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Database Design

6-3

Second Normal Form

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Objectives

- This lesson covers the following objectives:
  - Define the rule of Second Normal Form in the normalization process
  - Examine a non-normalized entity and determine which rule, or rules of normalization are being violated
  - Apply the rule of Second Normal Form to resolve a violation in the model

Purpose

- Your goal as a database designer is to “store information in one place only and in the best possible place”
- Consistently applying the rules of normalization helps you achieve this goal
- When organizing information such as your friends’ phone numbers and addresses, you want to make sure that you store that information in the appropriate place -- such as a personal address book

Purpose

- If you store a friend's address in your recipe box, for instance, you may not find it until the next time you look up that recipe
- Normalization is a process that helps eliminate these kinds of problems

Second Normal Form Example

- Examine the entity PRODUCT SUPPLIER
- The UID is a composite UID consisting of the supplier number and the product number
- If one supplier supplies 5 different products, then 5 different instances are created
- What happens if the supplier name changes?

Second Normal Form Example

- The supplier name would then need to be changed in 5 different instances
- What if some of them were changed, but not others?
- How would users know which name is the correct name?

The supplier name is dependent only on part of the UID – the supplier number.

Second Normal Form Description

- Second Normal Form (2NF) requires that any non-UID attribute be dependent on (be a property of, or a characteristic of) the entire UID
- Is purchase price a property of supplier number, product number, or both?

Following the rules of 2NF allows us to validate that every attribute is in the correct entity, and identify entities that may have been missed in our original ERD.

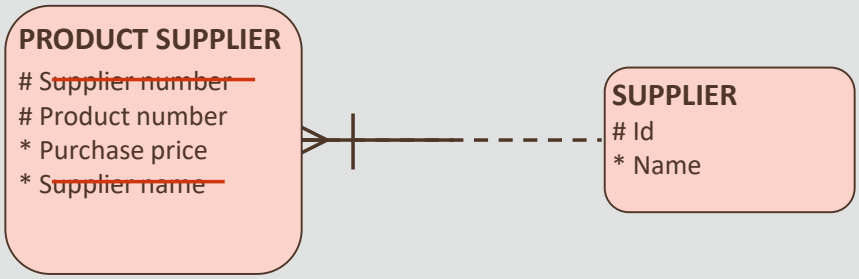
Note that the rule of Second Normal Form states that any non-UID field must be dependent on the entire UID.

An entity is considered to be in 2NF if the UID of the entity is simple.

Memory aid: “every non-UID attribute must be dependent on the whole UID” (not just part of it).

Second Normal Form Description

- Is supplier name a property of supplier number, product number, or both?
- 2NF requires a “both” answer to each question



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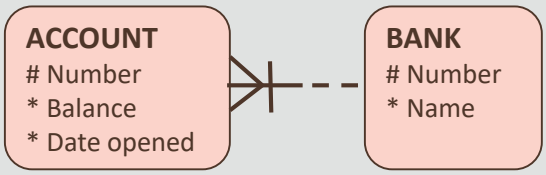
Following the rules of 2NF allows us to validate that every attribute is in the correct entity, and identify entities that may have been missed in our original ERD.

To convert the example shown to 2NF, we need to Create a SUPPLIER entity (if it does not already exist), and move the supplier name attribute to the SUPPLIER entity.

In this case, we can also remove the supplier number from the PRODUCT SUPPLIER entity, and replace it with a Barred Relationship.

Second Normal Form Bar Relationship

- The UID for ACCOUNT is a composite UID from a barred relationship consisting of ACCOUNT number and BANK number
- Is balance a property of ACCOUNT number, BANK number, or both?
- Is date opened a property of ACCOUNT number, BANK number, or both?



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This slide example is in 2NF. Both non UID attributes are dependent on both Account number and Bank number.

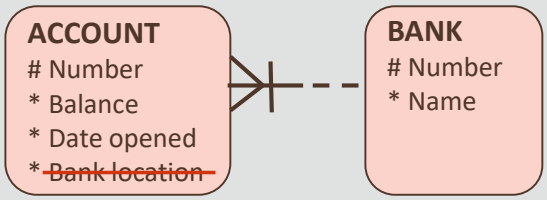
Remember that the Barred Relationship is part of the UID. The UID for ACCOUNT is the combination of ACCOUNT number and BANK number (from the Barred relationship).

