# TEMPLE UNIVERSITY
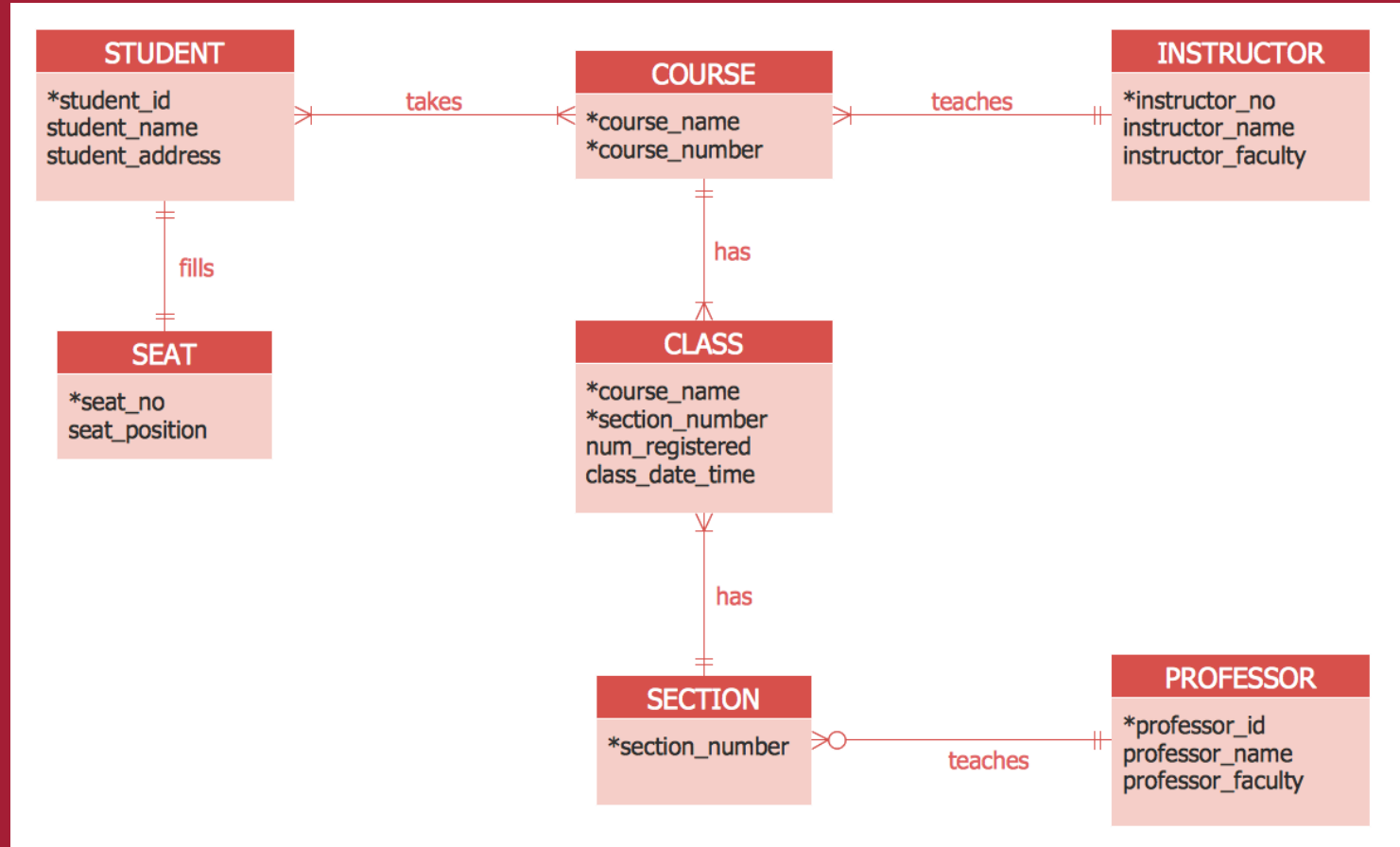
# Digital Systems

3.1 Data Modeling with
Entity Relationship Diagrams (ERDs)

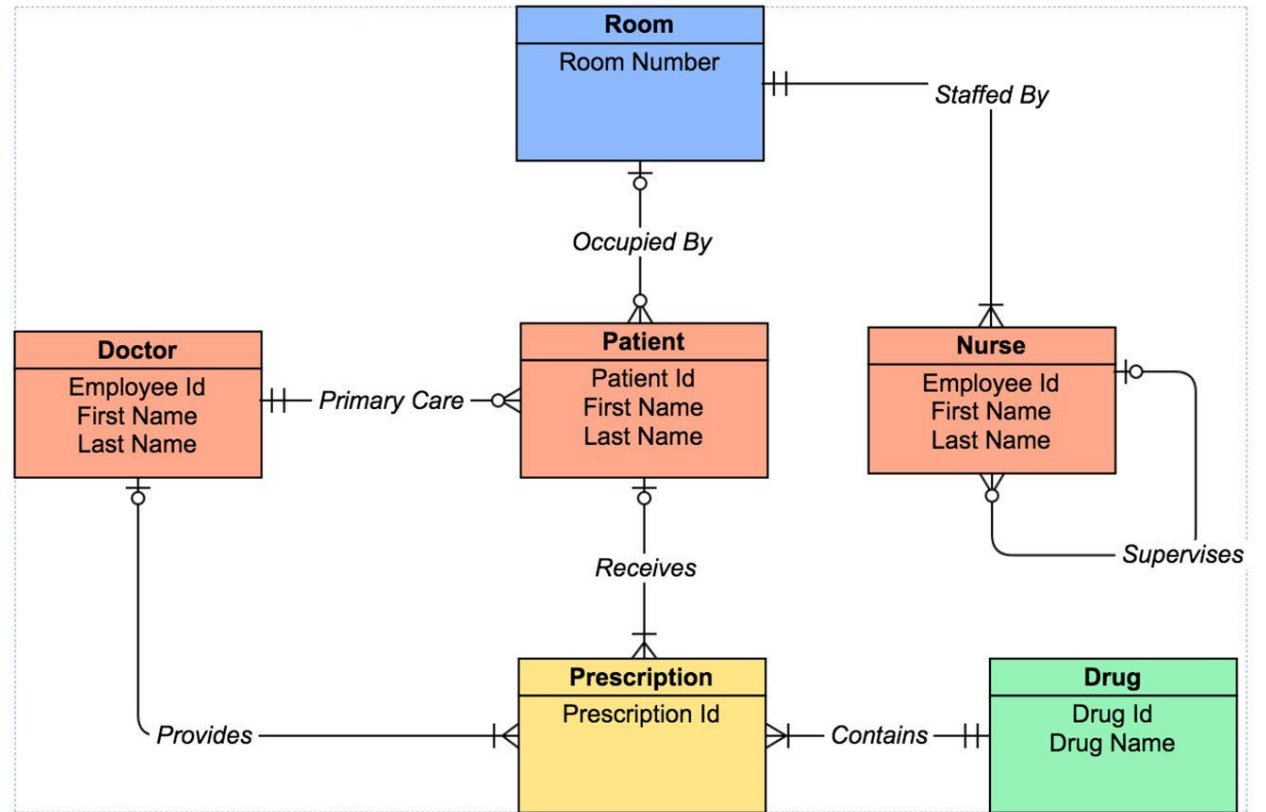**FOX MIS**

# What is an "Entity Relationship Diagram"?



Data Model

Entity = Noun | Attribute = Adjective | Relationship = Verb

# What is an Entity Relationship Diagram?

❖ An Entity Relationship Diagram (ERD) is a visual representation of different data using conventions that describe how these data are related to each other.
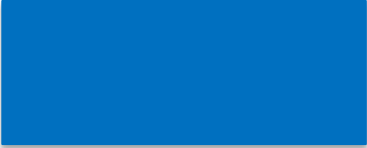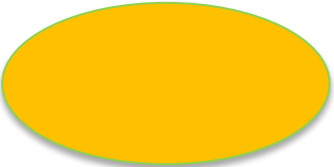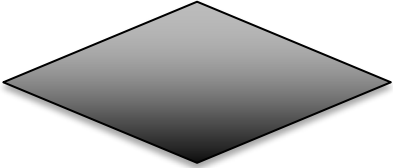
# ERD Symbols

1. Chen's Database Notation

2. Crow's Foot Database Notation

# ERD Symbols

Chen's Database Notation

# Chen's Database Notation

| Symbol | Description |
|---|---|
| | **Entity = noun**<br>ex: shopper, item |
| | **Attribute = adjective/characteristic**<br>ex: item price |
| | **Relationship = verb**<br>ex: buys |

# Chen's Database Notation

A shopper walks into a store to buy an item. When the shopper makes a purchase, the system is updated with information about the person, including their name, loyalty card id and zip code. The store also records which items were purchased, including details like item name, price and item source.

