



Unit 2

Entity-Relationship Diagram (ERD)

By



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A decorative pattern of white-outlined squares of various sizes is arranged in a sparse, grid-like fashion across the top and left edges of the slide. The squares are of different dimensions, creating a modern, geometric aesthetic.

1. Introduction.

A decorative arrangement of squares in the top-left corner, consisting of a 3x3 grid of squares with varying shades of blue and white.

An entity-relationship diagram (ERD) is :

- 
- A vertical column of five squares in the left margin, with varying shades of blue and white.
- 
- A vertical column of four squares in the bottom-left margin, with varying shades of blue and white.
- ❖ a data modeling technique that graphically illustrates an information system's entities and the relationships between those entities.
 - ❖ a conceptual and representational model of data used to represent the entity framework infrastructure.



Steps involved in creating an ERD include:



1. Identifying and defining the entities.



2. Determining all interactions between the entities.



3. Analyzing the nature of interactions/determining the cardinality of the relationships.



4. Creating the ERD.





❖ crucial to creating a good database design.



❖ used as a high-level logical data model, which is useful in developing a conceptual design for databases.





Entity

- An entity is a real-world item or concept that exists on its own.
- Entities are equivalent to database tables in a relational database, with each row of the table representing an instance of that entity.



Attribute

- An attribute of an entity is a particular property that describes the entity.

Relationship

- A relationship is the association that describes the interaction between entities.

Cardinality

- in the context of ERD, is the number of instances of one entity that can, or must, be associated with each instance of another entity. In general, there may be one-to-one, one-to-many, or many-to-many relationships.



Employee Entity



Department Entity



Employee Attribute :

employee number
name

Department number



Department Attribute :

department number
name



Employee
employee number
name
department number






M

1

department
department number
name



2 Components of E-R Diagram



- 
- ❖ **Entity relational diagram (ER Diagram)** is used to represent the requirement analysis at the conceptual design stage.
 - ❖ the database is designed from the ERD or ERD is converted to the database.
- 
- Each **entity** in the ERD corresponds to a **table** in the database.
 - The **attributes** of any an entity correspond to **field** of a table.
 - The **ERD** is converted to the **database**.
- 
- 
- 



The elements of an ERD are:



1. ENTITIES

- 
- ✓ Entities are objects or concepts that represent important data.
 - ✓ They are typically nouns (*customer, supervisor, location, or promotion*).
- 



➤ **Strong entities** exist independently from other entity types. They always possess one or more attributes that uniquely distinguish each occurrence of the entity.

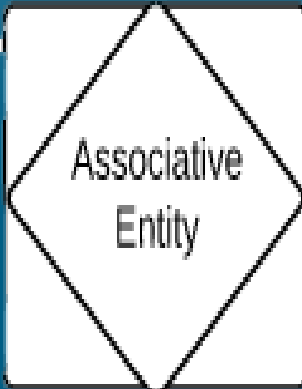
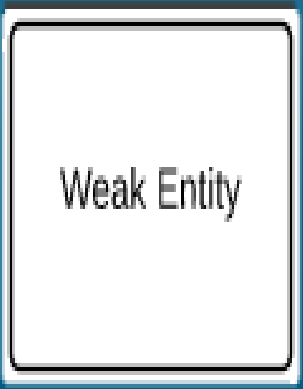
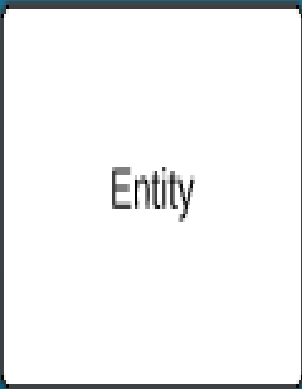


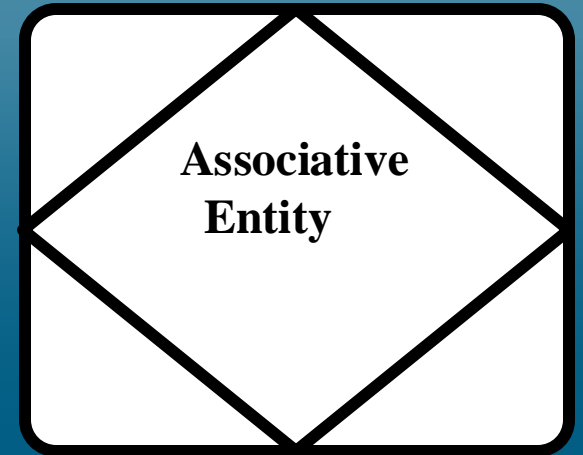
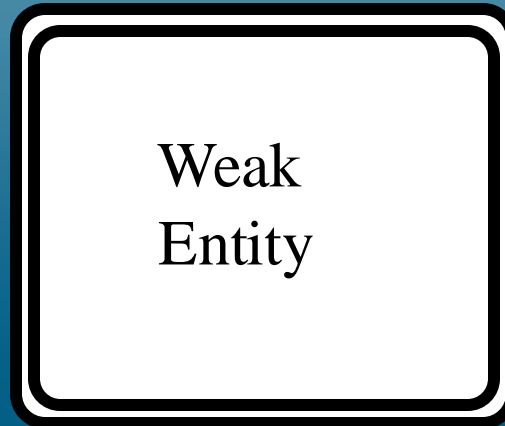
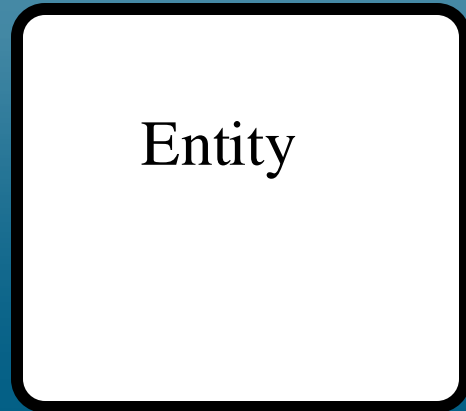
➤ **Weak entities** depend on some other entity type. They don't possess unique attributes (also known as a primary key) and have no meaning in the diagram without depending on another entity. This other entity is known as the owner.



