ER-Modeling

What is ERD?

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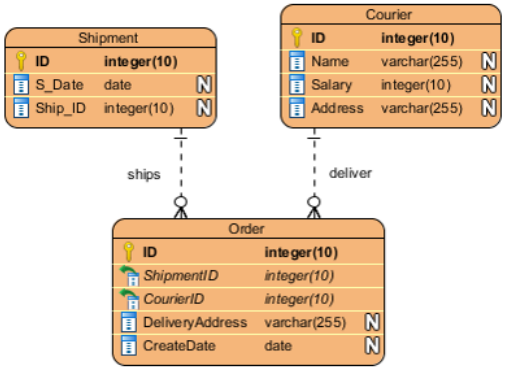
- Entity Relationship Diagram, also known as ERD, ER Diagram or ER model, is a type of structural diagram for use in database design.

- An ERD contains different symbols and connectors that visualize two important information: **The major entities within the system scope**, and the **inter-relationships among these entities**.

ERD

- When we talk about entities in ERD, very often we are referring to business objects such as:
  - People
  - Roles
  - Student
  - Product

"Relationship" is about how these entities relate to each other within the system.



When to draw ER Diagrams?

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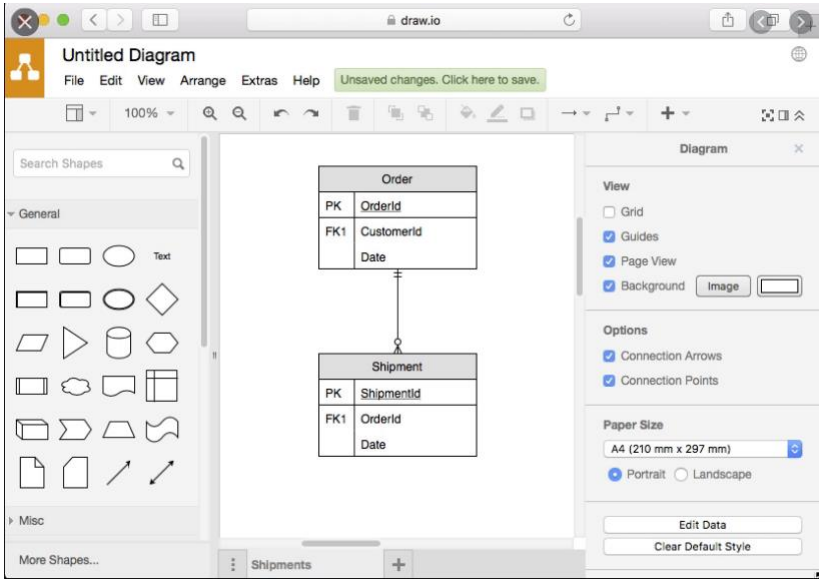
- Database design
- Database debugging
- Database creation and patching
- Aid in requirements gathering



Entity

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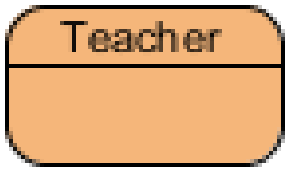
- Person (e.g student)
- Object (invoice)
- Event (Transcation)

- In ERD, the term "entity" is often used instead of "table", but they are the same



Entity Attributes

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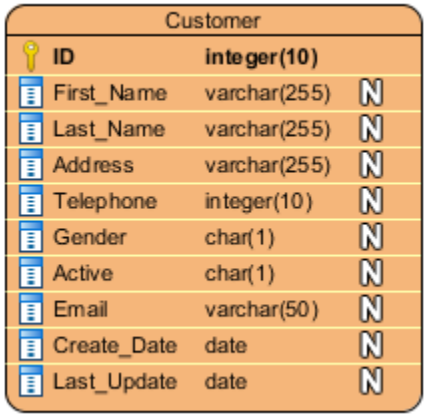
- Known as column



