Practice 6 – Normalization

At the Maluluka Technical University, room reservations are stored in a paper-based notebook.A part of this notebook is shown in the table below. For each reservation, the following data are stored:

- *(E) Employee (instructor) making the reservation*
- *(M) beginning of reservation (reserved froM)*
- *(T) end of reservation (reserved To)*
- *(S) code of the Subject (only in case of teaching activity)*
- *(N) room Number*
- *(C) room Capacity (how many students fit in it)*
- *(L) is the room Locked?*
- *(A) is the room Accessible for people with disabilities?*
- *(B) code of the Building*
- *(P) Postal address of the building*
- *(R) location of Reception of the building*

E	*M*	*T*	*S*	*N*	*C*	*L*	*A*	*B*	*P*	*R*
Bal Béla	*2017. 10. 12. 8:15*	*2017. 10. 12. 10:00*	*ML12*	*12*	*36*	*N*	*Y*	*V2*	*Duduhaha boulevard 5.*	*V2*
Jobb Géza	*2017. 10. 12. 10:15*	*2017. 10. 12. 12:00*	*ML34*	*12*	*36*	*N*	*Y*	*V2*	*Duduhaha boulevard 5.*	*V2*
Alma Anna	*2017. 10. 12. 10:15*	*2017. 10. 12. 18:00*		*24*	*20*	*N*	*Y*	*V2*	*Duduhaha boulevard 5.*	*V2*
Körte Máté	*2017. 10. 12. 12:15*	*2017. 10. 12. 16:00*	*ML38*	*38*	*150*	*Y*	*Y*	*St*	*Maluluka avenue 3.*	*E*

Whenever a new reservation is needed, they search for an older reservation of the same room in the notepad, and copy the data from there. The notepad is kept for a year and then thrown out.

1. Can in this case any of the following emerge?
    a. insertion anomaly,
    b. modification anomaly,
    c. deletion anomaly.

The university wants to replace this complicated administration method to a computer-based reservation system. For this, they specified that the buildings are identified by their codes while rooms are identified by their codes and their buildings together. Each building has a single reception which might be in a different building.

2. Model this problem using an ER diagram. Aim at creating an easy-to-understand diagram, and do not overcomplicate it for increasing consistency.
3. Determine the functional dependencies among the data stored in the columns of the notepad.
    a. What functional dependencies can be determined based on the already known details of the specification?

    b. What further questions have to be clarified in order to be able to fully determine the functional dependency set?

The engineers of the Maluluka University Reservation System Consortium have clarified with the client that for each building only a single address has to be stored even if the building itself has multiple entrances. Also, the address of each building is different. A building can contain both open and locked rooms. The data was supplemented by the reservation ID (I) attribute, which identifies reservations, and finally modeled the problem with the following functional dependency set:
F = {B→PR, P→BR, BN→CLAP, I→BESTNM}

4. *Solve the following problems based on the above dependency set F.*
    a. Find an occassional dependency in the provided data set, which is not a real functional dependency.
    b. Are there real dependencies, which do not hold as occassional dependencies?
    c. Find a transitive dependency in the dependency set. Observe the caused redundancy.
    d. Can the below dependencies be deducted from dependency set F?
        i. BA→R
        ii. I→L
        iii. BN→E
        iv. N→L
5. Create a schema decomposition based on the ER diagram.
    a. Find the projected dependency sets belonging to sub-schemas.
    b. Find all keys of the schemas, and determine which are primary and which are secondary attributes.
    c. Determine the normal forms of the obtained sub-schemas.

Exercises for practicing

7. Based on the functional dependencies of exercise 3, determine which attrubutes are primary and which are secondary.
8. List all keys and some superkeys of
    a. the initial, universal schema, and
    b. the sub-schemas obtained in exercise 5.
9. The Great Blackout has reached Maluluka. How would you map the database to notepads as mass storage units? Think of how your mapping would help the queries (is a given room reserved in a given point in time)?
10. What ER model corresponds to the initial schema?