➤ **Associative entities** are entities that associate the instances of one or more entity types. They also contain attributes that are unique to the relationship between those entity instances.













A decorative graphic consisting of several white squares of varying sizes arranged in a sparse, grid-like pattern in the top-left corner of the slide.

2. RELATIONSHIPS

- 
- A single white square.
- **Relationships** are meaningful associations between or among entities.
 - They are usually verbs, e.g. *assign*, *associate*, or *track*.
 - A relationship provides useful information that could not be discerned with just the entity types.
- 
- A single white square.
- 
- A single white square.
- 
- A single white square.
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- A single white square.
- 
- A single white square.

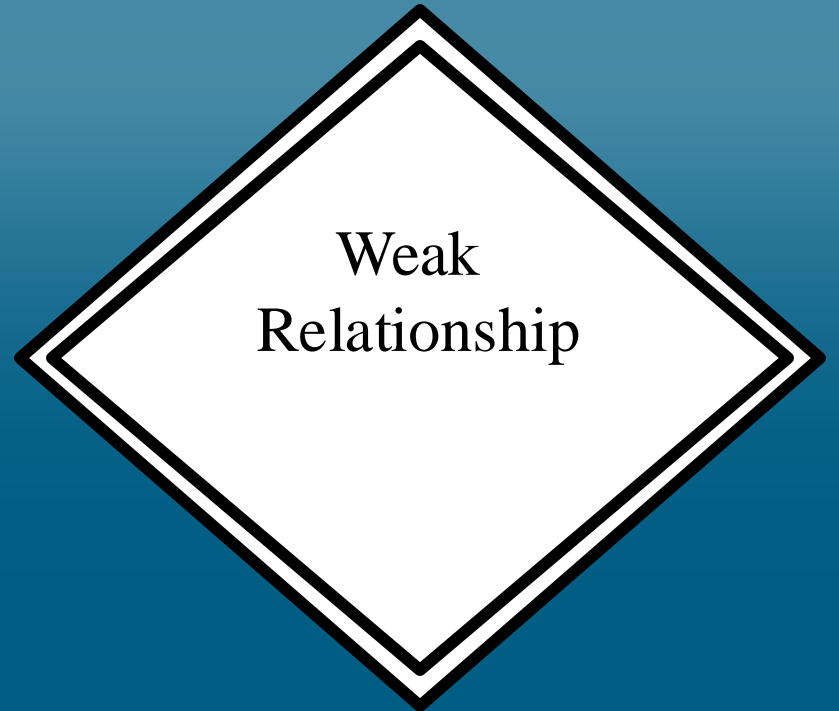
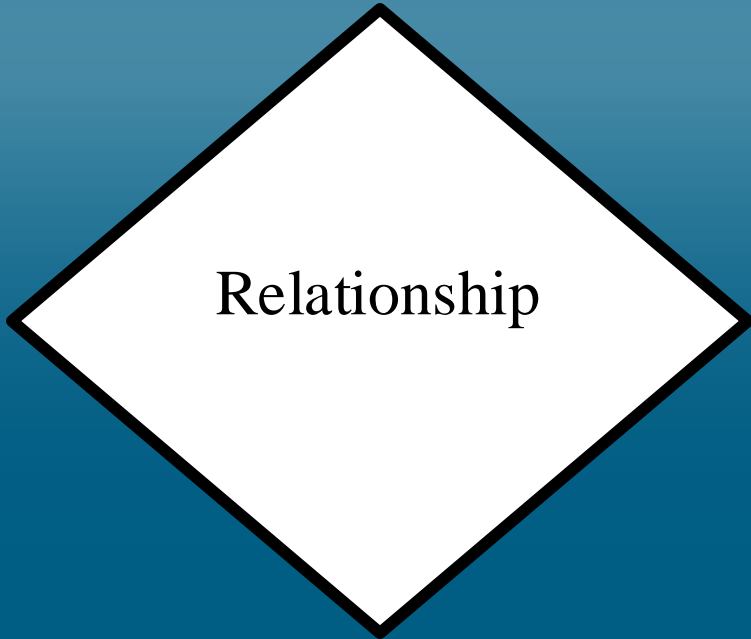


❖ **Weak relationships**, or identifying relationships, are connections that exist between a weak entity type and its owner.



❖ **Ternary Relationship**, Relationship of degree three.







3. ATTRIBUTES

- **Attributes** are characteristics of either an entity, a many-to-many relationship, or a one-to-one relationship.



Attribute

A series of white-outlined squares of various sizes are arranged in a decorative pattern along the left and top edges of the slide. There are 15 squares in total, with some appearing in vertical columns and others scattered across the top.

Multivalued attributes are those that are capable of taking on more than one value.

**Multivalued
Attributes**

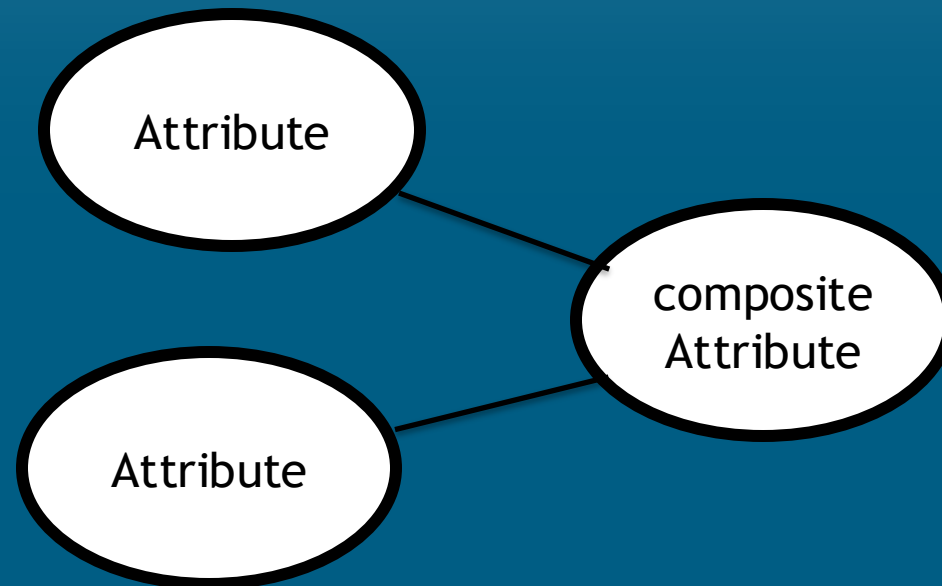










➤ **Derived attributes** are attributes whose value can be calculated from related attribute values.