Primary Key

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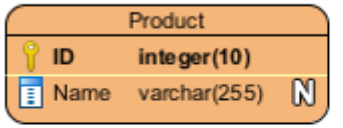
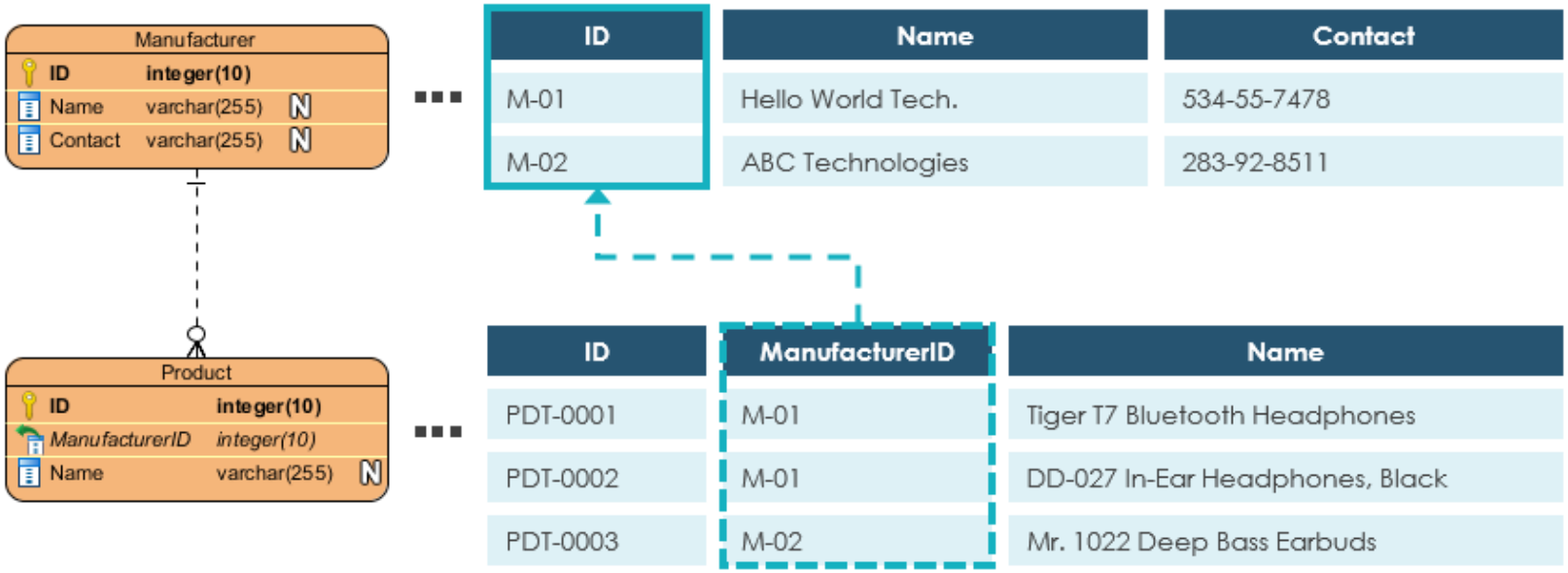
Must be unique



ID	Name
PDT-0001	Tiger T7 Bluetooth Headphones
PDT-0002	DD-027 In-Ear Headphones, Black
PDT-0002	SDB-21 Hi-Fi Stereo Over-ear Earphones
PDT-0003	Mr. 1022 Deep Bass Earbuds

Foreign Key


Manufacturer
ID integer(10)
Name varchar(255) N
Contact varchar(255) N
Product
ID integer(10)
ManufacturerID integer(10)
Name varchar(255) N
ID
Name
Contact
M-01
Hello World Tech.
534-55-7478
M-02
ABC Technologies
283-92-8511
ID
ManufacturerID
Name
PDT-0001
M-01
Tiger T7 Bluetooth Headphones
PDT-0002
M-01
DD-027 In-Ear Headphones, Black
PDT-0003
M-02
Mr. 1022 Deep Bass Earbuds

