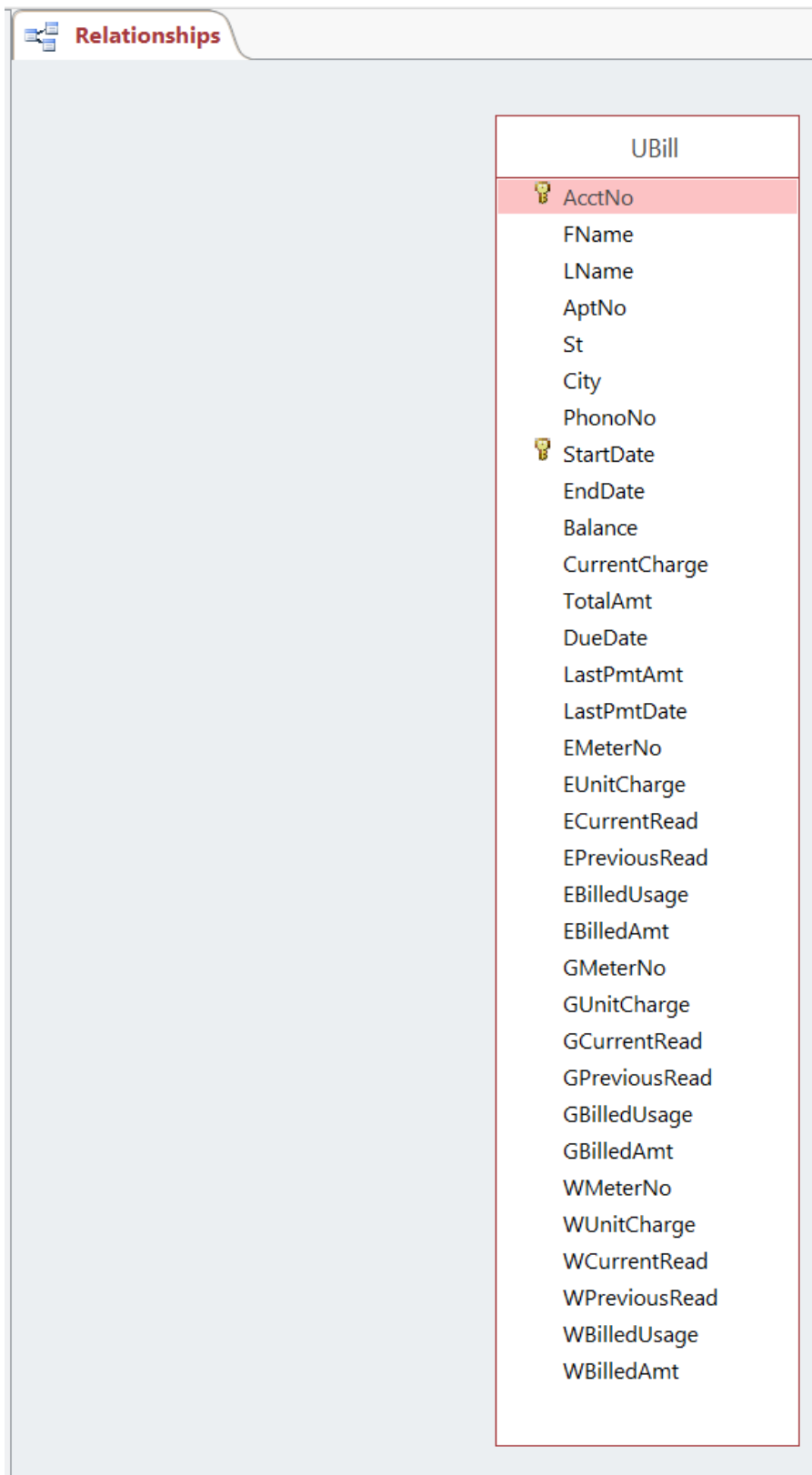


## Lab 4 Exercise

### Business Rules

- a. Each customer must have one and only one account.
- b. Each account must have at least one of the connections, e.g., electric, gas, and water.
- c. Electricity meter number is not the same as gas meter number, water meter number, or electric meter number.
- d. Each electric meter number is associated with one and only one account number.
- e. Each gas meter number is associated with one and only one account number.
- f. Each water meter number is associated with one and only one account number.
- g. Current charge is the summation of electric, gas and water billed amounts for the billing period. There are no adjustments from previous cycles.
- h. The Unit charge for each meter is never going to change.
- i. Every customer is billed on the 1<sup>st</sup> day of each month

- 1) an Access table that is in 1NF (using **Account No** and **Start Date** as a composite PK)



The screenshot shows the Microsoft Access Relationships window. The title bar reads "Relationships". The main area displays a list of fields for a table named "UBill". The fields are listed in a single column. The first two fields, "AcctNo" and "StartDate", are highlighted in red and each has a yellow key icon to its left, indicating they are part of the primary key. The remaining fields are listed in black text.