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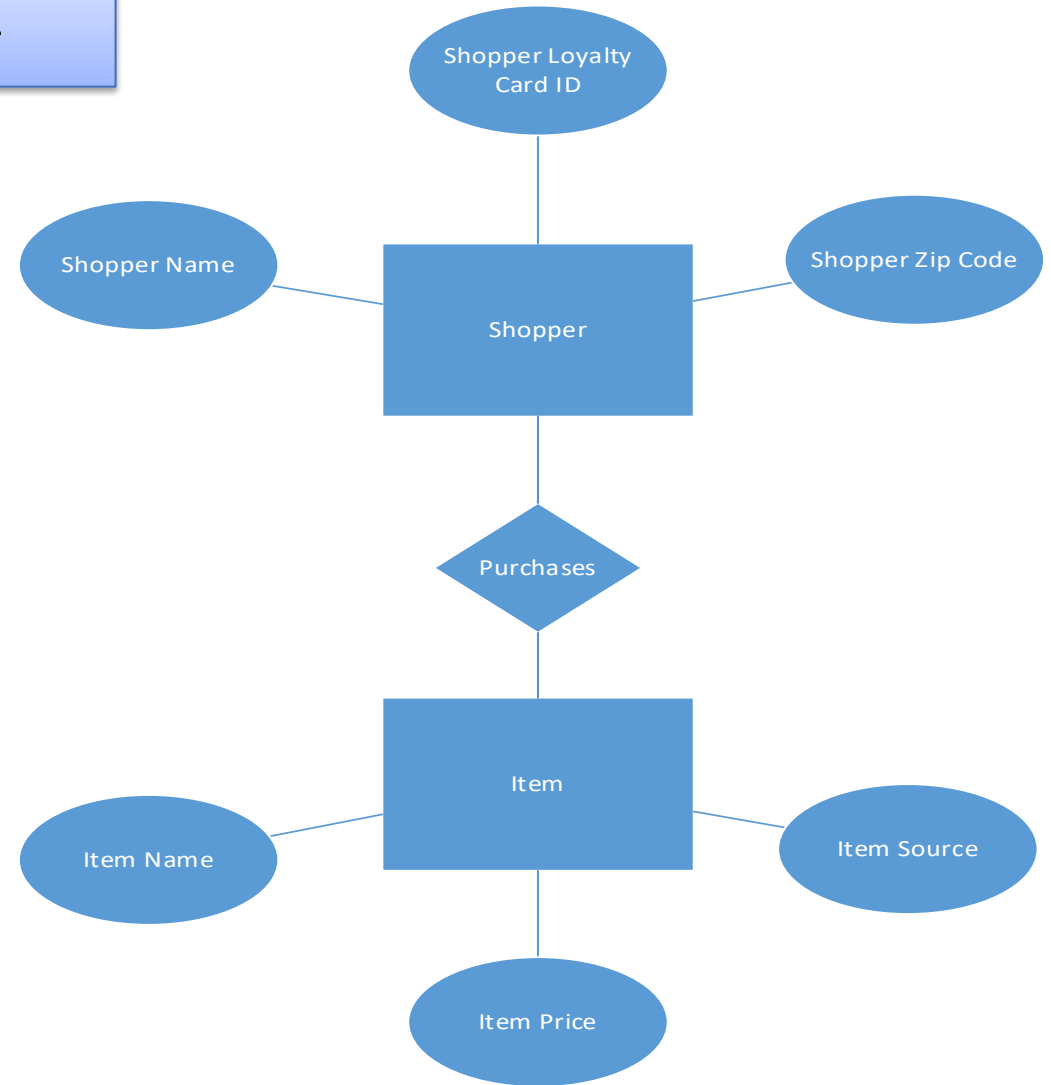
# Chen's Database Notation