**Derived
Attributes**

➤ **Composite attributes** are represented by ellipses that are connected with an ellipse. they are further divided in a tree like structure. Every node is then connected to its attribute





➤ **Key attribute** represents the main characteristic of an Entity. It is used to represent Primary key. Ellipse with underlying lines represent Key Attribute.



Key
Attribute



3. Binary Relationship and Cardinality

- ❑ **Binary relationship** : A relationship where two entities are participating.
- ❑ **Cardinality** is the number of instance of an entity from a relation that can be associated with the relation.
 - **One-to-one** — When only one instance of an entity is associated with the relationship, it is marked as '1:1'. The following image reflects that only one instance of each entity should be associated with the relationship. It depicts one-to-one relationship.

The following image reflects that only one instance of each entity should be associated with the relationship. It depicts one-to-one relationship.



■ **One-to-many** – When more than one instance of an entity is associated with a relationship, it is marked as '1:N'.

The following image reflects that only one instance of entity on the left and more than one instance of an entity on the right can be associated with the relationship. It depicts one-to-many relationship.



- **Many-to-one** – When more than one instance of entity is associated with the relationship, it is marked as 'N:1'.
- The following image reflects that more than one instance of an entity on the left and only one instance of an entity on the right can be associated with the relationship. It depicts many-to-one relationship.



Many-to-many – The following image reflects that more than one instance of an entity on the left and more than one instance of an entity on the right can be associated with the relationship. It depicts many-to-many relationship.



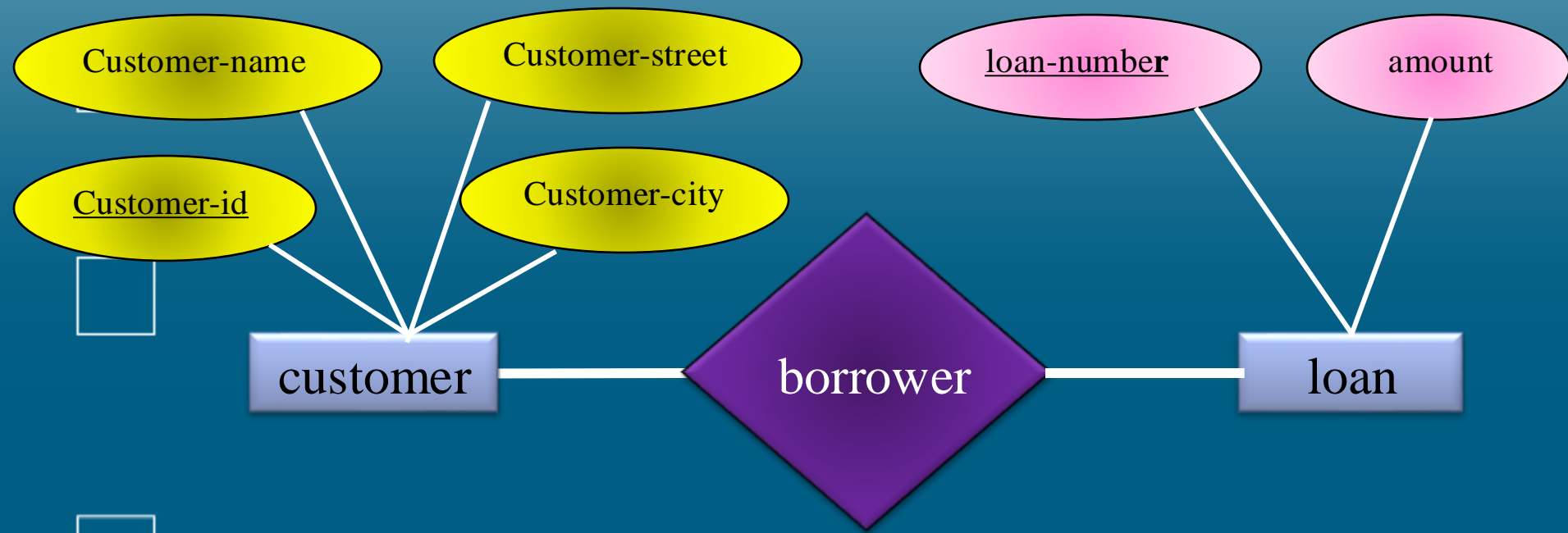


Figure 4.1 E-R diagram corresponding to customers and loans



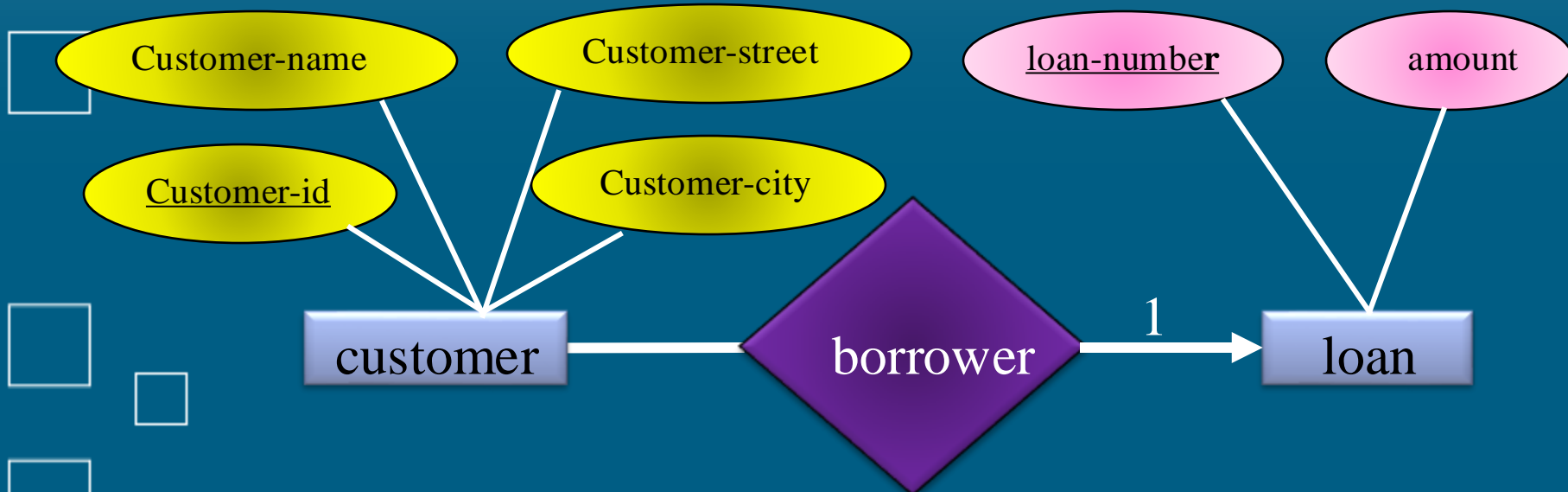
The relationship set *borrower* may be many-to-many, one-to-many, many-to-one, or one-to-one.



