

# Normalization & Definitions



**1NF:** a relation has no multi-valued attributes. In other words, it is a relation in relational model.

**2NF:** a relation is in 1NF and every non-PK attribute is **fully functionally** dependent on the PK.

**3NF:** a relation is in 2NF and no non-PK is **transitively** dependent on the PK. In other words, there are no FKs between non-PKs.

**Partial dependency:**  $A, B \rightarrow C$  and  $(B \rightarrow C \text{ or } A \rightarrow C)$

**Transitive dependency:**  $A \rightarrow B$  and  $B \rightarrow C$ , then  $A \rightarrow C$  (Amstrong's axiom)

**Superkey:** An attribute, or set of attributes, that uniquely identifies a tuple within a relation (DS p. 100)

**Candidate key (CK):** A superkey such that no proper subset is a superkey within the relation. CK has two properties: uniqueness and irreducibility.

**Primary key (PK):** The CK that is selected to uniquely identify tuples. **Alternative key (AK)** the CK that is not selected to be the PK.

**General definition for 2NF:** a relation is in 1NF and every non-CK attribute is **fully functionally** dependent on any CK.

**General definition for 3NF:** a relation is in 2NF and no non-CK attribute is **transitively** dependent on the CK.

**Boyce-Codd Normal Form (BCNF):** A relation is in BCNF if and only if every determinant is a candidate key

Note: Be aware that there are various definitions on the Web.

1. Normalize (to 3NF) the following two relations:

Orders (Order\_id, Order\_date, customer\_id, customer\_name, customer\_address)

Order\_items (Order\_id, item\_id, item description, item\_qty, item\_price)

2. Is the following relation in the 3NF? Why yes or no?

Vehicle(V\_ID, VIN, make, color, model, year)      VIN is a Vehicle Identification Number

3. The following table is not in 3NF. Why?

<u>branchNo</u>	branchAddress	telNo	mgrStaffNo	Mgrname
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618	S1500	Tom Daniels
B002	City Center Plaza, Seattle, WA 98122	206-555-6756	S0010	Mary Martinez
B003	14 - 8th Avenue, New York, NY 10012	212-371-3000	S0145	Art Peters
B004	16 - 14th Avenue, Seattle, WA 98128	206-555-3131	S2250	Sally Stern

4. The purpose of this form shown below is to record the medication given to a particular patient at the Wellmeadows Hospital. Create a set of relations in 3NF to represent the data.

Wellmeadows Hospital Patient Medication Form							
<div style="border: 1px solid black; display: inline-block; padding: 5px; margin-bottom: 10px;">           Patient Number : P10034         </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">           Full Name : <u>Robert MacDonald</u> </div> <div style="width: 45%;">           Ward Number : <u>Ward 11</u> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;">           Bed Number : <u>84</u> </div> <div style="width: 45%;">           Ward Name : <u>Orthopaedic</u> </div> </div>							
Drug Number	Name	Description	Dosage	Method of Admin	Units per Day	Start Date	Finish Date
10223	Morphine	Pain Killer	10mg/ml	Oral	50	24/03/96	24/04/96
10334	Tetracycline	Antibiotic	0.5mg/ml	IV	10	24/03/96	17/04/96
10223	Morphine	Pain Killer	10mg/ml	Oral	10	25/04/96	02/05/96