Entity Relationship Diagram (ERD)
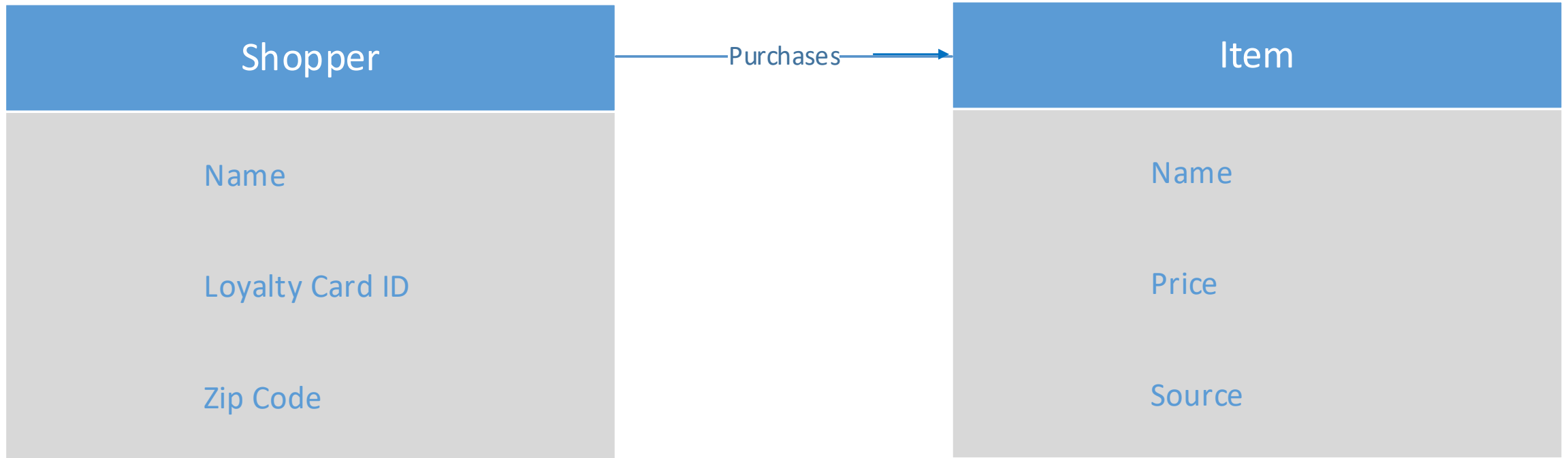
# ERD Symbols

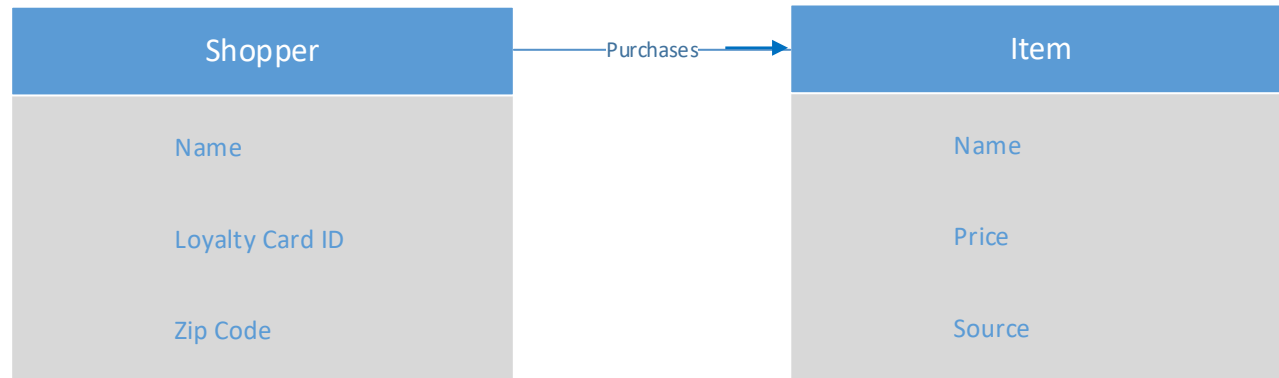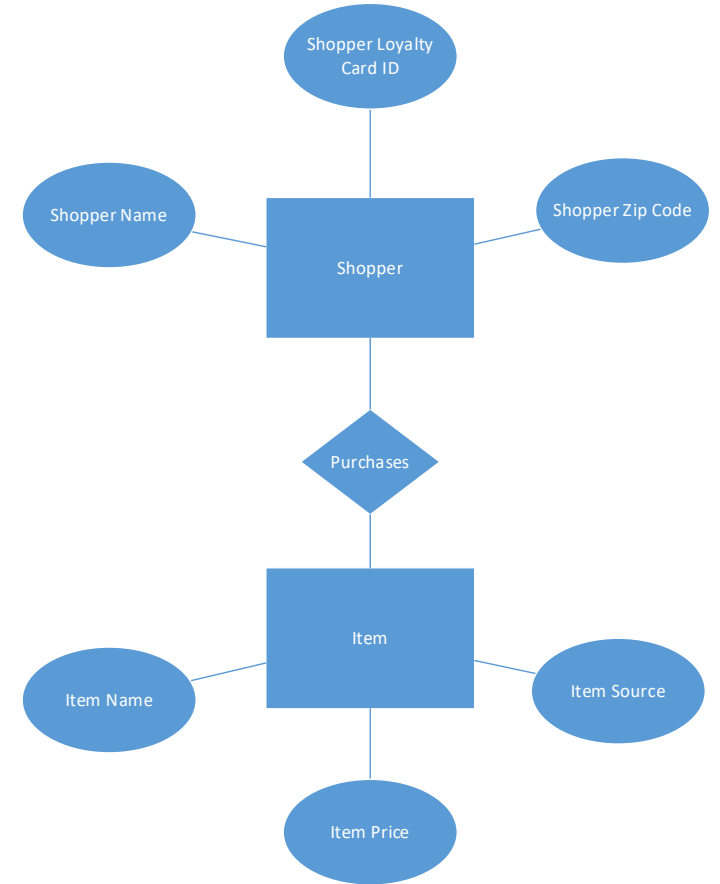Crow's Foot Database Notation

