The University of Texas at Austin
McCombs School of Business

MIS 381N – INTRO. TO DATABASE MANAGEMENT

Conceptual Design

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QUESTIONS

Any questions

before we begin …

AGENDA

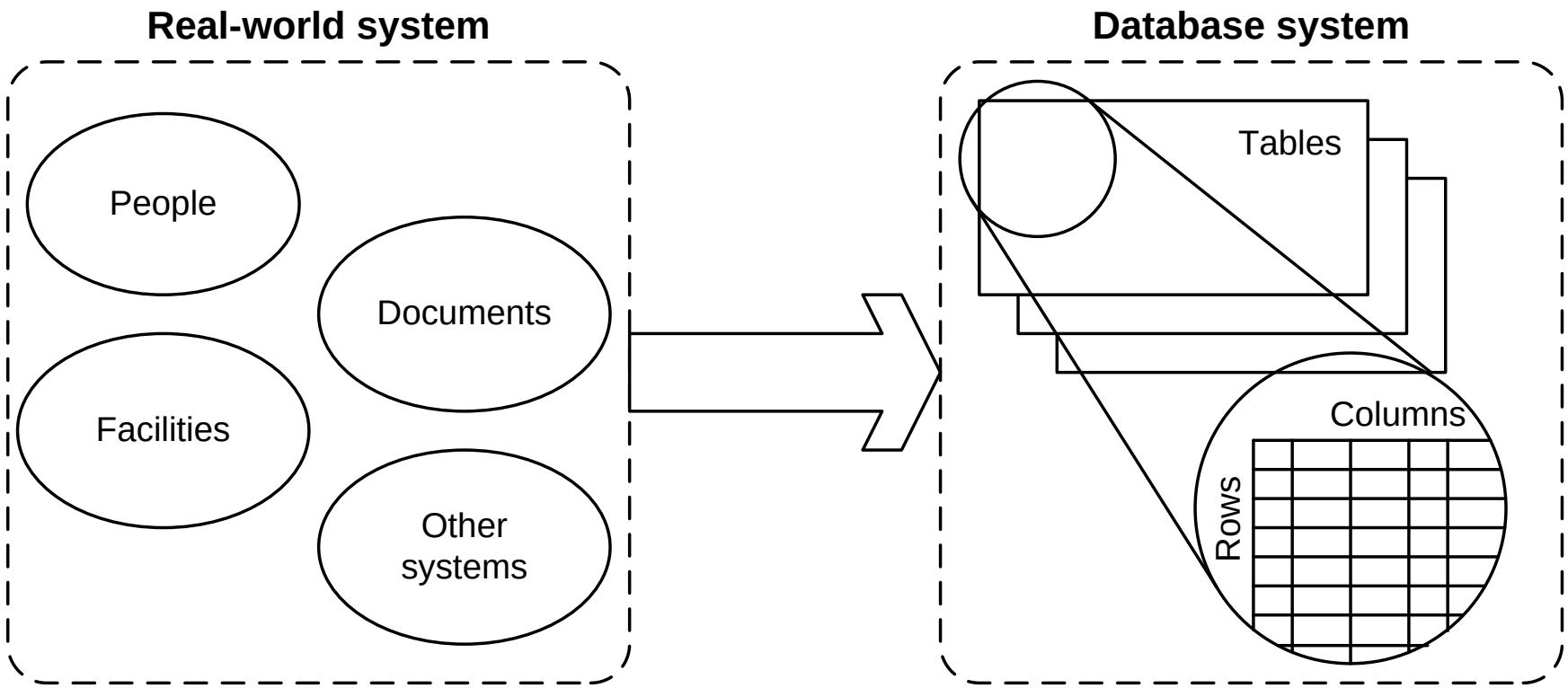
Lecture	**Conceptual Design**
Discussion	**Hands-on exercise** **Accounts payable**
Looking Forward	**Read chapters 1 and 9** **Homework 1**

QUESTION

Why would you need a database?

Where do we get the data (tables, columns, rows?)