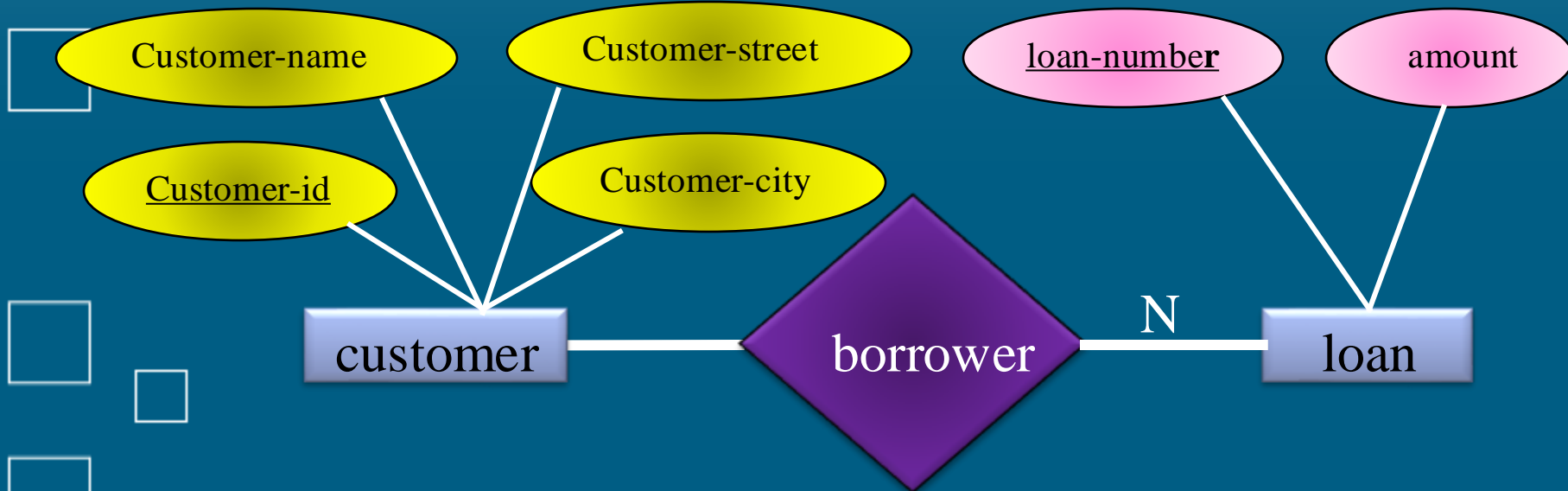
To distinguish among these types, we draw either a directed line (\longrightarrow) or an undirected line (---) between the relationship set and the entity set in question.



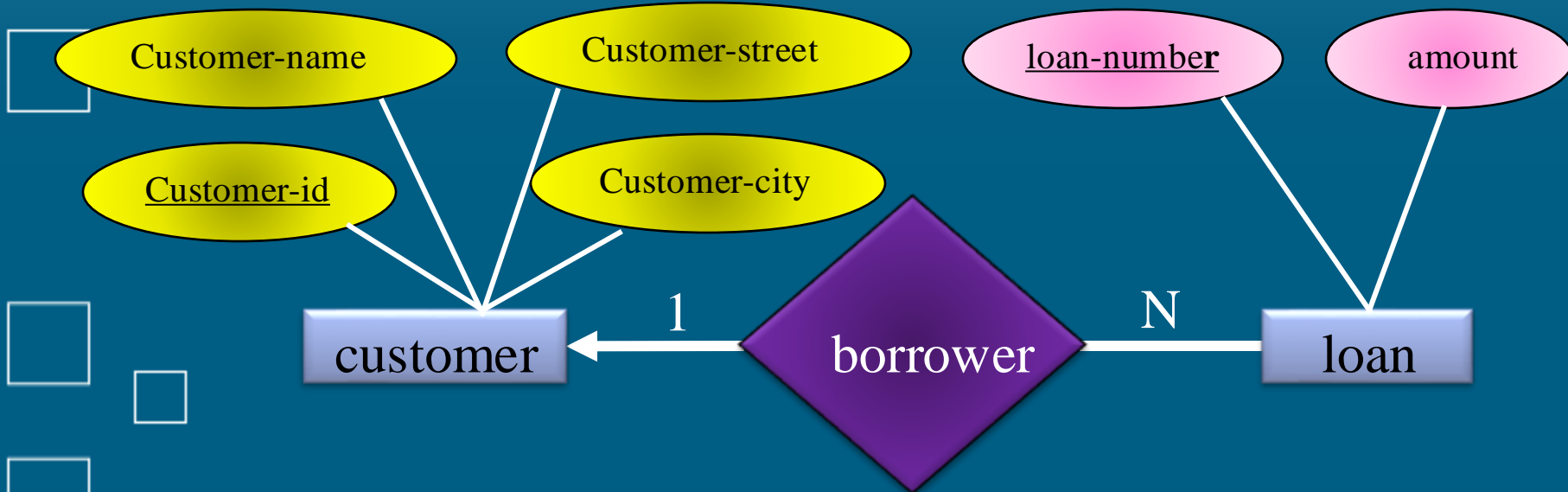
• A **directed line** (\rightarrow) from the relationship set *borrower* to the entity set *loan* specifies that *borrower* is either a one-to-one or many-to-one relationship set, from *customer* to *loan*, *borrower* cannot be a many-to-many or a one-to-many relationship set from *customer* to *loan*