# Crow's Foot Database Notation

| Shopper |
| --- |
| Name |
| Loyalty Card ID |
| Zip Code |

Purchases →

| Item |
| --- |
| Name |
| Price |
| Source |

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# Entity Relationship Diagram: Recap

A shopper walks into a store to buy an item. When the shopper makes a purchase, the system is updated with information about the person, including their name, loyalty card id and zip code. The store also records which items were purchased, including details like item name, price and item source.

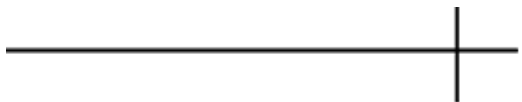| Shopper | |
|---|---|
| Name | |
| Loyalty Card ID | |
| Zip Code | |

Purchases →

| Item | |
|---|---|
| Name | |
| Price | |
| Source | |

**Crow's Foot Database Notation**

Shopper Loyalty Card ID

Shopper Name — Shopper — Shopper Zip Code

Purchases

Item Name — Item — Item Source

Item Price

**Chen's Database Notation**

# Cardinality in Data Modeling: Relationships

Cardinality describes a fundamental characteristic of the relationship between two entities.

| Symbol | Description |
|--------|-------------|
|  | One (Mandatory one) |
|  | Many (Mandatory many) |
|  | Zero or one (Optional one) |
|  | Zero or many (Optional many) |

# Cardinality in Data Modeling: Relationships
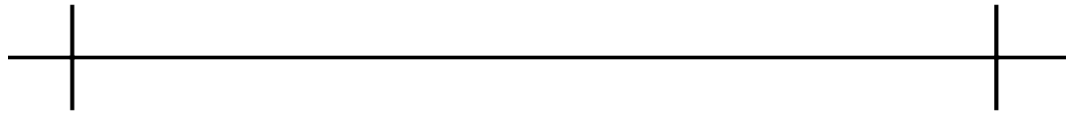
**1:1** = a **one to one** relationship
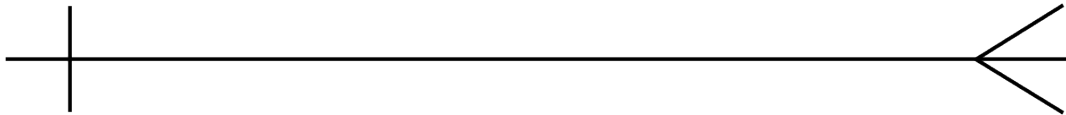
**1:m** = a **one to many** relationship
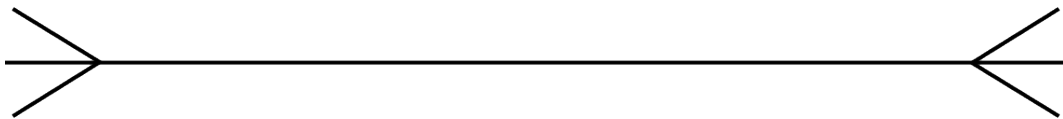
**m:m** = a **many to many** relationship

# Cardinality in Data Modeling: Relationships

❖ Below is an example of a **1:1** relationship between *employee* and office.
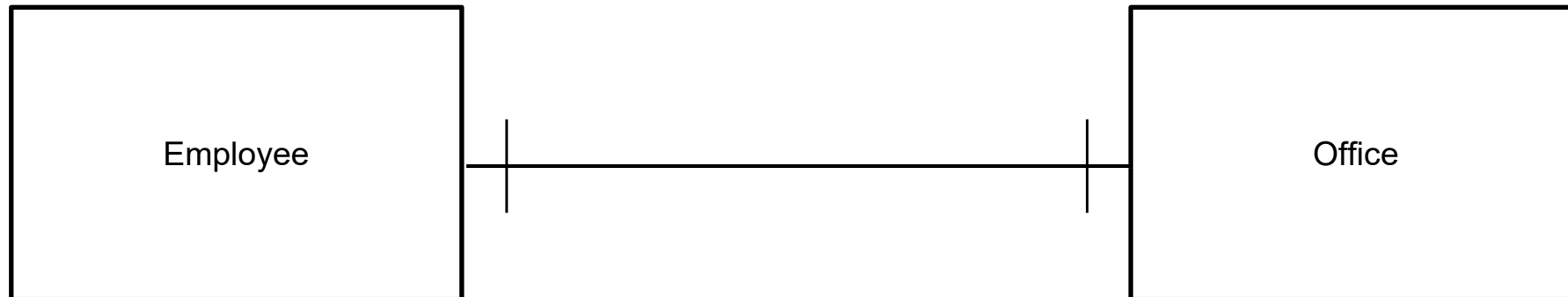
# Cardinality in Data Modeling: Relationships

❖ Below is an example of a **1:m** relationship between *customer* and *transaction*.