A DATABASE SYSTEM IS MODELED AFTER A REAL-WORLD SYSTEM



A model is a ”representation” of the real-world

DESIGNING THE DATA MODEL

Conceptual Model

Non-technical English language statements developed collaboratively that articulate the role of data in the business

Logical Model

Conceptual model translated into entities and relationships using Entity-Relationship modeling tools

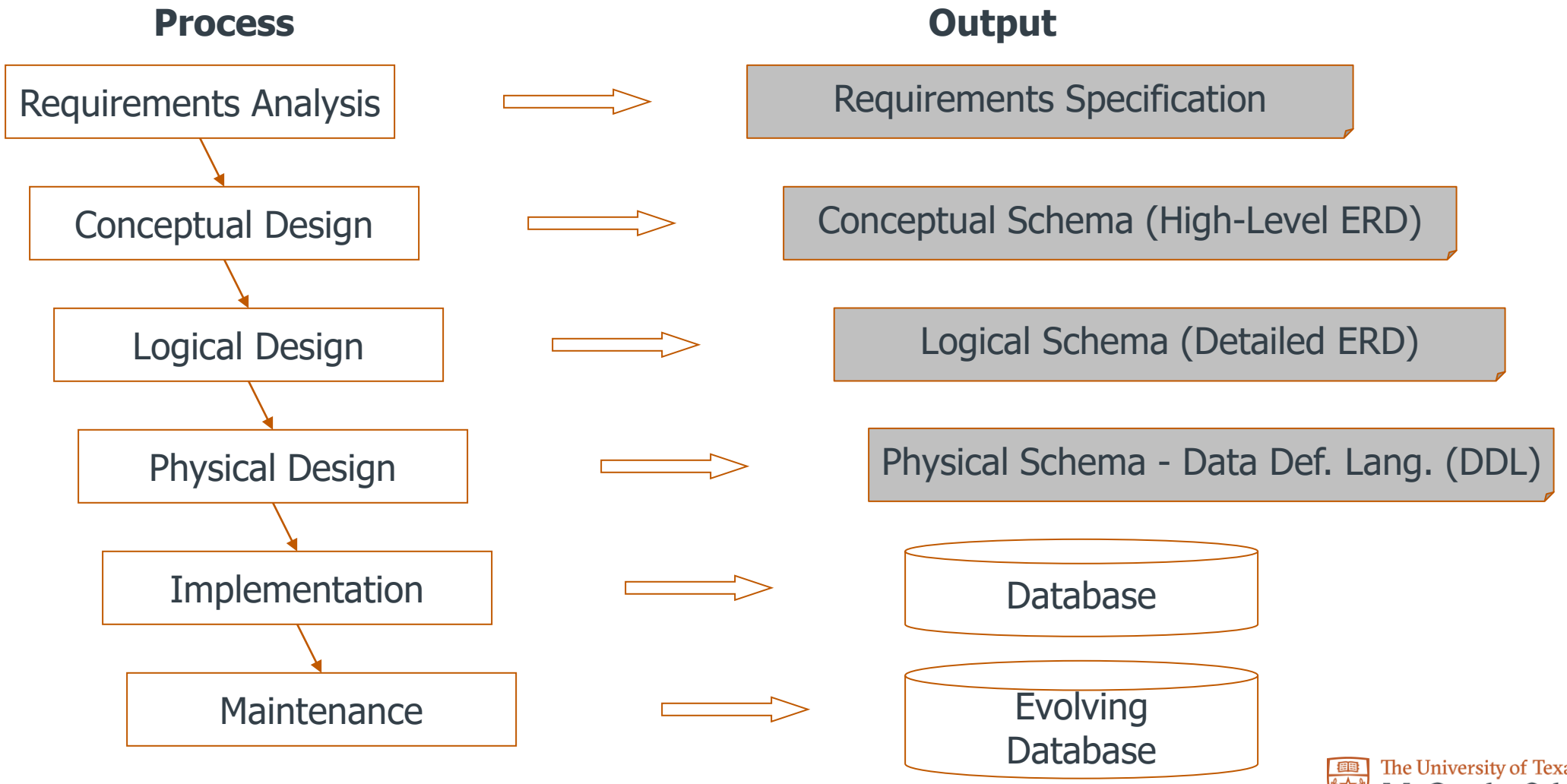
Physical Model

Conversion of logical data model into definitions of tables and columns (database).

CONCEPTUAL MODEL

- **Top-down**
  Start with strategic conversations with stakeholders to articulate the conceptual model in simple easy to understand English language statements.
- **Bottom-up**
  Start with artifacts, documents and systems analysis to articulate the conceptual model in simple easy to understand English language statements.
- Both approaches should lead to the same place

PHASES OF DATABASE DESIGN



REVIEW QUESTION

What are the (three) main types of relationships?

