Session 3-1 Relational Model

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Three Schemas and Logical Data Modeling

Conceptual Model

Physical Model

Requirements → **ERD** → Set of **Relations/ Tables** → **DDL** (Security/ Constraints/ Views)

Logical Model (Relational Schema)
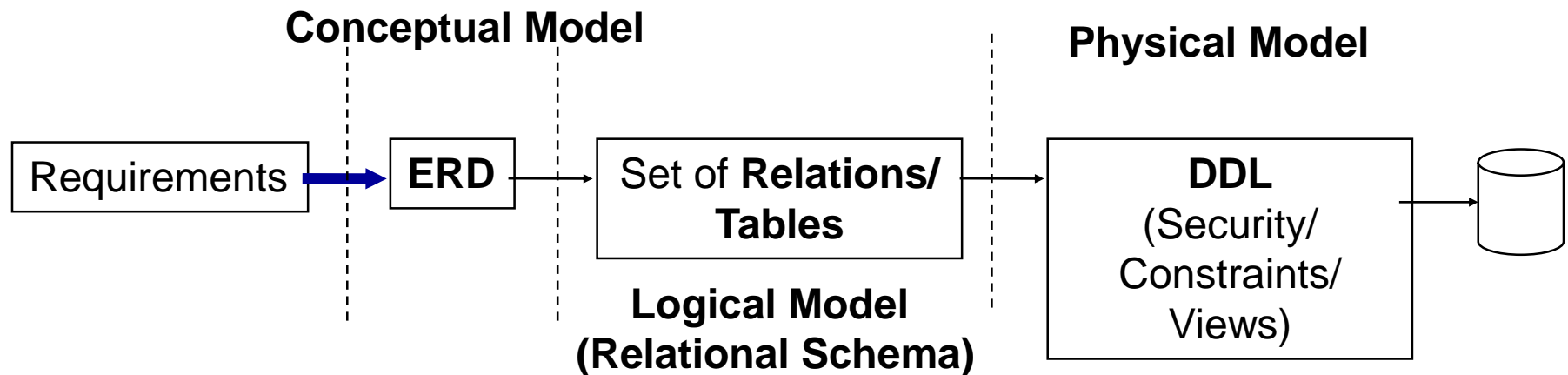
Logical Database Design

- The process of converting ERDs into *relational database models*

- Normalization
  - Prepare data models for implementation as a non-redundant, flexible, and adaptable database

Relational Database Model

- Represents data in the form of tables or relations (Invented by Codd, 1970)
- **Relation:** two-dimensional table of data
  - Columns (attribute, field): attributes of a relation
  - Rows (tuple, record, instance): records containing data values for an entity
  - Primary key (identifier)
  - Foreign key (relationship)

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Properties of a relation

- It must have a unique name
- Attributes (columns) in tables must have unique names
- Every attribute value must be atomic (not multivalued, not composite)
- Every row must be unique (can't have two rows with exactly the same values for all their fields)

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Relational Model Example

DeptNo	DeptName	DeptBudget
1	Marketing	220,000
2	Operations	400,000
3	Accounting	100,000

DEPARTMENT
Table

Primary Key

Foreign Key

DEPARTMENT (DeptNo, DeptName, DeptBudget)
EMPLOYEE (EmpNo, EmpName, SSN, DeptNo)

E			
1	Smith, Joseph	111-11-1111	3
2	Jones, David	222-22-2222	2
3	Olson, Jane	333-33-3333	3
4	Neff, Arnold	444-44-4444	1
5	Homes, Denise	555-55-5555	1
6	Naumi, Susan	666-66-6666	2
7	Young, John	777-77-7777	3

EMPLOYEE
Table

*Row(Record, Tuple)*

Column (Field, Attribute)

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Correspondence with E-R Model

- **Relations (tables)** correspond with **entity types** and with many-to-many relationship types

- **Rows** correspond with **entity instances** and with many-to-many relationship instances

- **Columns** correspond with **attributes**

- **NOTE:** The word *relation* (in relational database) is NOT the same as the word *relationship* (in E-R model)

