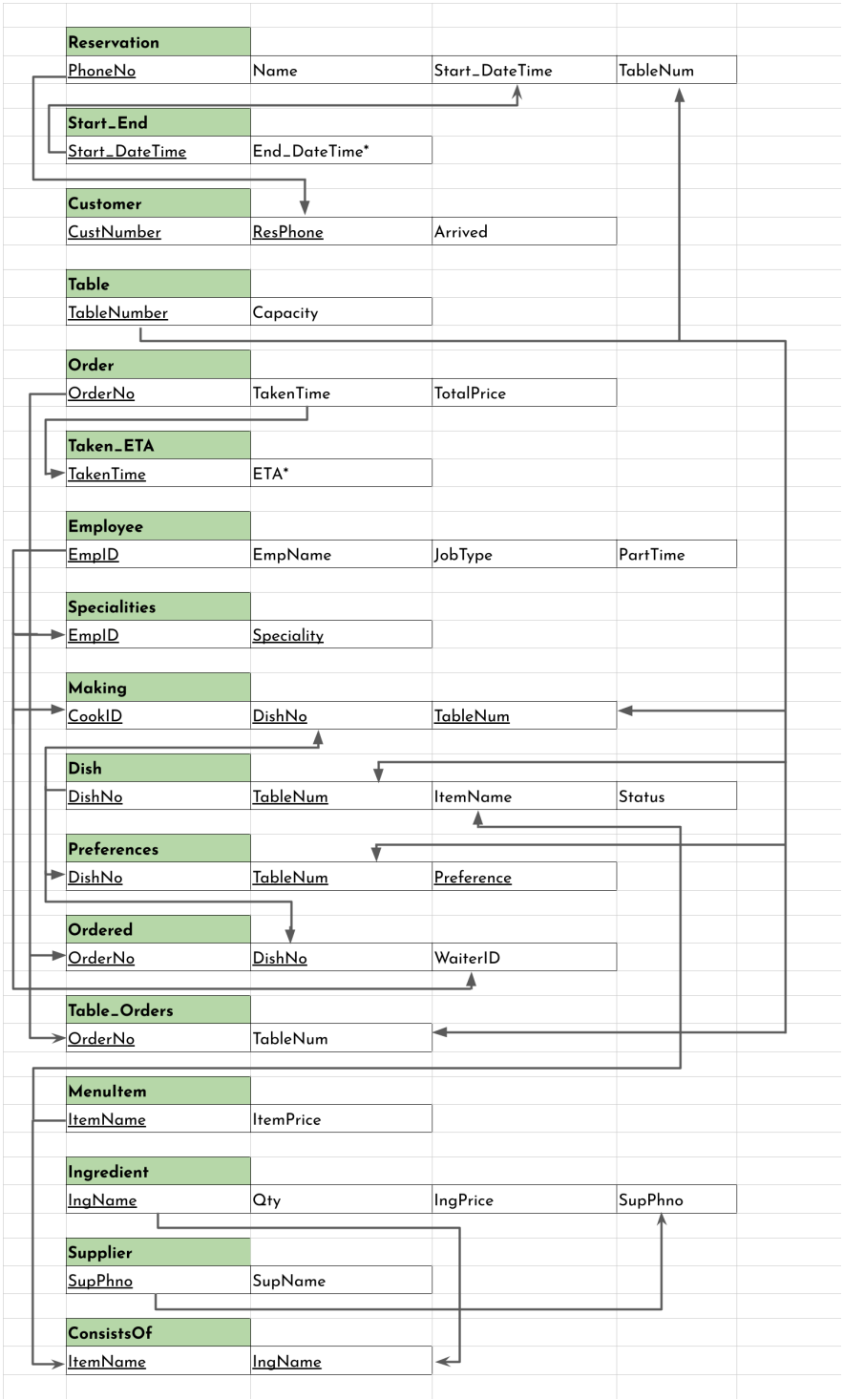
This is satisfied by all tables in which either there are no non-prime attributes, or there is only one. Among the other relations, three need to be decomposed.

In RESERVATION, End_DateTime is derived from Start_DateTime, which makes a functional dependency which does not satisfy 3NF. This is fixed by removing End_DatTime from RESERVATION and adding it as an attribute (with Start_DateTime as key) to a new relation, START_END.

Similarly, in ORDER, ETA is derived from TakenTime. This is solved analogously; ETA is removed from ORDER and added, with TakenTime as key, to a new relation named Taken_ETA.

In INGREDIENT, all suppliers have a unique phone number. Therefore we have the dependency SupPhno $\rightarrow$ SupName. This does not satisfy 3NF; we therefore create a new table, SUPPLIER, with SupPhno as key and SupName as an attribute, removing the latter from INGREDIENT.

These three changes satisfy the third normal form for the table.



Third Normal Form