WHAT DO WE DO IN THE CASE OF THESE RELATIONSHIPS?

- One-to-one relationship
  - Combine into one table
- One-to-many relationship
  - Keep these separated into two tables
- Many-to-many relationship
  - Link these two tables with a third join/linking/bridge table

ASSOCIATIVE ENTITY

- A base relation to resolve many-to-many relationships
- They’re known under many names:
  - association table, bridge table, cross-reference table, crosswalk, intermediary table, intersection table, join table, junction table, link table, linking table, many-to-many resolver, map table, mapping table, pairing table, pivot table (used incorrectly - not to be confused with the correct use of pivot table in spreadsheets), or transition table

6 BASIC STEPS FOR DESIGNING A DATA STRUCTURE

- **Step 1:** **Identify the data elements**
- **Step 2:** **Subdivide each element into its smallest useful components**
- **Step 3:** **Identify the tables and assign columns ***
- **Step 4:** **Identify (or assign) the primary and foreign keys ***
- Step 5: Review whether the data structure is normalized
- Step 6: Identify the indexes

*** Identify Entity Relationships Where Possible**

ACCOUNTS PAYABLE EXAMPLE

- Top-down conversation
  - We will receive invoices from several vendors.
  - Each vendors will have a different format for their invoice.
  - The invoice will include a vendor invoice number and a corresponding purchase order number issued by us.
  - Vendors will include their contact information on the invoices as well as their payment terms and the contract corresponding to those terms.
  - Invoices will include a total amount owed as well as line items of products and services that make up the total.

STEP 1: IDENTIFY THE DATA ELEMENTS

Acme Fabrication, Inc.

Custom Contraptions, Contrivances and Confabulations

1234 West Industrial Way East Los Angeles California 90022

800.555.1212 fax 562.555.1213 www.acmefabrication.com

Invoice Number:	I01-1088
Invoice Date:	10/05/06
Terms:	Net 30

Part No.	Qty.	Description	Unit Price	Extension
CUST345	12	Design service, hr	100.00	1200.00
457332	7	Baling wire, 25x3ft roll	79.90	559.30
50173	4375	Duct tape, black, yd	1.09	4768.75
328771	2	Rubber tubing, 100ft roll	4.79	9.58
CUST281	7	Assembly, hr	75.00	525.00
CUST917	2	Testing, hr	125.00	250.00
		Sales Tax		245.20

Your salesperson:	Ruben Goldberg, ext 4512
Accounts receivable:	Inigo Jones, ext 4901

$7,557.83

PLEASE PAY THIS AMOUNT

Thanks for your business!

Questions

- Which elements are relevant?
- Which elements are not relevant?
  - i.e., we don't need to store it
- What elements are missing that we should store?

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$7,557.83

PLEASE PAY THIS AMOUNT

Thanks for your business!

- Vendor name
- Vendor address
- Vendor phone number
- Vendor fax number
- Vendor web address
- Invoice number
- Invoice date
- Invoice terms
- Item part number
- Item quantity
- Item description
- Item unit price
- Item extension
- Vendor sales contact name
- Vendor sales contact ext
- Vendor AR contact name
- Vendor AR contact ext
- Invoice total

