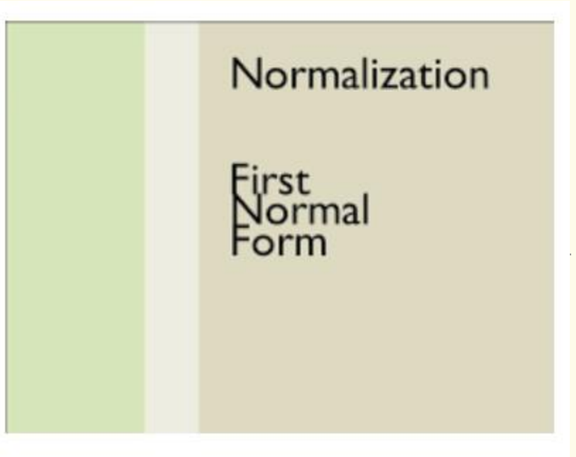
First Normal Form



First Normal Form (1NF)

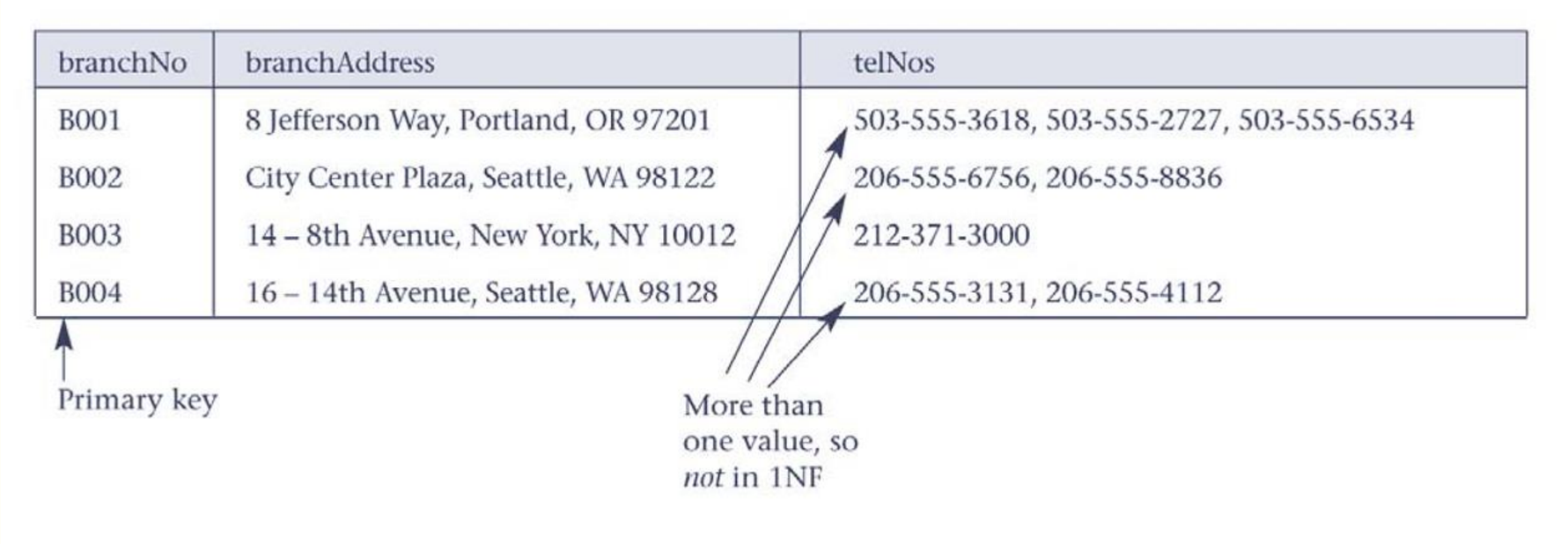
- Recall that in a relation, the intersection of one row and one column contains one and only one value. It prohibits nesting or repeating groups in a table.

- **A table is in first normal form (1NF) if and only if every non key attribute is functionally dependent on the primary key.**

UNF to 1NF

- A table is unnormalised (UNF) if there are attributes that hold multiple values in a record.