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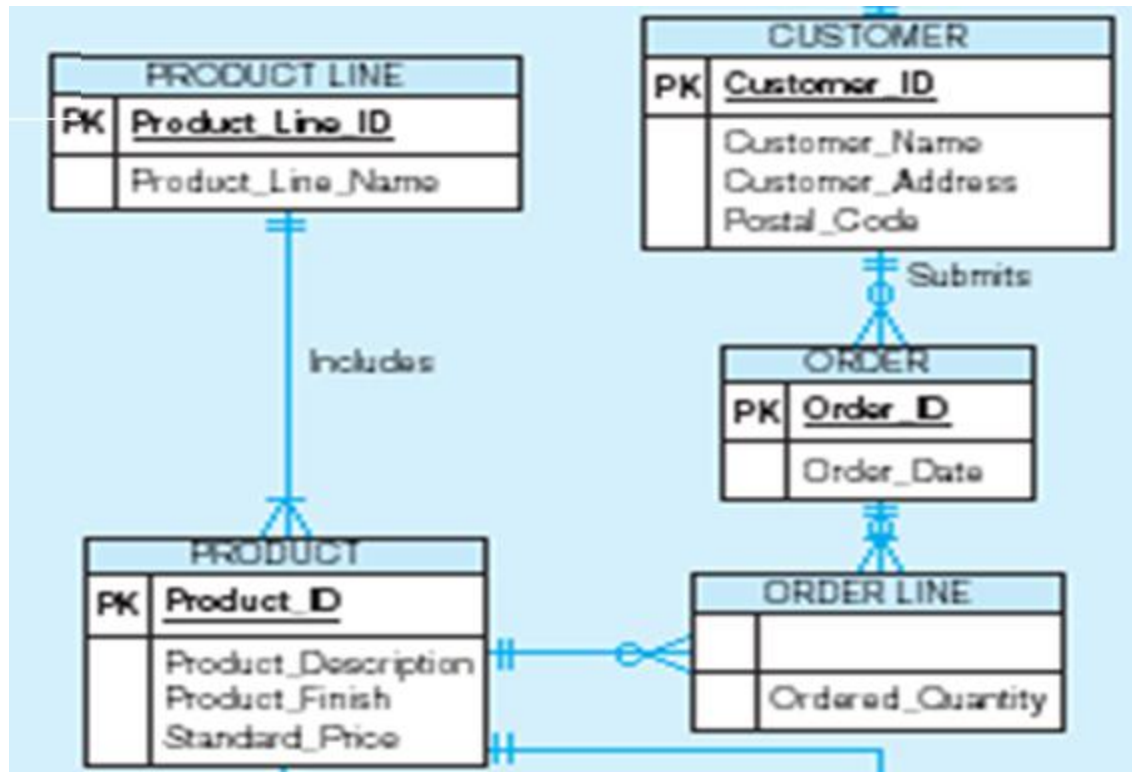Mike Ilitch School of Business
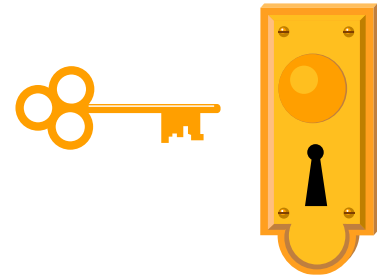
Key Fields