QUESTION

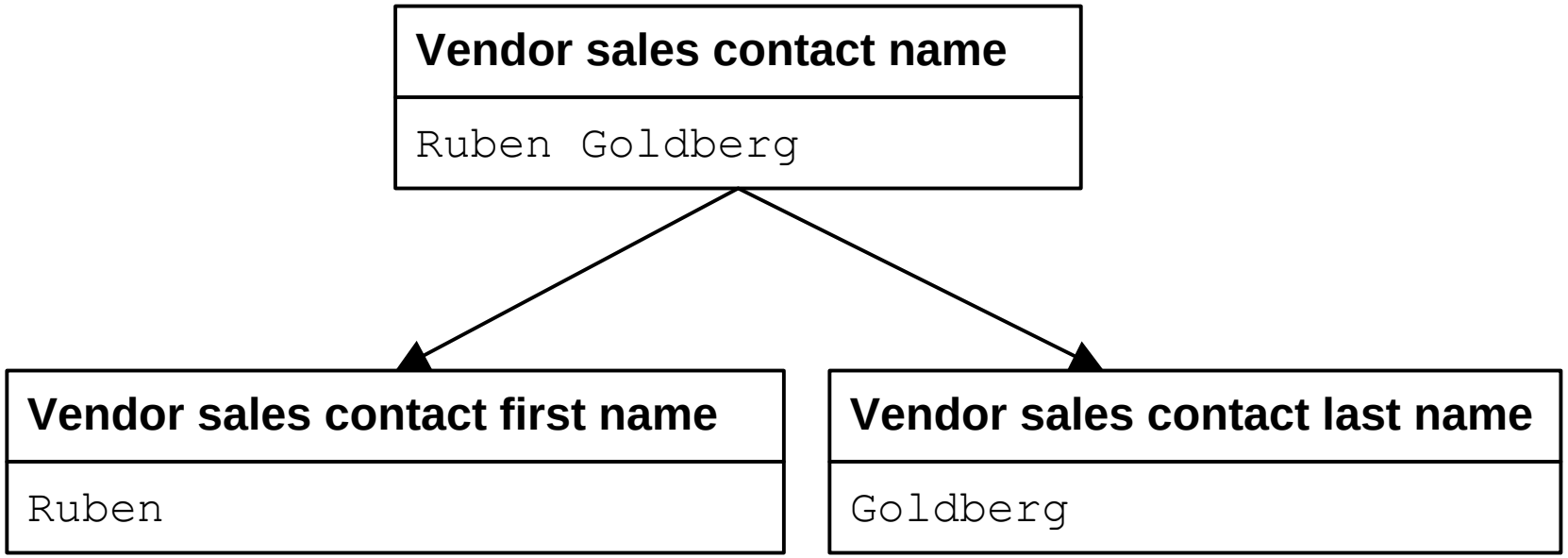
Which data elements should be split up into multiple columns?

QUESTION

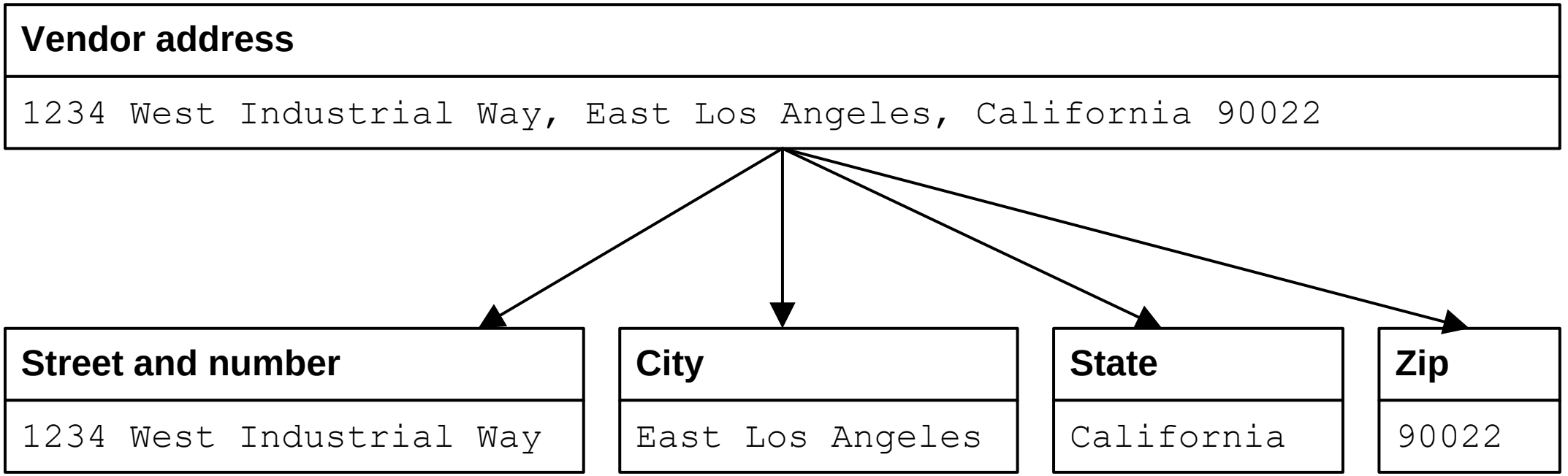
What is a reason to sub-divide data elements like Vendor_Sales_Contact_Name?

