

Entity Relationship Diagram (ERD)

Order#	CustomerID	Product	Date	Price	Country	Reviews	Likes	Rating	Related Item 1	Related Item 2	Related Item 3	Category
201-40025084-3326	e4025689	ASIN 654B8R94Z2	2/27/17	\$5.04	US	3	5	1	ASIN 654B8R94Z2	ASIN 2U9C40S901	ASIN 5J90FOP485	Electronics
573-43960286-9030	b4390218	ASIN 1F849FK051	2/28/17	\$604.00	CA	14	22	0.9	ASIN 1F849FK051	ASIN 78DD0394F0	ASIN 2U9C40S901	Electronics
351-15935263-7832	r0949572	ASIN 8KF904J489	3/1/17	\$25.99	US	14	17	1	ASIN 8KF904J489	ASIN 3F44C094F2	ASIN 78DD0394F0	Electronics
864-45009859-5129	s1900290	ASIN 654B8R94Z2	3/1/17	\$15.14	US	14	16	0.7	ASIN 2U9C40S901	ASIN 2U9C40S901	ASIN 1F849FK051	Electronics
921-36206811-9035	a4029521	ASIN 1F849FK051	3/18/17	\$158.00	UK	7	10	0.7	ASIN 78DD0394F0	ASIN 78DD0394F0	ASIN 8KF904J489	Electronics
953-19064026-4531	r3404952	ASIN 78DD0394F0	3/12/17	\$11.52	US	0	1	1	ASIN 78DD0394F0	ASIN 654B8R94Z2	ASIN 7X64H903Z8	Electronics
668-78913590-3239	g2049105	ASIN 5J90FOP485	3/20/17	\$5.81	US	0	0	1	ASIN 3F44C094F2	ASIN 1F849FK051	ASIN 654B8R94Z2	Electronics
632-60916144-9637	m2401459	ASIN 2U9C40S901	3/16/17	\$22.25	DE	1	1	0.9	ASIN 7X64H903Z8	ASIN 7X64H903Z8	ASIN 9Y9R0357C3	Electronics
781-43150591-1534	q3015403	ASIN 7X64H903Z8	3/15/17	\$35.68	CA	2	3	0.9	ASIN 7X64H903Z8	ASIN 5J90FOP485	ASIN 8KF904J489	Electronics
602-31531015-2240	t9013581	ASIN 654B8R94Z2	3/8/17	\$89.98	US	0	0	0.8	ASIN 654B8R94Z2	ASIN 2U9C40S901	ASIN 5J90FOP485	Electronics
351-35206016-5536	x3250154	ASIN 1F849FK051	3/9/17	\$40.48	FR	8	8	0.9	ASIN 1F849FK051	ASIN 78DD0394F0	ASIN 2U9C40S901	Electronics
351-39501955-5327	a8910952	ASIN 8KF904J489	3/18/17	\$43.89	PT	0	0	0.7	ASIN 8KF904J489	ASIN 3F44C094F2	ASIN 5J90FOP485	Electronics
358-13653196-1353	c5091685	ASIN 5J90FOP485	3/19/17	\$39.12	US	4	4	0.9	ASIN 5J90FOP485	ASIN 9Y9R0357C3	ASIN 2U9C40S901	Electronics
153-50195168-4138	h1981988	ASIN 2U9C40S901	3/20/17	\$0.00	CA	2	2	0.2	ASIN 7X64H903Z8	ASIN 7X64H903Z8	ASIN 78DD0394F0	Electronics
538-62309861-5338	p5189176	ASIN 78DD0394F0	3/28/17	\$28.82	US	8	8	0.8	ASIN 654B8R94Z2	ASIN 654B8R94Z2	ASIN 3F44C094F2	Electronics