Relationship / Cardinality

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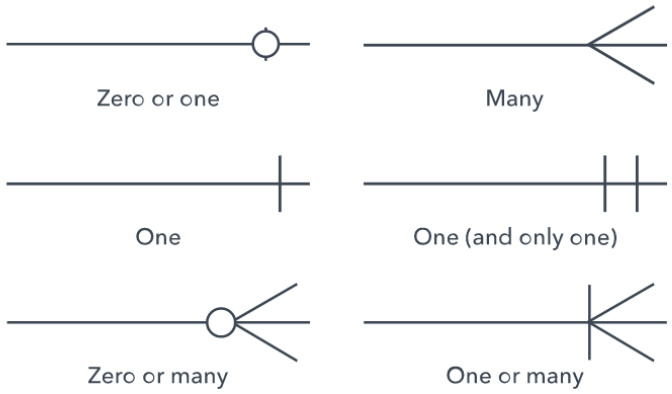
- Student enroll in a course.
- The entity Student is related to Course

- Cardinality – ONE team has MANY players



One-to-One Relationship

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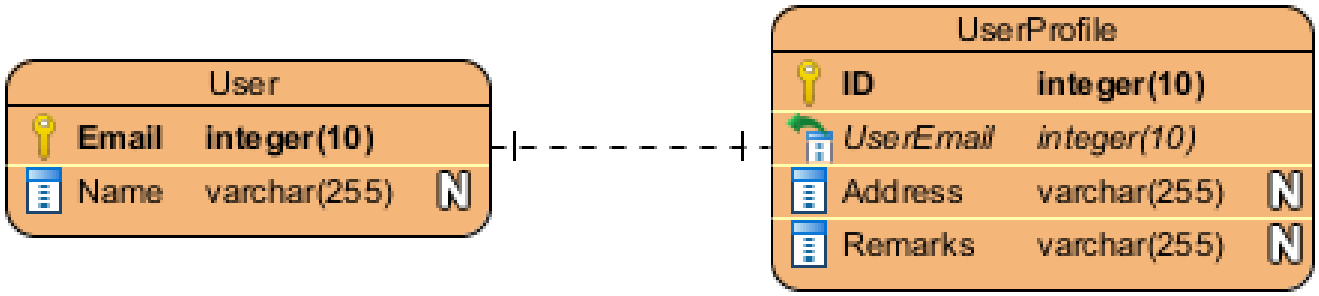
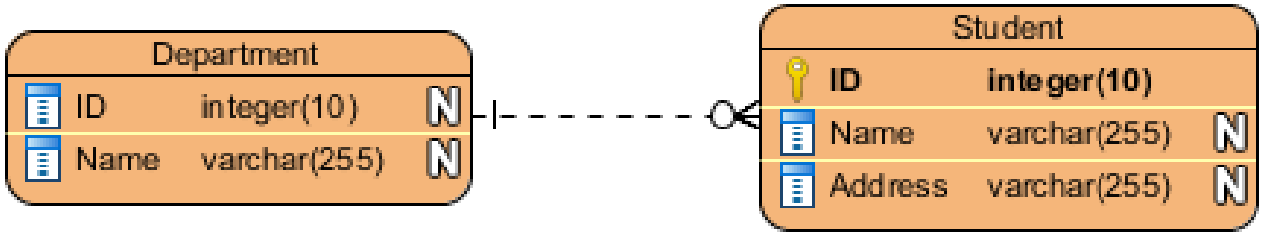