UBill	
AcctNo	
FName	
LName	
AptNo	
St	
City	
PhonoNo	
StartDate	
EndDate	
Balance	
CurrentCharge	
TotalAmt	
DueDate	
LastPmtAmt	
LastPmtDate	
EMeterNo	
EUnitCharge	
ECurrentRead	
EPreviousRead	
EBilledUsage	
EBilledAmt	
GMeterNo	
GUnitCharge	
GCurrentRead	
GPreviousRead	
GBilledUsage	
GBilledAmt	
WMeterNo	
WUnitCharge	
WCurrentRead	
WPreviousRead	
WBilledUsage	
WBilledAmt	

2) the Access tables that conform to 2NF, and explanation of what partial dependencies you have found and how you removed them

Partial Dependencies: find out if a part of a composite PK could determine other non-key attributes

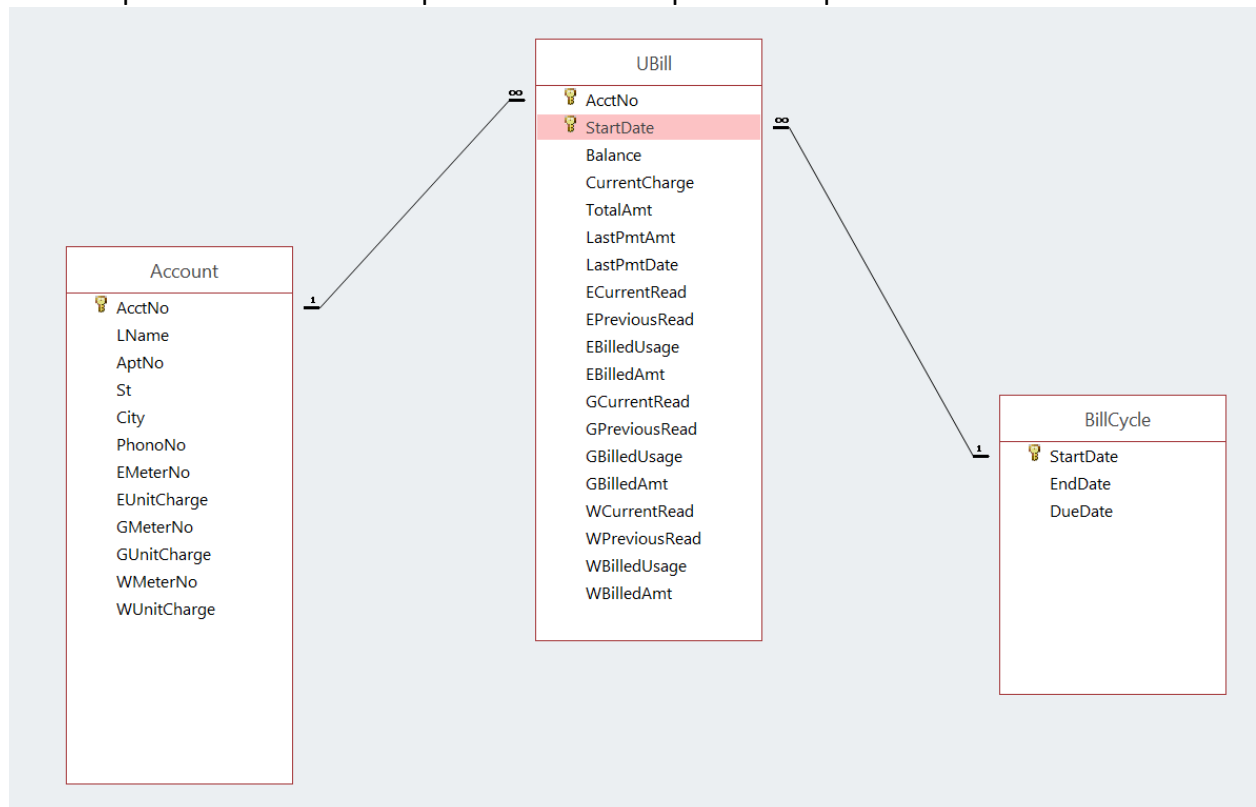
AcctNo → FName, LName, AptNo, St, City, PhoneNo, EMeterNo, EUnitCharge, GMeterNo, GUnitCharge, WMeterNo, WUnitCharge: these attributes are all determined by Account number alone and they have nothing to do with Bill Start Date

StartDate → EndDate, DueDate: these attributes are all determined by Bill Start Date alone and they have nothing to do with Account Number

AcctNo, StartDate → Balance, CurrentCharge, TotalAmt, LastPmtAmt, LastPmtDate, ECurrentRead, EPreviousRead, EBilledUsage, EBilledAmt, GCurrentRead, GPreviousRead, GBilledUsage, GBilledAmt, WCurrentRead, WPreviousRead, WBilledUsage, WBilledAmt:

Both of the Primary Keys determine the following attributes.

So we separate the table into 3 parts based on the previous dependencies



4) The data model that conforms to 3NF, and explanation of what transitive dependencies you have found and how you removed them

Transitive dependencies:

Find out if some non-key attributes could determine other non-key attributes, I found out:

EMeterNo → EUnitCharge

GMeterNo → GUnitCharge

WMeterNo-> WUnitCharge

EMeterNo, StartDate-> ECurrentRead, EPreviousRead, EBilledUsage, EBilledAmt

GMeterNo, StartDate-> GCurrentRead, GPreviousRead, GBilledUsage, GBilledAmt

WMeterNo, StartDate-> WCurrentRead, WPreviousRead, WBilledUsage, WBilledAmt

So we separate the table into more parts based on the previous dependencies