201-40025084-3326	e4025689	ASIN 3F44C094F2	3/1/17	\$5.00	US	2	2	0.2	ASIN 1F849FK051	ASIN 1F849FK051	ASIN 9Y9R0357C3	Electronics
573-43960286-9030	b4390218	ASIN 9Y9R0357C3	3/17/17	\$604.00	CA	-1	0.8	0.7	ASIN 8KF904J489	ASIN 8KF904J489	ASIN 7X64H903Z8	Electronics
351-15935263-7832	r0949572	ASIN 7X64H903Z8	3/17/17	\$25.99	CA	1	1	1	ASIN 5J90FOP485	ASIN 5J90FOP485	ASIN 654B8R94Z2	Electronics
864-45009859-5129	s1900290	ASIN 654B8R94Z2	3/17/17	\$15.14	US	14	16	0.7	ASIN 2U9C40S901	ASIN 2U9C40S901	ASIN 1F849FK051	Electronics
921-36206811-9035	a4029521	ASIN 1F849FK051	3/18/17	\$158.00	UK	7	10	0.7	ASIN 78DD0394F0	ASIN 78DD0394F0	ASIN 8KF904J489	Electronics
953-19064026-4531	r3404952	ASIN 8KF904J489	3/19/17	\$11.52	US	0	0	0.9	ASIN 3F44C094F2	ASIN 3F44C094F2	ASIN 5J90FOP485	Electronics
668-78913590-3239	g2049105	ASIN 5J90FOP485	3/20/17	\$5.81	US	0	1	0.7	ASIN 9Y9R0357C3	ASIN 9Y9R0357C3	ASIN 2U9C40S901	Electronics
632-60916144-9637	m2401459	ASIN 2U9C40S901	3/16/17	\$22.25	DE	1	1	0.9	ASIN 7X64H903Z8	ASIN 7X64H903Z8	ASIN 9Y9R0357C3	Electronics
781-43150591-1534	q3015403	ASIN 78DD0394F0	3/17/17	\$35.68	US	0	0	0.8	ASIN 654B8R94Z2	ASIN 654B8R94Z2	ASIN 7X64H903Z8	Electronics
602-31531015-2240	t9013581	ASIN 5J90FOP485	3/27/17	\$0.00	CA	0	0	0.8	ASIN 1F849FK051	ASIN 1F849FK051	ASIN 654B8R94Z2	Electronics
351-35206016-5536	x3250154	ASIN 9Y9R0357C3	3/28/17	\$10.10	CA	-1	0	0.9	ASIN 8KF904J489	ASIN 8KF904J489	ASIN 1F849FK051	Electronics
351-39501955-5327	a8910952	ASIN 7X64H903Z8	3/1/17	\$43.89	US	1	1	0.9	ASIN 5J90FOP485	ASIN 5J90FOP485	ASIN 8KF904J489	Electronics
358-13653196-1353	c5091685	ASIN 2U9C40S901	3/13/17	\$12.50	CA	2	2	0.9	ASIN 5J90FOP485	ASIN 9Y9R0357C3	ASIN 2U9C40S901	Electronics
153-50195168-4138	h1981988	ASIN 2U9C40S901	3/13/17	\$12.50	CA	2	3	0.8	ASIN 2U9C40S901	ASIN 7X64H903Z8	ASIN 78DD0394F0	Electronics
538-62309861-5338	p5189176	ASIN 5J90FOP485	3/12/17	\$28.82	US	0	0	0.9	ASIN 8KF904J489	ASIN 3F44C094F2	ASIN 5J90FOP485	Electronics
358-13653196-1353	c5091685	ASIN 2U9C40S901	3/13/17	\$12.50	CA	-1	0	0.9	ASIN 8KF904J489	ASIN 8KF904J489	ASIN 1F849FK051	Electronics
153-50195168-4138	h1981988	ASIN 2U9C40S901	3/14/17	\$28.82	US	2	3	0.8	ASIN 2U9C40S901	ASIN 7X64H903Z8	ASIN 78DD0394F0	Electronics