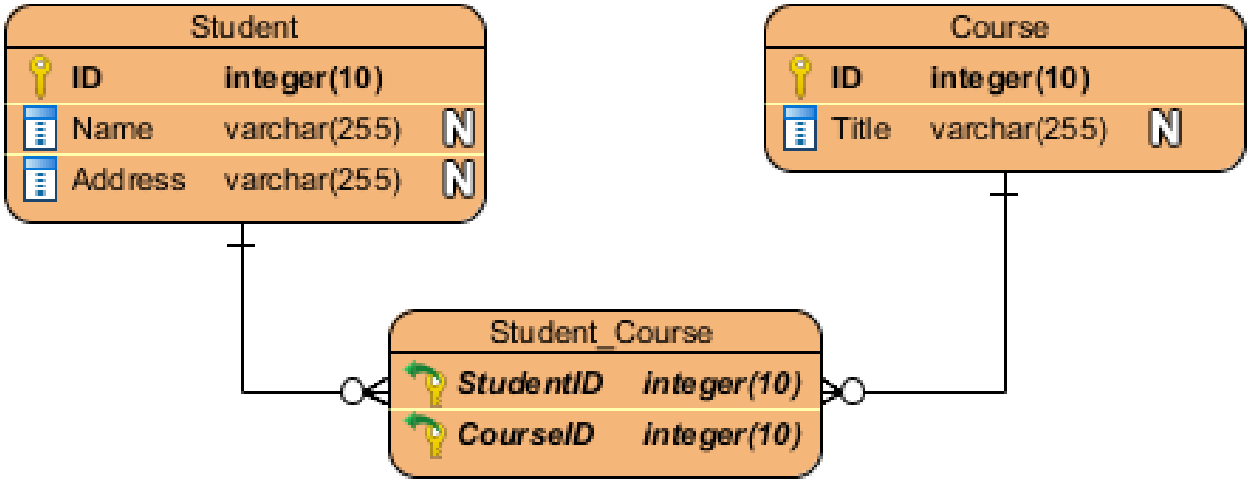
One-to-Many Relationship

LEXICON



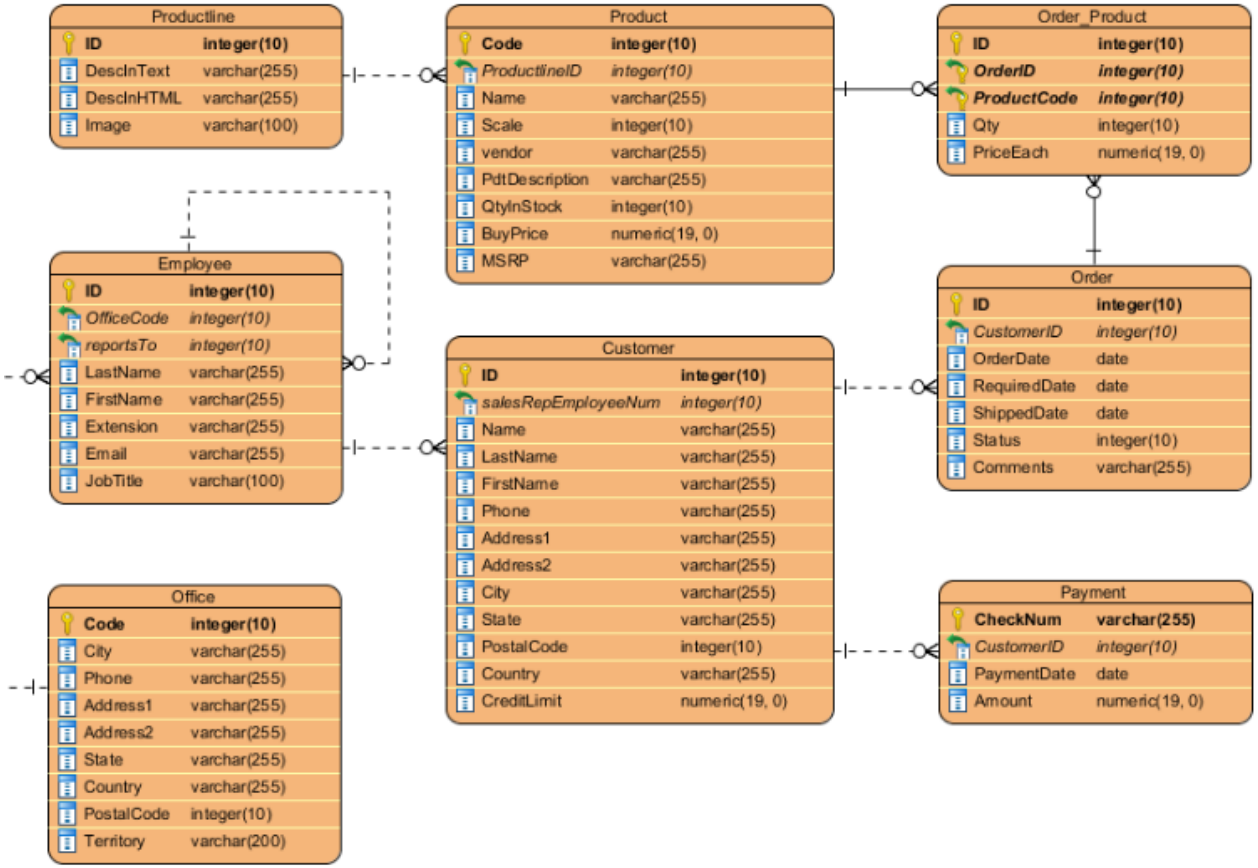
Many-to-Many Relationship

LEXICON



Online Shop

LEXICON



What is Normalization?

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- Process of efficiently organizing data in a database
- Eliminate redundant data.
- Only store related data in a table.

The Normal Forms

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1NF

2NF

3NF

First Normal Form (1NF)

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- A relation will be 1NF if it contains an atomic value.
- It states that an attribute of a table cannot hold multiple values. It must hold only single-valued attribute.

EMPLOYEE table:

EMP_ID	EMP_NAME	EMP_PHONE	EMP_STATE
14	John	7272826385, 9064738238	UP
20	Harry	8574783832	Bihar
12	Sam	7390372389, 8589830302	Punjab

The decomposition of the EMPLOYEE table into 1NF has been shown below:

EMP_ID	EMP_NAME	EMP_PHONE	EMP_STATE
14	John	7272826385	UP
14	John	9064738238	UP
20	Harry	8574783832	Bihar
12	Sam	7390372389	Punjab
12	Sam	8589830302	Punjab

Second Normal Form (2NF)

LEXICON

- In the 2NF, relational must be in 1NF.