- The following table (Branch) is in UNF as the *telNos* column contains multiple values.



branchNo	branchAddress	telNos
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
B002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131, 206-555-4112

UNF to 1NF

- To go from UNF to 1NF, we identify the repeating group(s) in the unnormalised table which repeats for the key attribute(s).

- The steps involved in transforming an unnormalised table into a set of first normal form tables are as follows:

    1. Place the primary key attribute and the attribute(s) that are functionally dependent on the primary key into a table of their own.

    2. Place the primary key attribute and the repeating (multivalued) attribute(s) into a table of their own.

Example One

- The schema of this UNF relation can be represented as follows:

  Branch (branchNo, branchAddress,
  {Phones (telNo)})
  Primary key branchNo

- The set braces {} identify the attribute Phones as multivalued, and we list the component attributes that form Phones between parenthesis ().

Example One

1. Place the primary key attribute (branchNo) and the attribute(s) (branchAddress) that are functionally dependent on the primary key into a table of their own as follows:

Branch (1NF)

branchNo	branchAddress
B001	8 Jefferson Way, Portland, OR 97201
B002	City Center Plaza, Seattle, WA 98122
B003	14 – 8th Avenue, New York, NY 10012
B004	16 – 14th Avenue, Seattle, WA 98128

Primary key

Example One

2. Place the primary key attribute (branchNo) and the repeating (multivalued) attribute(s) (telNo) into a table of their own as follows:

BranchTelephone (1NF)

branchNo	telNo
B001	503-555-3618
B001	503-555-2727
B001	503-555-6534
B002	206-555-6756
B002	206-555-8836
B003	212-371-3000
B004	206-555-3131
B004	206-555-4112

Becomes foreign key

Becomes primary key

Example One - Full set of relations

Branch(branchNo, branchAddress)

Primary key branchNo

BranchTelephone(branchNo, telNo)

Primary key telNo

Foreign key branchNo references Branch(branchNo)

Example Two

ClientRental(clientNo, cName, {rentals(propertyNo, pAddress, rentStart, rentFinish, rent, ownerNo, ownerName)})

Primary key clientNo

ClientRental

clientNo	cName	propertyNo	pAddress	rentStart	rentFinish	rent	ownerNo	oName
CR76	John Kay	PG4	6 Lawrence St, Glasgow	1-Jul-03	31-Aug-04	350	CO40	Tina Murphy
		PG16	5 Novar Dr, Glasgow	1-Sep-04	1-Sep-05	450	CO93	Tony Shaw
CR56	Aline Stewart	PG4	6 Lawrence St, Glasgow	1-Sep-02	10-June-03	350	CO40	Tina Murphy
		PG36	2 Manor Rd, Glasgow	10-Oct-03	1-Dec-04	375	CO93	Tony Shaw
		PG16	5 Novar Dr, Glasgow	1-Nov-05	10-Aug-06	450	CO93	Tony Shaw

Example Two

- The relation (ClientRental) is unnormalised (not in First Normal Form) because there is a repeating group of attributes (propertyNo, pAddress, rentStart, rentFinish, rent, ownerNo, ownerName). For each clientNo, there are a number of rental properties associated with it.

- Therefore the primary key clientNo does not functionally determine any of these attributes in the repeating group.

  clientNo → cName

Example Two

1. Place the primary key attribute (ClientNo) and the attribute (cName) that is functionally dependent on the primary key into a table of their own as follows:

   Client(clientNo, cName)

   Primary key clientNo

Example Two

2. Place the primary key attribute (clientNo) and the repeating attribute(s) into a table of their own as follows:

   ClientRental(clientNo, propertyNo, pAddress, rentStart, rentFinish, rent, ownerNo, ownerName)

   Primary key clientNo, propertyNo

   Foreign key clientNo references Client(clientNo)

Example Two - Full set of relations

Client(clientNo, cName)

Primary key clientNo

ClientRental(clientNo, propertyNo, pAddress, rentStart, rentFinish, rent, ownerNo, ownerName)

Primary key clientNo, propertyNo

Foreign key clientNo references Client(clientNo)