collection of information
that is organized

DATABASE

so data can be easily
stored, managed, updated, and retrieved

Lucidchart (2017) What
is an Entity
Relationship Diagram?
<https://www.lucidchart.com/pages/er-diagrams>





Welcome to ERD

Entities

Customer	
Key	Customer_ID
Key	FirstName
Key	LastName
Key	Street
Key	City
Key	Zip
Key	Phone

Order	
PK	Order_number
Key	Customer_ID
Key	Customer_name
Key	To_street
Key	To_city
Key	To-state
Key	To-zip
Key	Ship_date

Product	
Key	Product_ID
Key	Quantity
Key	Product_type

Attributes

II 2:14 / 6:57

<https://www.youtube.com/watch?v=BaN7Ng7a82Y>

<https://www.lucidchart.com/pages/entity-relationship-diagrams>

What is an Entity Relationship Diagram (ERD)?

- An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database.
- An entity in this context is an object, a component of data.
- An entity set is a collection of similar entities. These entities can have attributes that define its properties.
- By defining the entities, their attributes, and showing the relationships between them, an ER diagram illustrates the logical structure of databases.
- Source:
<https://www.smartdraw.com/entity-relationship-diagram/>

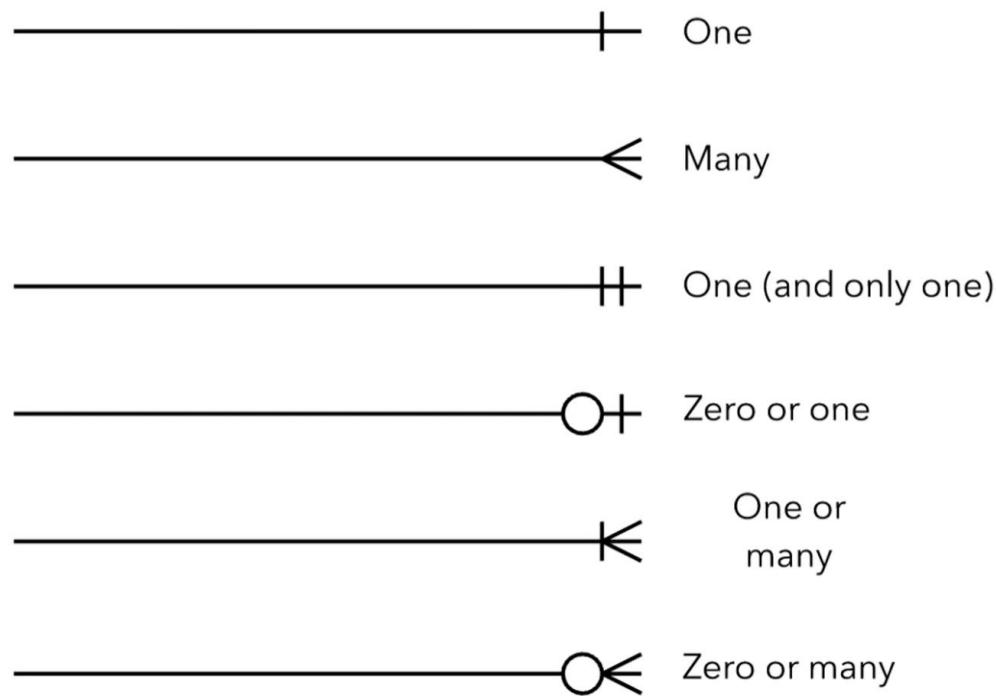
DBMS – What Is Entity Relationship Diagram (ERD) ?



In simple words , the Entity Relationship Diagram is a **blueprint**, that can be used to create a database using a specific database management system, **RDBMS**. We can compare this with architectural drawings. An architect creates blueprints before building a house .

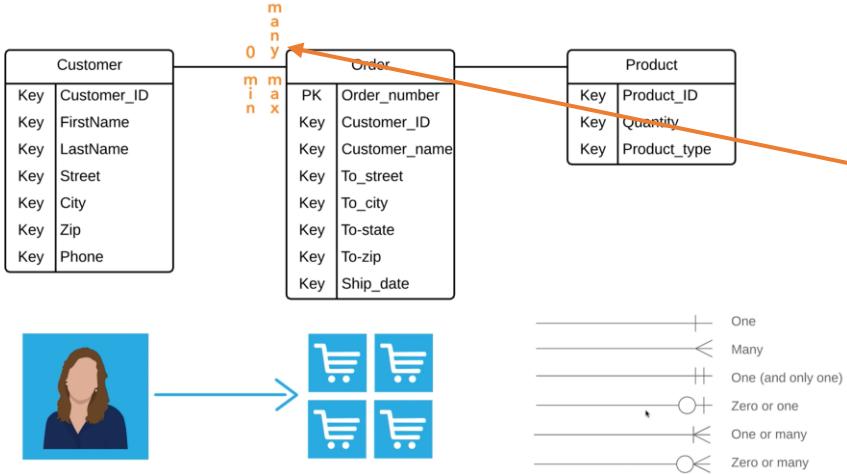
Visit - www.learncomputerscienceonline.com