Vendor sales contact name
Ruben Goldberg

STEP 2: A NAME THAT'S DIVIDED INTO FIRST AND LAST NAMES



AN ADDRESS THAT'S DIVIDED INTO ITS COMPONENTS



STEP 3: IDENTIFY THE TABLES (ENTITIES) AND COLUMNS (ATTRIBUTES)

- Item quantity
- Item description
- Item unit price
- Item extension
- Vendor sales contact name
- Vendor sales contact ext
- Vendor AR contact name
- Vendor AR contact ext
- Invoice total
- Vendor name
- Vendor address
- Vendor city
- Vendor state
- Vendor zip
- Vendor phone number
- Vendor fax number
- Vendor web address
- Invoice number
- Invoice date
- Invoice terms
- Item part number

QUICK DISCUSSION AS A CLASS

1. **Identify tables** (Can you identify entity-to-entity relationships)?
2. **Identify which columns would go with which table.**

(i.e. which attributes go with which entity)

3. **Pair up with a partner and compare**

STEP 3: IDENTIFY THE TABLES (ENTITIES) AND COLUMNS (ATTRIBUTES)

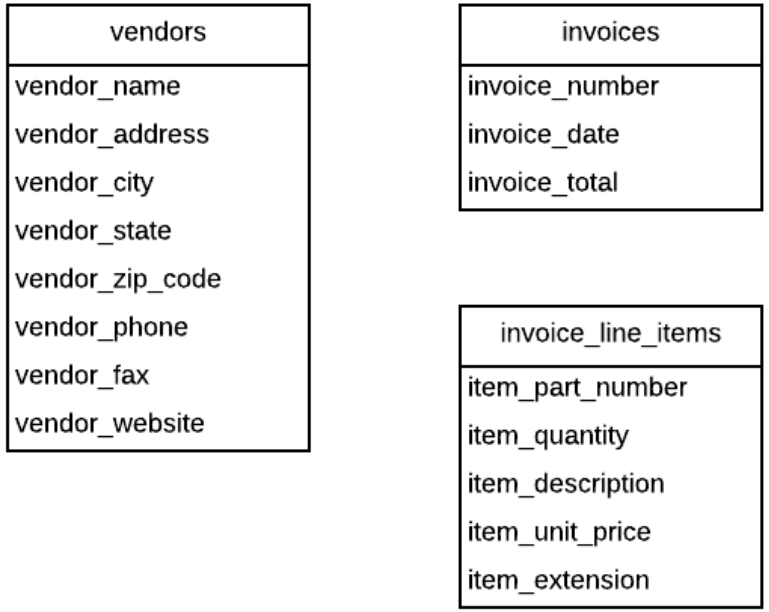
Vendors

Invoices

Invoices Items

- Vendor name
- Vendor address
- Vendor city
- Vendor state
- Vendor zip
- Vendor phone number
- Vendor fax number
- Vendor web address
- Invoice number
- Invoice date
- Invoice terms
- Item part number
- Item quantity
- Item description
- Item unit price
- Item extension
- Vendor sales contact name
- Vendor sales contact ext
- Vendor AR contact name
- Vendor AR contact ext
- Invoice total