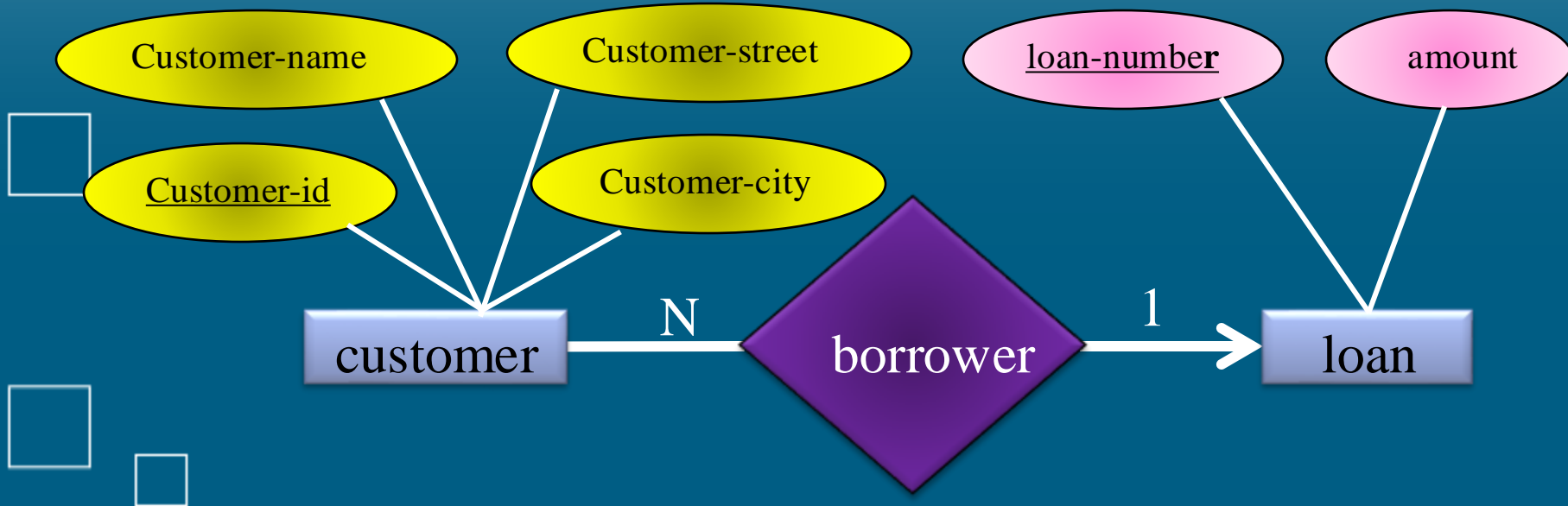
An **undirected line** (—) from the relationship set *borrower* to the entity set *loan* specifies that *borrower* is either a many-to-many or one-to-many relationship set from *customer* to *loan*.



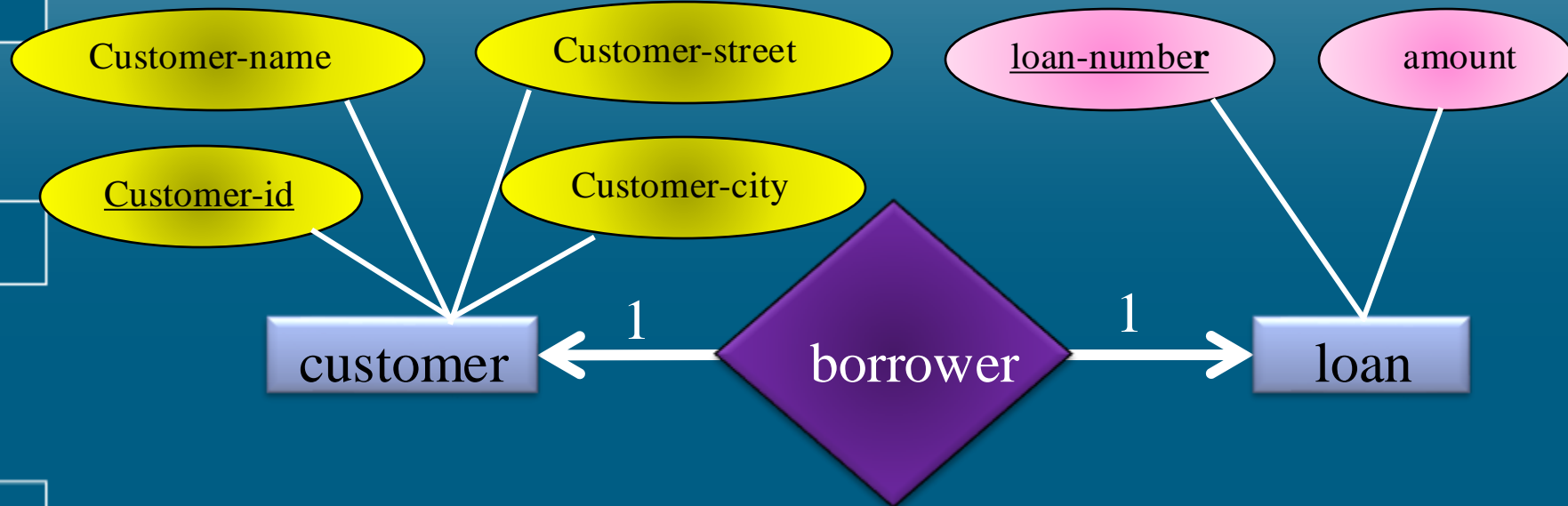
If the relationship set *borrower* were one-to-many, from *customer* to *loan*, then the line from *borrower* to *customer* would be directed, with an arrow pointing to the *customer* entity set

