**IST659 – Data Admin Concepts & Db Mgmt**

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**Problem 1:** **Hierarchical Database Model**



**Problem 2: Supertype and Subtype**



**Problem 3: Data Normalization**

**Functional Dependencies:**

Account Number First Name, Last Name, Address, Phone

Bill ID Bill Start Date, Bill End Date, Bill Due Date, Last Payment Amount, Last Payment Due

Voice Plan ID Minutes, Per Minute Charge, Voice Amount

Text Plan ID Number of Texts, Per Text Message Charge, Text Amount

Data Plan ID MB used, Per MB Charge, Data Amount

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1. **1NF:**

At this level of normalization, the entire form and its contents are stores in a single table. With interconnected dependencies the table appears to be highly complex and difficult to comprehend.



1. **2NF**: **Removing Partial Dependencies**

In this normalization step, I removed the partial dependencies of the attributes such as minutes, per minute charge, MB used, Per MB charge and few more. By creating a new entity for Text, Data and Voice we therefore make sure that the non-key attributes depend only on the primary and nothing else. Yet, there is a transitive dependency in the ‘Wireless Bill Summary’ entity which will be addressed in the next normalization step.

Voice Plan ID Minutes, Per Minute Charge, Voice Amount

Text Plan ID Number of Texts, Per Text Message Charge, Text Amount

Data Plan ID MB used, Per MB Charge, Data Amount

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1. **3NF: Removing Transitive Dependencies**

In the final normalization step, we deal with the transitive dependency in the ‘Wireless Bill Summary’ entity. Here, the transitive dependency exists between details regarding the customer and the customer id. Thus, to remove this dependency we can create a new entity to hold the customer details.

Account Number First Name, Last Name, Address, Phone

Bill ID Bill Start Date, Bill End Date, Bill Due Date, Last Payment Amount, Last Payment Due

Now the non-key determinant i.e. ‘Customer ID’ becomes the primary key of the newly created entity and stays as the Foreign Key in the old table. Also, to facilitate the relationship between the Data, Text & Voice tables and the Bill Summary table we include the ‘Voice Plan ID’, ‘Data Plan ID’ and ‘Text Plan ID’ to the latter and ‘Account ID’ and ‘Bill ID’ in the former as foreign keys.

I have created the Text/Data/Bill entities in such as way that we can link these tables with both the ‘Bill Summary’ and ‘Account Details’ entity. This can be used to trace the usage details back to customer through the Account ID attribute. Here, I used just the ‘Account ID’ attribute and no ‘Customer ID’ is because of the business rule where one account can be held by only one customer.

The ‘Total Amount’ attribute in the ‘Bill Summary’ entity is like the ‘Ordered Quantity’ attribute from the lecture example. The ‘Total Amount’ attribute derive its value from the attributes like ‘Text amount’, ‘Data Amount’ and ‘Voice Amount’ entities through the each and every plan id foreign key.