❖ These entities have a 1:m relationship because a customer can book multiple transactions, but a transaction belongs to one and only one customer.



Customer —|———< Transaction

# Cardinality in Data Modeling: Relationships

❖ Below is an example of a **m:m** relationship between *library* and *book*.



Library ───<────────>── Book

# Cardinality in Data Modeling: Relationships
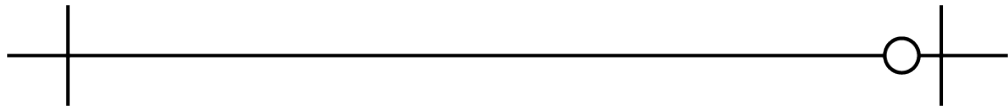
1:01 = a __one to zero or one__ relationship
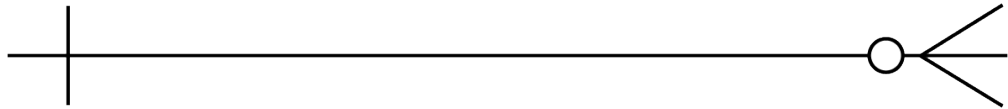
1:0m = a __one to zero or many__ relationship
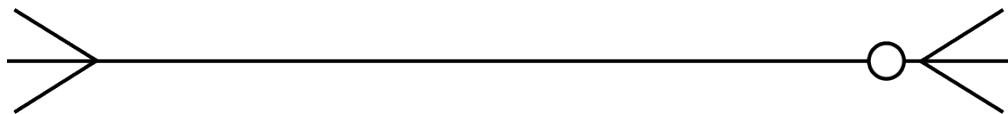
m:0m = a __many to zero or many__ relationship

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# Cardinality in Data Modeling: Relationships

❖ Below is an example of a **1:0m** relationship between *customer* and *product*.



Customer

Product
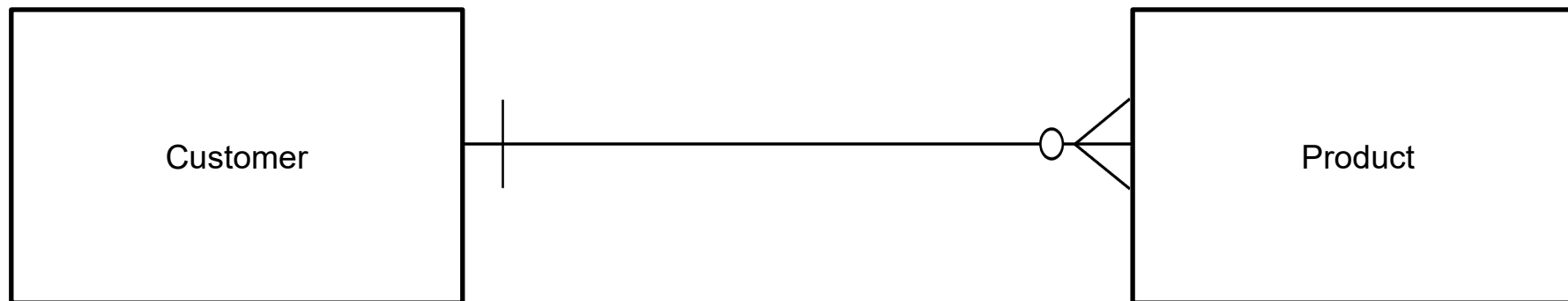
# Cardinality in Data Modeling: Relationships