For example: account number: 12345. John Smith may have this account number at First National Bank. Maria Santos may have the same account number, but at a different bank.

Account numbers themselves may not be unique, but they are unique within a bank – that is why the bank number is part of the unique identifier of an account

Second Normal Form Violation

- In this ERD, the attribute bank location has been added. Is bank location a property of ACCOUNT number, BANK number, or both?
- It is a property of BANK number only and is thus misplaced, this is a violation of Second Normal Form
- What would happen if a bank's location changed?
- Every account at that bank would need to be updated



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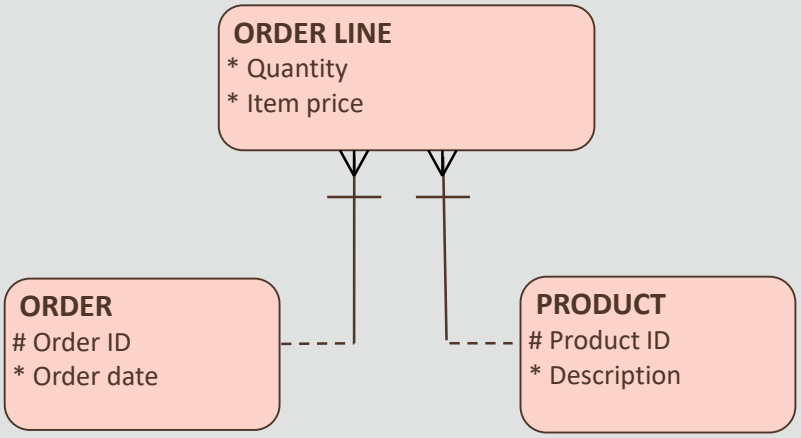
Review the UID of ACCOUNT. It is bank number and account number. Analyze the other non-UID attributes in the ACCOUNT entity, and ask yourself the following:
What do you need in order to find out:
The account balance? - You need to know both the account number and the bank number.
The date opened? - You need to know both the account number and the bank number.
The bank location? - You need to know only the bank number, as all accounts at that bank will have the same location.

This is a violation of 2NF, as the bank location attribute is not dependant on the entire UID for ACCOUNT.

This attribute should therefore be removed from ACCOUNT and placed in the BANK entity.

Order ERD

- What is wrong with this diagram?



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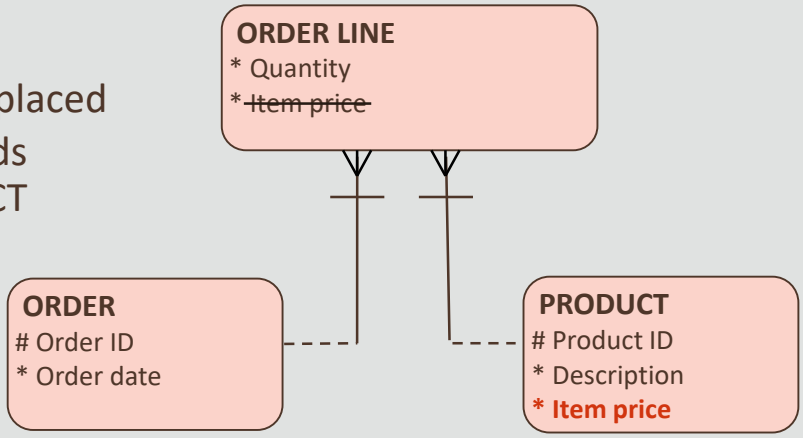
The UID for ORDER LINE comes from the barred relationships, so it is a combination of Order id and Product id.

Examine the non-UID attributes and ask:
What do you need to know to find the Quantity – you need to know the Order id and the Product id.
What do you need to know to find the Item Price – you need to know only the Product id. So this attribute is in the wrong place. Remove from the ORDER LINE entity and place in the PRODUCT entity.

Order ERD

- The ERD is now in 2NF
- Answer:
  - The price attribute was misplaced
  - Item Price depends solely on PRODUCT
  - This is a violation of Second Normal Form



Terminology

- Key terms used in this lesson included:
  - Second Normal Form (2NF)

Summary

- In this lesson, you should have learned how to:
  - Define the rule of Second Normal Form in the normalization process
  - Examine a non-normalized entity and determine which rule, or rules of normalization are being violated
  - Apply the rule of Second Normal Form to resolve a violation in the model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