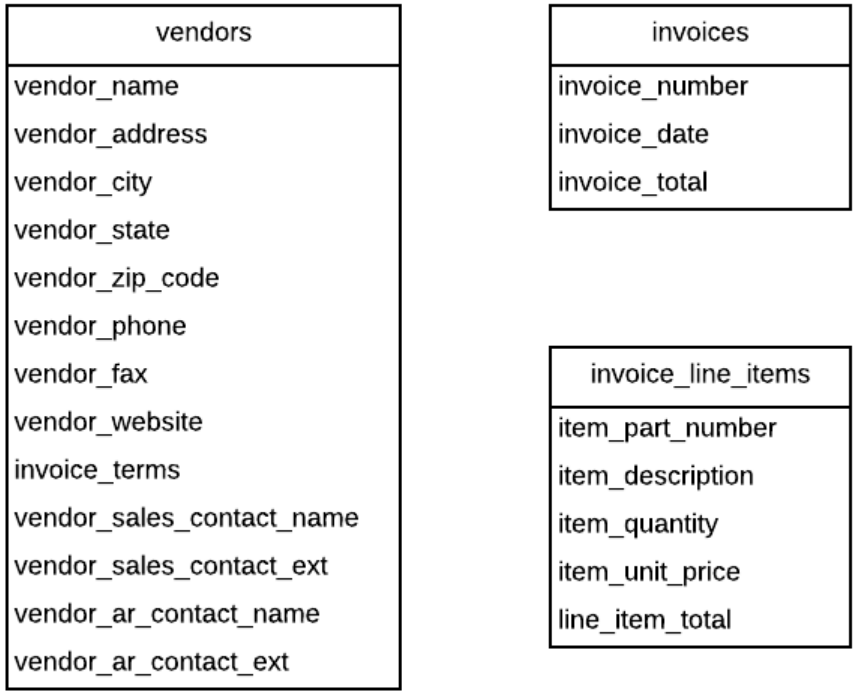
STEP 3: IDENTIFY THE TABLES (ENTITIES) AND COLUMNS (ATTRIBUTES)



- Vendor name
- Vendor address
- Vendor city
- Vendor state
- Vendor zip
- Vendor phone number
- Vendor fax number
- Vendor web address
- Invoice number
- Invoice date
- **Invoice terms**
- Item part number
- Item quantity
- Item description
- Item unit price
- Item extension
- **Vendor sales contact name**
- **Vendor sales contact ext**
- **Vendor AR contact name**
- **Vendor AR contact ext**
- Invoice total

What about these?

STEP 3: IDENTIFY THE TABLES (ENTITIES) AND COLUMNS (ATTRIBUTES)



- Vendor name
- Vendor address
- Vendor city
- Vendor state
- Vendor zip
- Vendor phone number
- Vendor fax number
- Vendor web address
- Invoice number
- Invoice date
- Invoice terms
- Item part number
- Item quantity
- Item description
- Item unit price
- Item extension
- Vendor sales contact name
- Vendor sales contact ext
- Vendor AR contact name
- Vendor AR contact ext
- Invoice total

STEP 4: IDENTIFY THE PRIMARY AND FOREIGN KEYS

vendors
vendor_name
vendor_address
vendor_city
vendor_state
vendor_zip_code
vendor_phone
vendor_fax
vendor_website
invoice_terms
vendor_sales_contact_name
vendor_sales_contact_ext
vendor_ar_contact_name
vendor_ar_contact_ext

invoices
invoice_number
invoice_date
invoice_total

invoice_line_items
item_part_number
item_description
item_quantity
item_unit_price
line_item_total

QUESTION

What is a good primary key for the table:

- Vendors
- Invoices
- Invoice Line Items

STEP 4: IDENTIFY THE PRIMARY AND FOREIGN KEYS

vendors
PK **vendor_id**
vendor_name
vendor_address
vendor_city
vendor_state
vendor_zip_code
vendor_phone
vendor_fax
vendor_website
invoice_terms
vendor_sales_contact_name
vendor_sales_contact_ext
vendor_ar_contact_name
vendor_ar_contact_ext