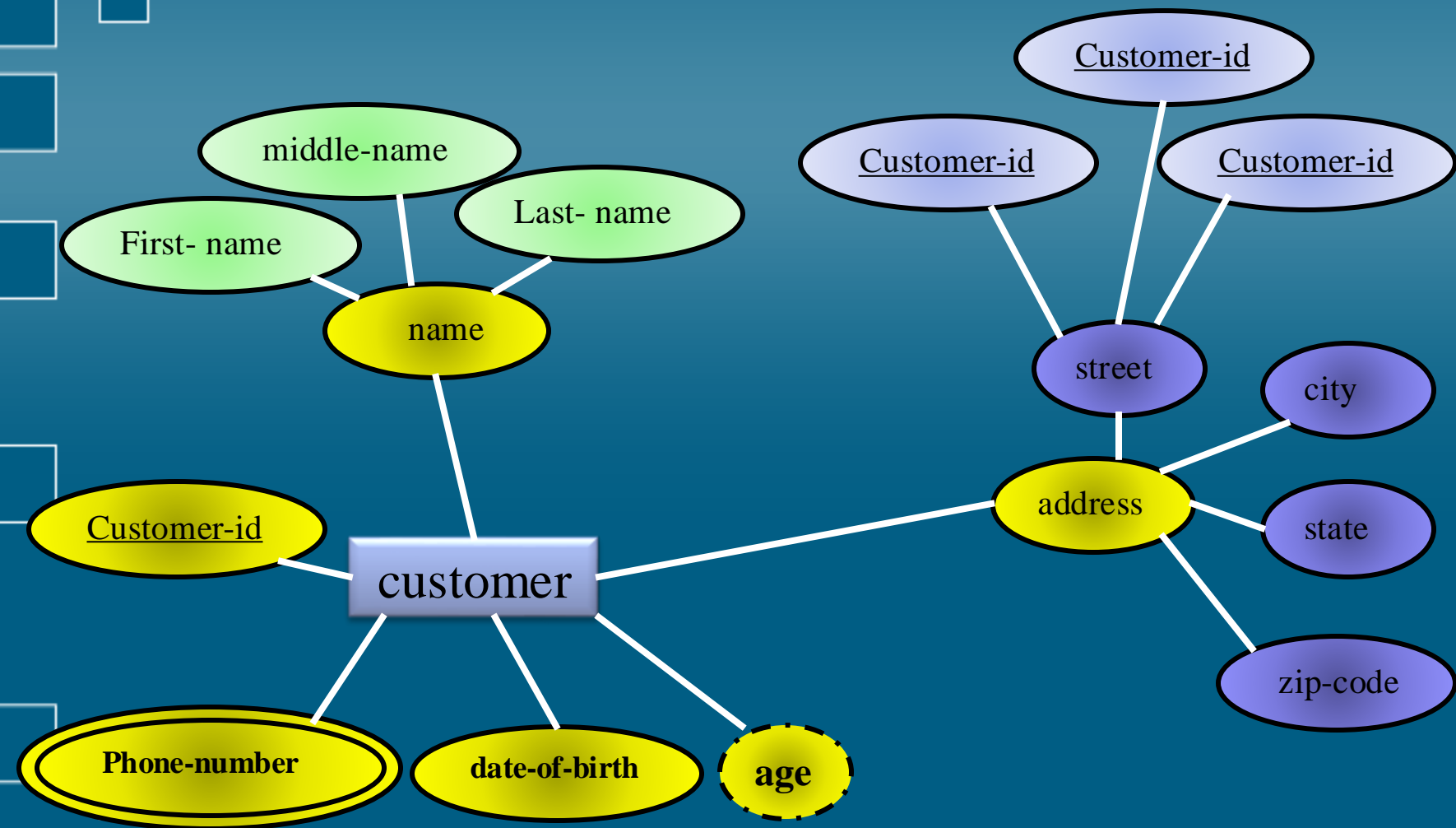
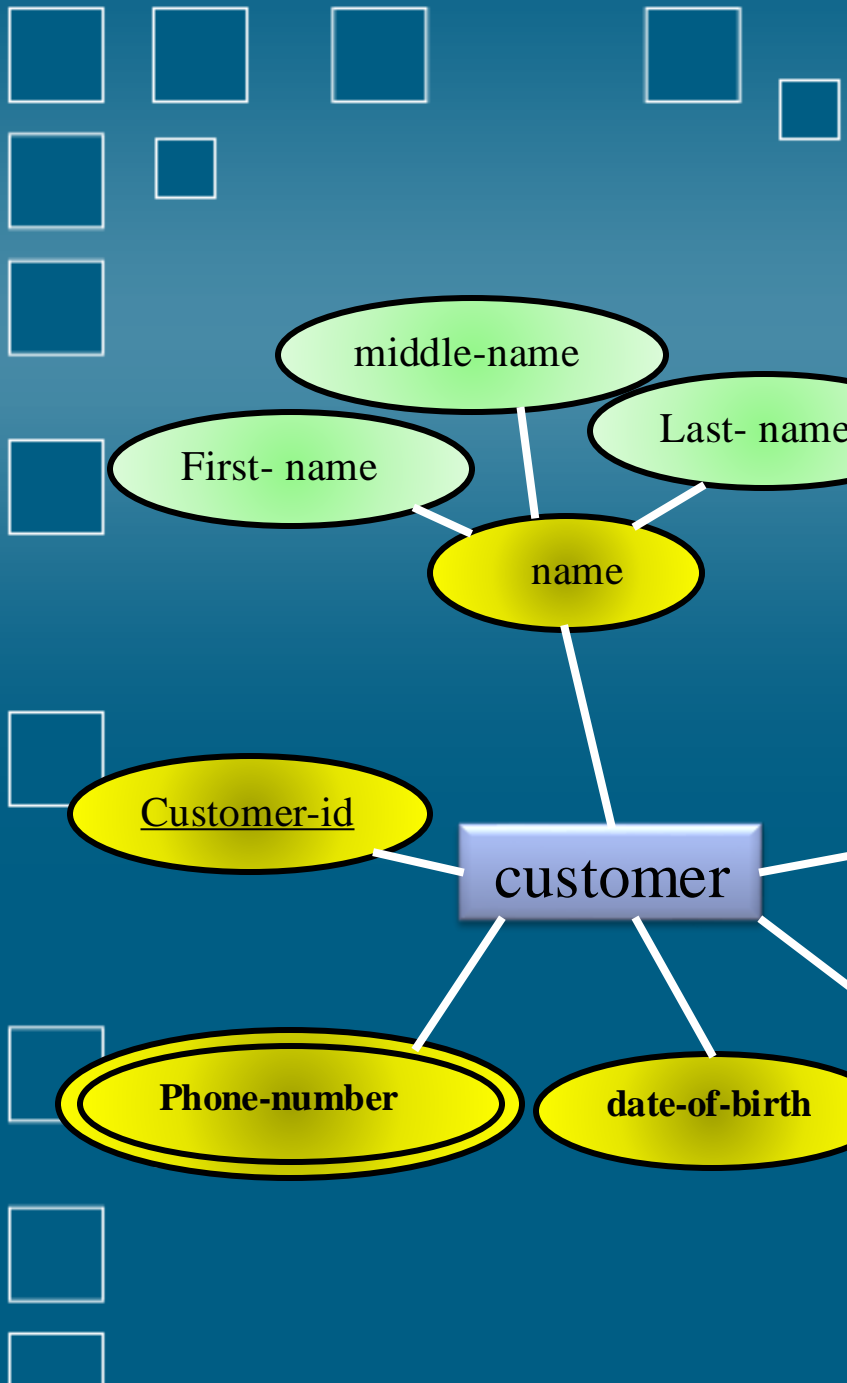