- In the second normal form, all non-key attributes are fully functional dependent on the primary key.

TEACHER table

TEACHER_ID	SUBJECT	TEACHER_AGE
25	Chemistry	30
25	Biology	30
47	English	35
83	Math	38
83	Computer	38

2NF

LEXICON

TEACHER_DETAIL table:

TEACHER_ID	TEACHER_AGE
25	30
47	35
83	38

TEACHER_SUBJECT table:

TEACHER_ID	SUBJECT
25	Chemistry
25	Biology
47	English
83	Math
83	Computer

Third Normal Form (3NF)

LEXICON

- A relation will be in 3NF if it is in 2NF and not contain any transitive partial dependency.
- 3NF is used to reduce the data duplication. It is also used to achieve the data integrity.
- If there is no transitive dependency for non-prime attributes, then the relation must be in third normal form.

EMPLOYEE_DETAIL table:

EMP_ID	EMP_NAME	EMP_ZIP	EMP_STATE	EMP_CITY
222	Harry	201010	UP	Noida
333	Stephan	02228	US	Boston
444	Lan	60007	US	Chicago
555	Katharine	06389	UK	Norwich
666	John	462007	MP	Bhopal

3NF

LEXICON

EMPLOYEE table:

EMP_ID	EMP_NAME	EMP_ZIP
222	Harry	201010
333	Stephan	02228
444	Lan	60007
555	Katharine	06389
666	John	462007

EMPLOYEE_ZIP table:

EMP_ZIP	EMP_STATE	EMP_CITY
201010	UP	Noida
02228	US	Boston
60007	US	Chicago
06389	UK	Norwich
462007	MP	Bhopal