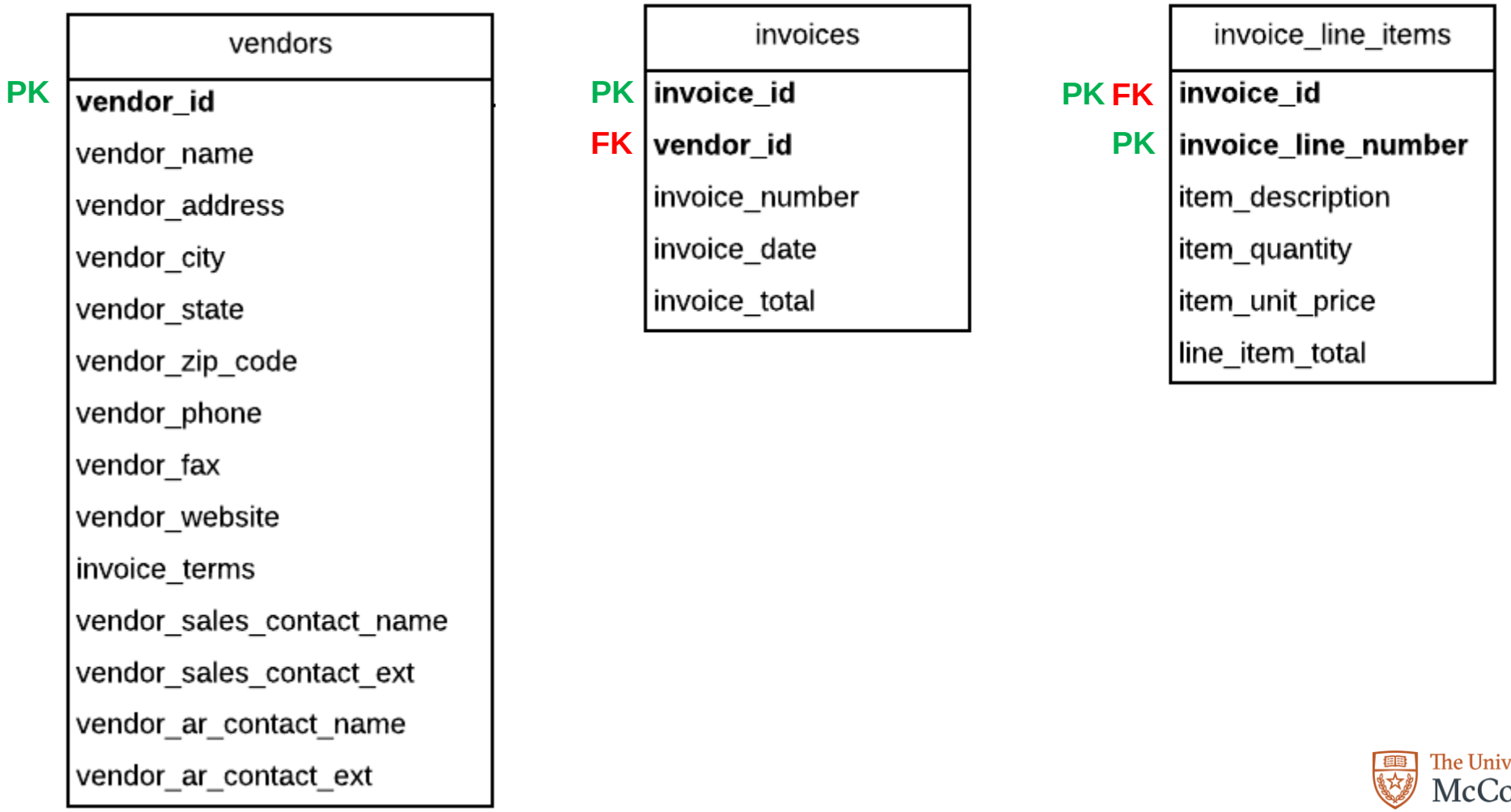
invoices
PK **invoice_id**
invoice_number
invoice_date
invoice_total

invoice_line_items
PK **invoice_line_number**
item_description
item_quantity
item_unit_price
line_item_total

QUESTION

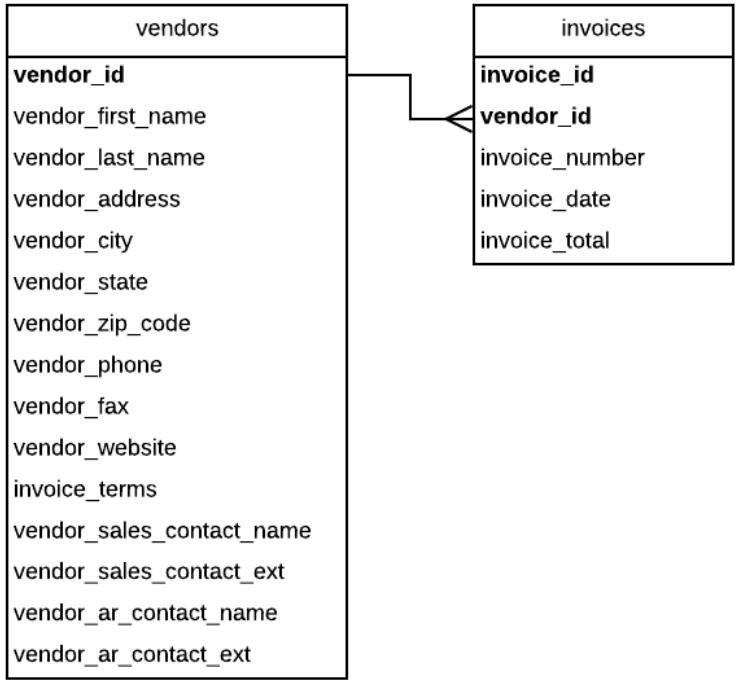
What is the purpose of a foreign key?