The Organization modeled below displays a fitness center database system. Our fitness center consists of 7 employees and 1 primary location. We offer group classes and personal traning sessions to meet the needs all of our clients.
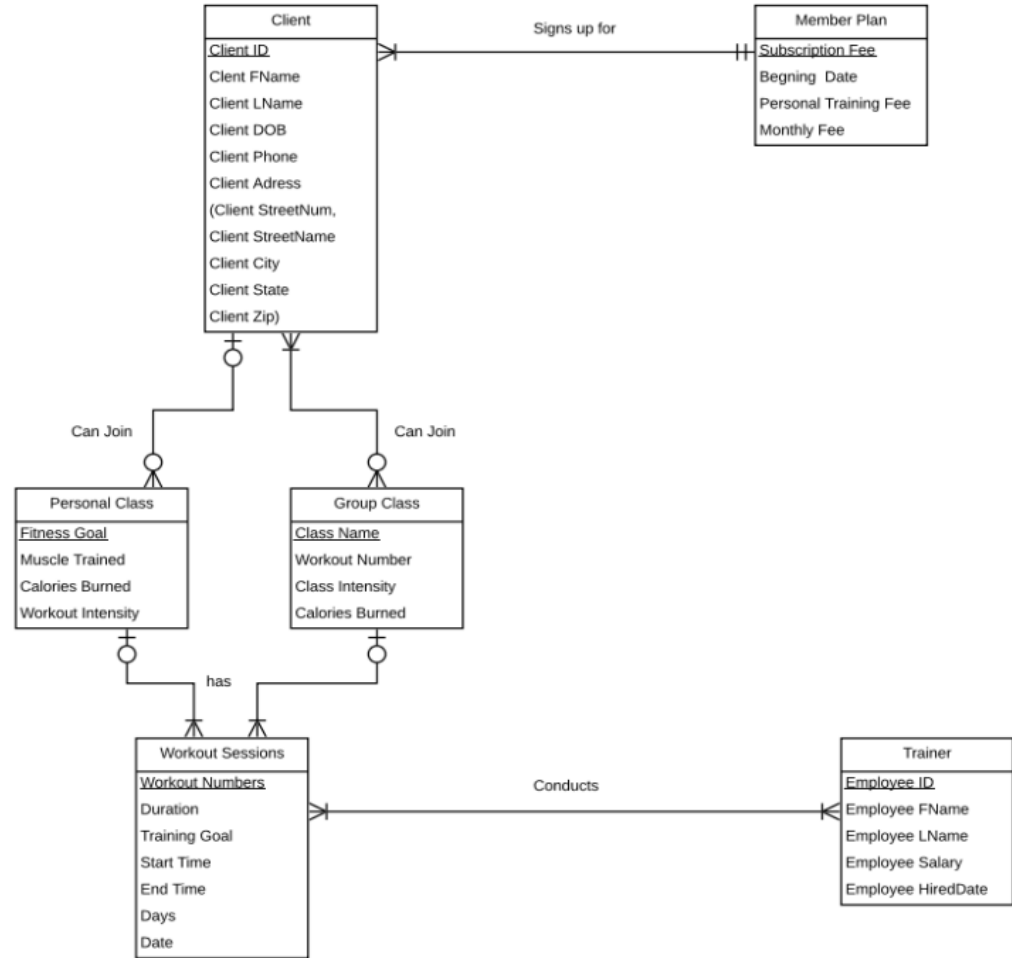


**Fitness Center**

# Order to Cash (O2C)

The process starts when the customer contacts Sales to place an order. The person in Sales creates the sales order. As part of doing this, the person in sales first checks to see if the customer has enough available credit to cover the order. They do this by looking up the customer's credit on a report that is generated by Accounting and sent to Sales every Monday morning. If the customer doesn't have enough available credit then the person in sales notifies the customer who can then either update or cancel their order. Next the person in sales checks to see if the items being ordered are in stock. They do this by checking a report on inventory that the Warehouse created at the end of each day. If the items being ordered are not in stock then the person in Sales notifies the customer who can then update or cancel their order. If the report indicates the items are in stock then the order goes to the Warehouse where the workers there will pick the order. Since Sales is looking at a report that is only updated at the end of each day, there is a chance that they accepted an order for an item that is not really in stock. If that is the case the Warehouse notifies Sales who then notifies the customer who can update or cancel their order...

# Order to Cash (O2C)

…Once the people in the warehouse pick the order, the people in Accounting have to make sure that the customer actually has enough credit to cover the order. Since the people in Sales use a credit report that is generated on Monday morning, there is a chance that the information on the credit report is old. If the customer doesn't have enough available credit then Accounting notifies Sales who then notifies the customer who can then choose to update or cancel their order. If the customer has enough available credit then their available credit is reduced by the total cost of the order and the warehouse is notified and they pack and ship the order. As soon as the order is shipped the people in the warehouse notify accounting and accounting generates and sends the invoice to the customer. When the customer pays the invoice the people in Accounting increase the customer's available credit by the amount of the payment, they post the payment and we're done.