- ***Primary keys*** *to guarantee all rows are unique*
  - <u>unique</u> identifiers of the relation in question (e.g., employee ID, social insurance numbers, etc.)
- ***Foreign keys*** *to establish the relationships among relations*
  - identifiers that enable a <u>dependent</u> relation (on the many side of a relationship) to refer to its <u>parent</u> relation (on the one side of the relationship)
- Can be simple (a single field) or composite (more than one field)
- Usually used as indexes to speed up the response to user queries
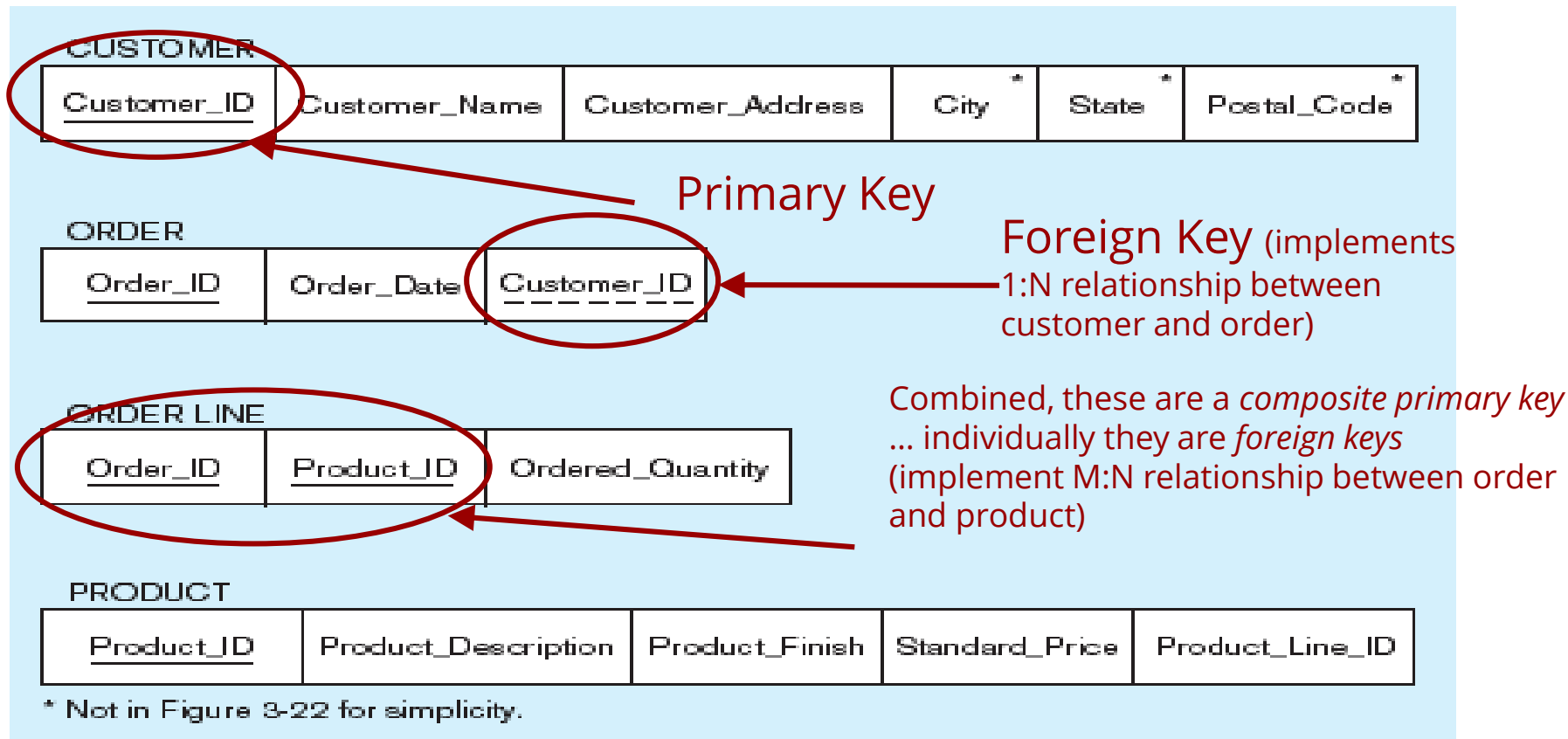
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ERD to Relational Model

Replace it with one with a better resolution

ERD to Relational Model (cont'd)

CUSTOMER

Customer_ID	Customer_Name	Customer_Address	City *	State *	Postal_Code *

Primary Key

Foreign Key (implements 1:N relationship between customer and order)

ORDER

Order_ID	Order_Date	Customer_ID

ORDER LINE

Order_ID	Product_ID	Ordered_Quantity

Combined, these are a *composite primary key* ... individually they are *foreign keys* (implement M:N relationship between order and product)

PRODUCT

Product_ID	Product_Description	Product_Finish	Standard_Price	Product_Line_ID

* Not in Figure 3-22 for simplicity.

Text Description of Relations

- CUSTOMER(<u>Customer_ID</u>, Customer_Name, Customer_Address,City,State,Postal_Code)

- ORDER(<u>Order_ID</u>,Order_Date,Customer_ID)

- ORDER LINE(<u>Order_ID</u>,<u>Product_ID</u>, Ordered_Quantity)

- PRODUCT(<u>Product_ID</u>,Product_Description, Product_Finish,Standard_Price, Product_Line_ID)

Wrap-Up

- Relational database model
  - Relation
  - Properties of a relation
  - Primary key
  - Foreign key
- Mapping between ERD and relational model

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