STEP 4: IDENTIFY THE PRIMARY AND FOREIGN KEYS



REFERENTIAL INTEGRITY

- **Deleting a row from primary key table:**
  - If the foreign key table contains one or more rows related to the deleted row
- **Inserting a row in the foreign key table:**
  - If the foreign key value doesn't have a matching primary key value in the related table
- **Updating the value of a foreign key:**
  - If the new foreign key value doesn't have a matching primary key value in the related table
- **Updating the value of a primary key:**
  - If the foreign key table contains one or more rows related to the row that's changed



LOOKING FORWARD

Check Canvas… regularly

Read chapters 1 and 9

Homework 1 - group

Quiz 2 - next week

THANK YOU

BACKUP SLIDES

PART 1

Manufacturer

CREATE AN ERD TO SHOW HOW YOU WOULD TRACK THIS INFORMATION

A manufacturing company produces products. The following product information is stored: product name, product ID and quantity on hand. These products are made up of many components. Each component can be supplied by one or more suppliers. The following component information is kept:

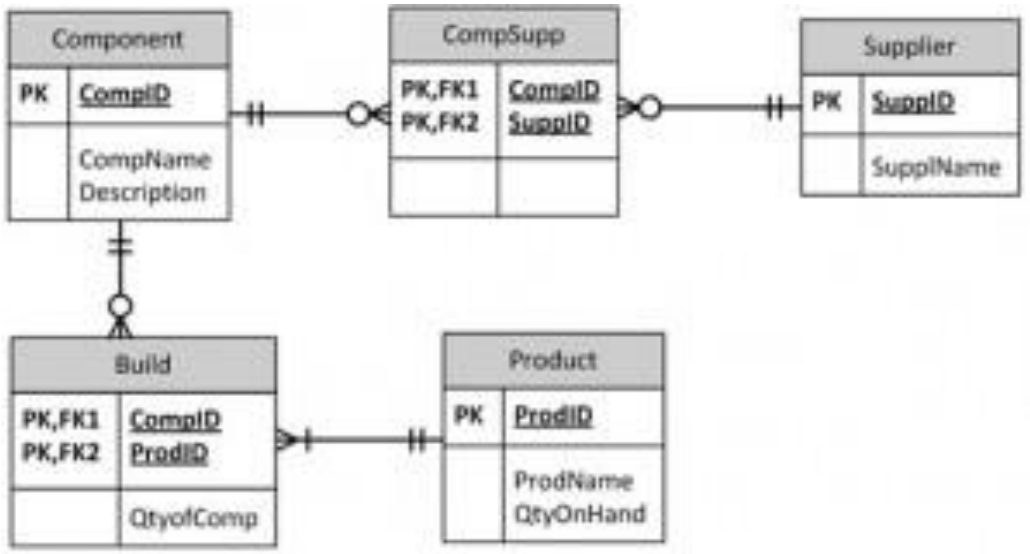
- component ID, name, description, suppliers who supply them, and products in which they are used.

Show entity names, primary keys, attributes for each entity, relationships between the entities and cardinality.

Assumptions:

- A supplier can exist without providing components.
- A component does not have to be associated with a supplier.
- A component does not have to be associated with a product. Not all components are used in products.
- A product cannot exist without components.

ERD ANSWER



- Component(CompID, CompName, Description) PK=CompID
- Product(ProdID, ProdName, QtyOnHand) PK=ProdID
- Supplier(SuppID, SuppName) PK = SuppID
- CompSupp(CompID, SuppID) PK = CompID, SuppID
- Build(CompID, ProdID, QtyOfComp) PK= CompID, ProdID

PART 2

Open ended

IN-CLASS EXERCISE: DATA DESIGN

- In your teams discuss how would you start modeling the data for Chase or Fidelity
  - Data elements, entities, relationships…
- You will have 10 minutes to complete this exercise and then you will return to the main room to share your work