# Order to Cash (Legacy Systems Low-Level)



**Customer** | Place Order → Update or Cancel Order? (Update / Cancel) | Pay Invoice

**Sales** | Create (or Update) Sales Order → *Credit Available? (No / Yes) → **In Stock (No / Yes) → Notify Customer

**Warehouse** | Pick Order → In Stock? (No / Yes) → Pack and Ship Order

**Accounting** | Credit Available? (No / Yes) → Reduce Available Credit → Invoice Customer | Post Payment → Increase Available Credit

What pieces of information do I need to take, check, ship and bill the customer for this order?

Work with you classmate to make a list.

* Credit maintained by Accounting in accounting information system and reported to Sales every Monday morning.
** Inventory maintained by Warehouse in inventory management system and reported to Sales at end of day
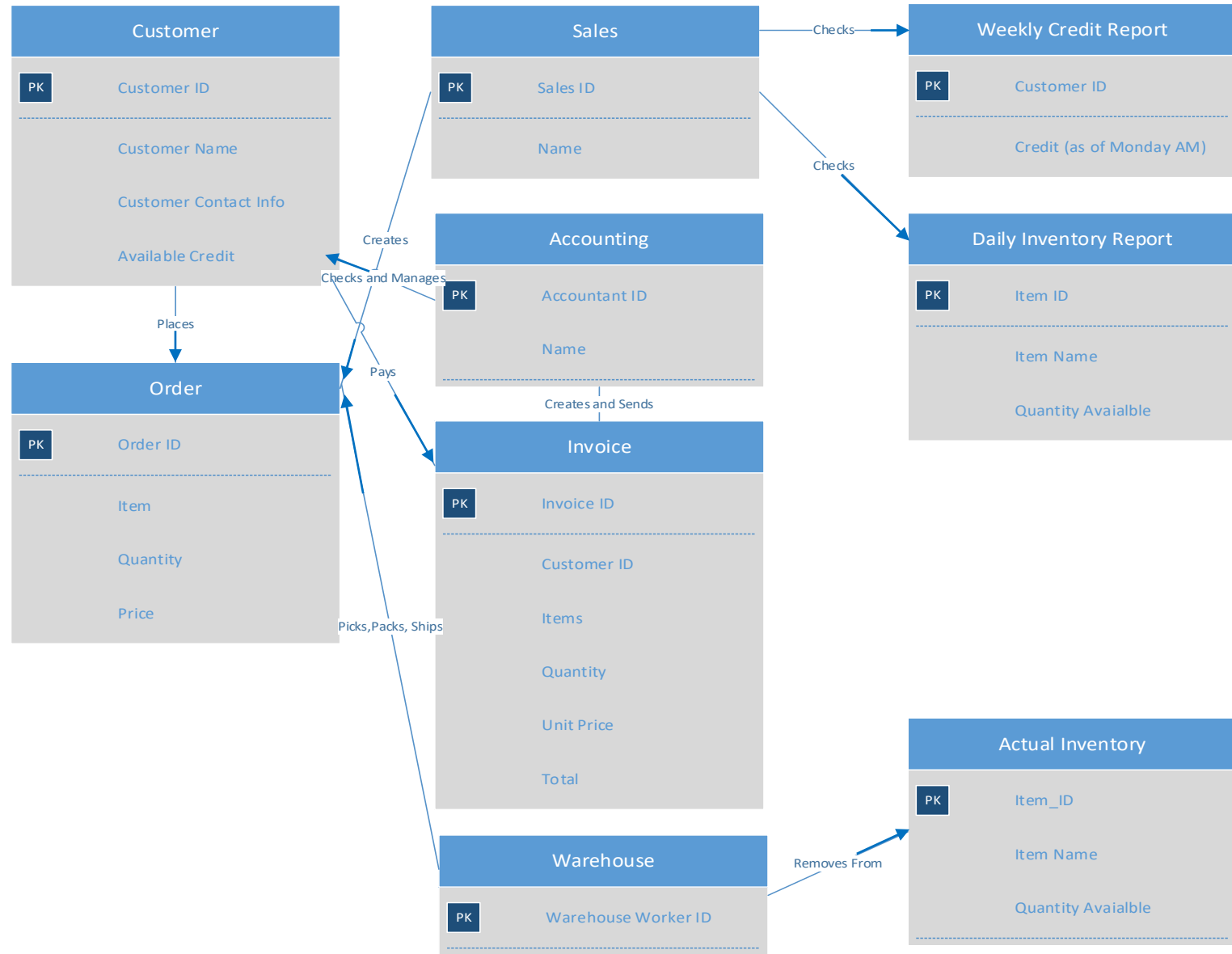
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# ERD: tables

- Relationship, i.e. verb is written on the arrow
- Entity listed at the top of the table
- Attributes are listed under the entity

Legend :
- PK : Primary Key

# More to Come

Prepare with Readings & Videos before our next class!!!