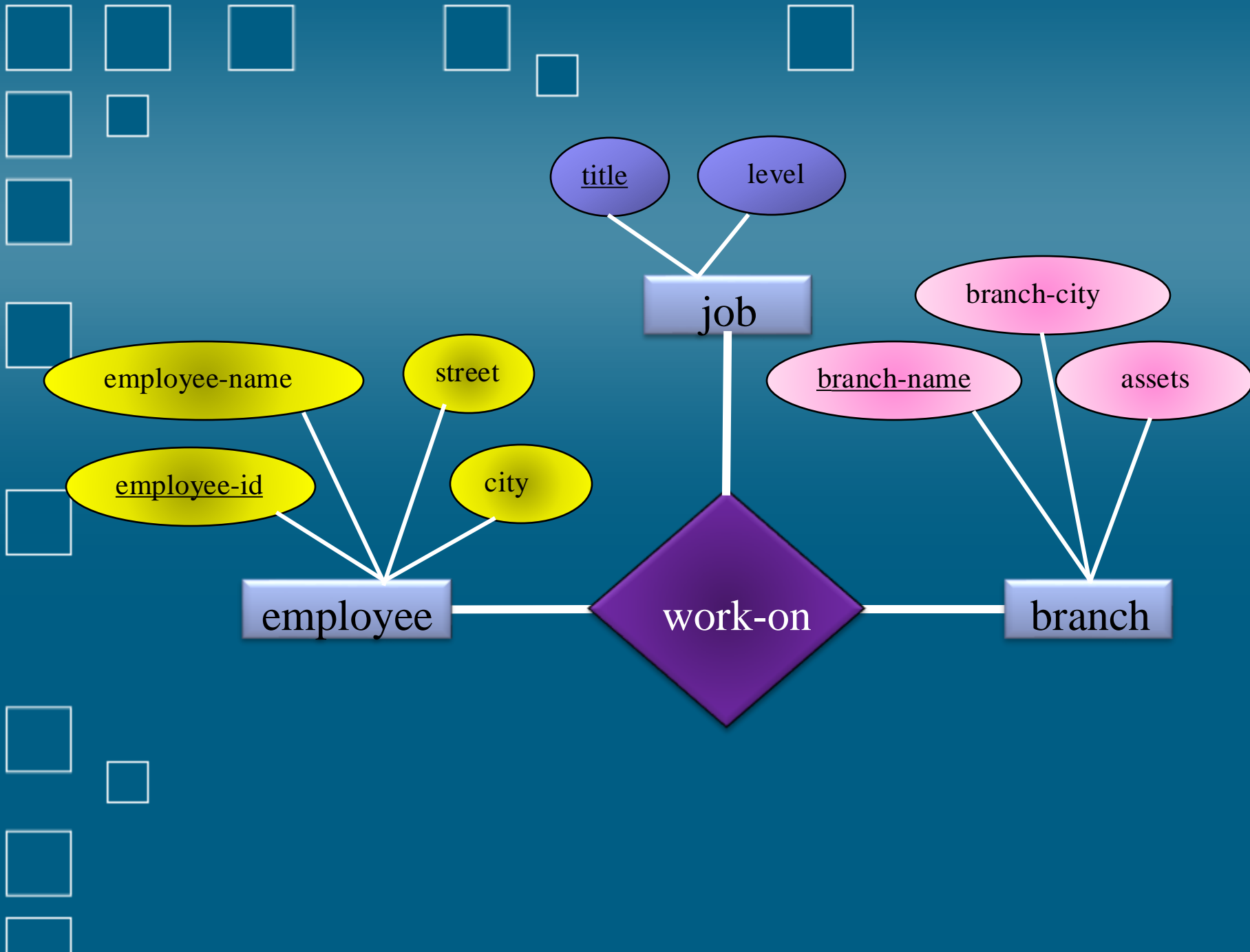
if the relationship set *borrower* were many-to-one from *customer* to *loan*, then the line from *borrower* to *loan* would have an arrow pointing to the *loan* entity set



Finally, if the relationship set *borrower* were one-to-one, then both lines from *borrower* would have arrows











5 Reduction of an E-R Schema to Tables

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- We can represent a database that conforms to an E-R database schema by a collection of tables.
 - For each entity set and for each relationship set in the database, there is a unique table to which we assign the name of the corresponding entity set or relationship set.
 - Each table has multiple columns, each of which
 - has a unique name.




Both the E-R model and the relational-database model are:



- ❖ abstract, logical representations of real-world enterprises.

Because the two models employ similar design principles, we can convert an E-R design into a relational design.

Converting a database representation from an E-R diagram to a table format is the way we arrive at a relational-database design from an E-R diagram.





Although important differences exist between a relation and a table, informally, a relation can be considered to be a table of values.



The constraints specified in an E-R diagram, such as primary keys and cardinality constraints, are mapped to constraints on the tables generated from the E-R diagram.





Example :

There is an entity:



customer-schema=(customer-id,name,address,city-state-ZIP,discount)

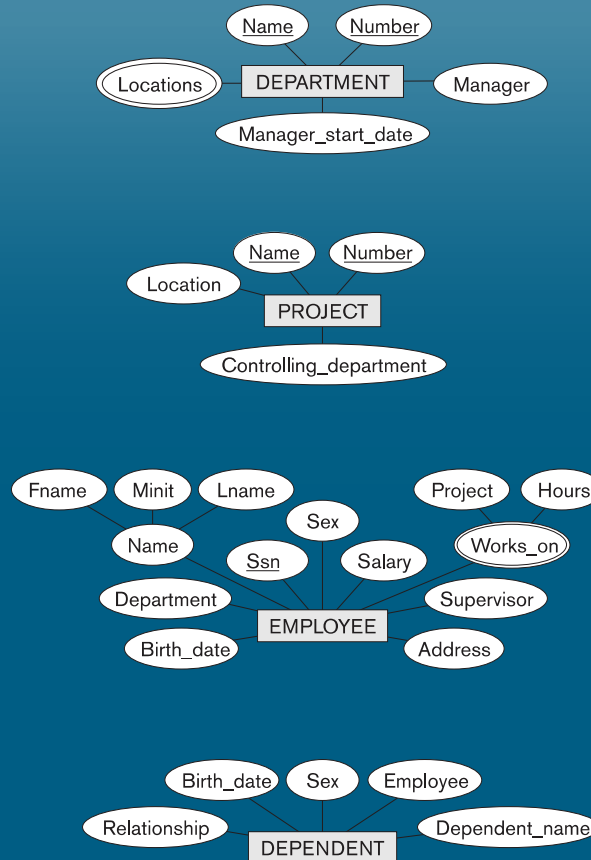


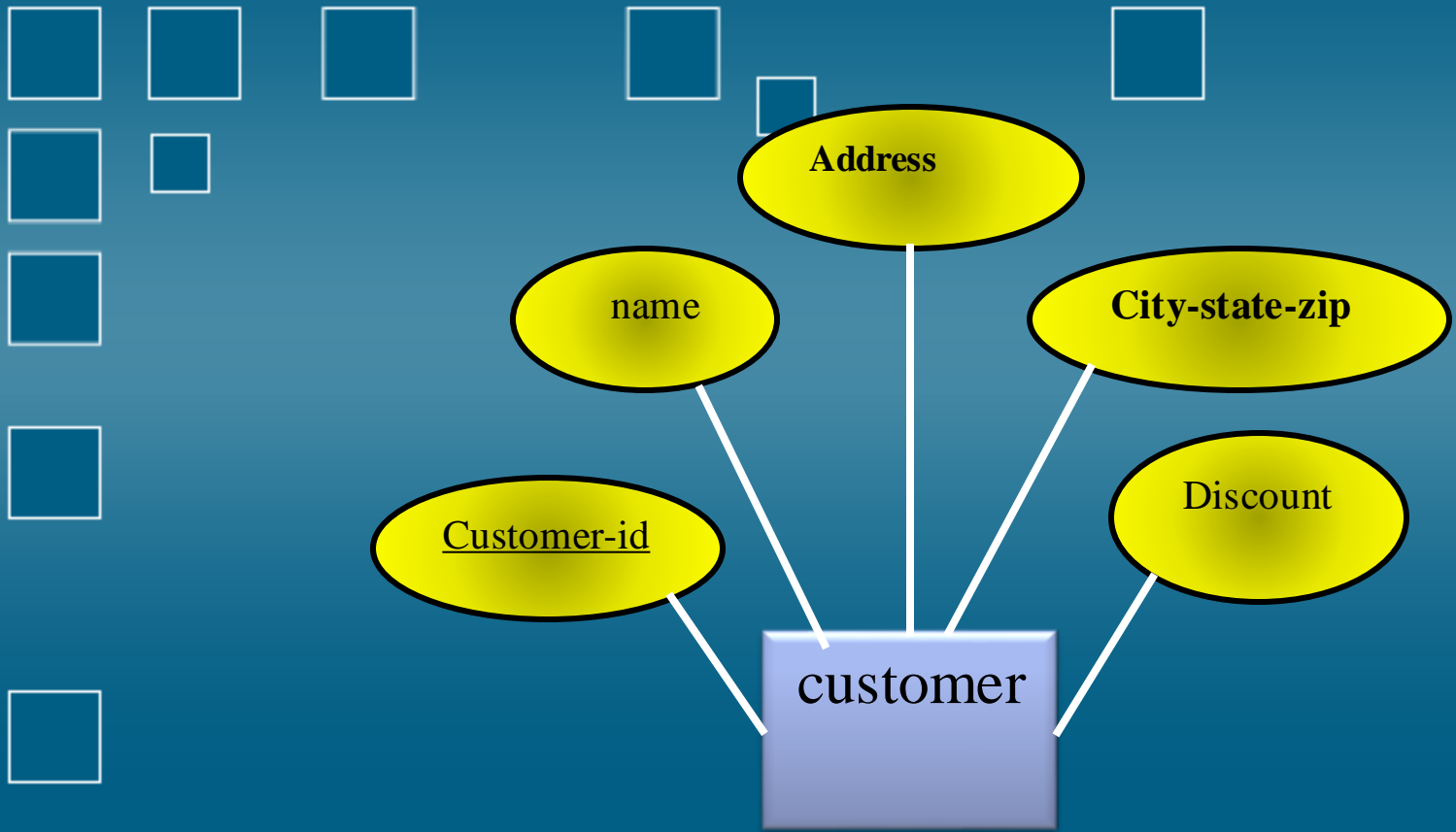
1.Transforming an entity to a relation – E/R Diagram.

2.Transforming an entity to a relation – relational .



Initial Conceptual Design of the COMPANY Database





Customer -ID	Name	Address	City -State-Zip	Discount
1273	Contemporary Designs	123 Oak St.	Austin,TX2888	5%
6390	Casual Comer	18 Hoosier Dr.	Bloomington ,IN5482	3%