ERD Cardinality



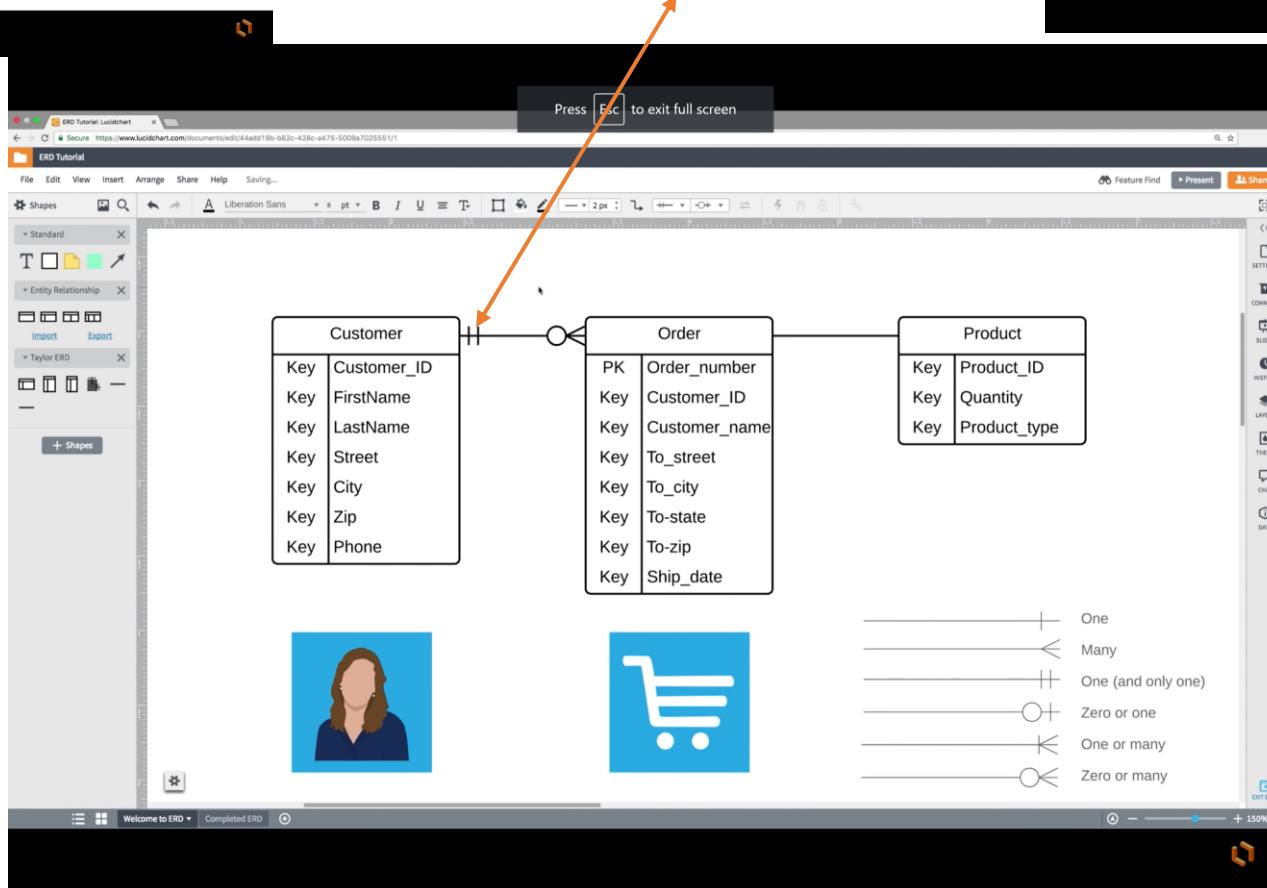
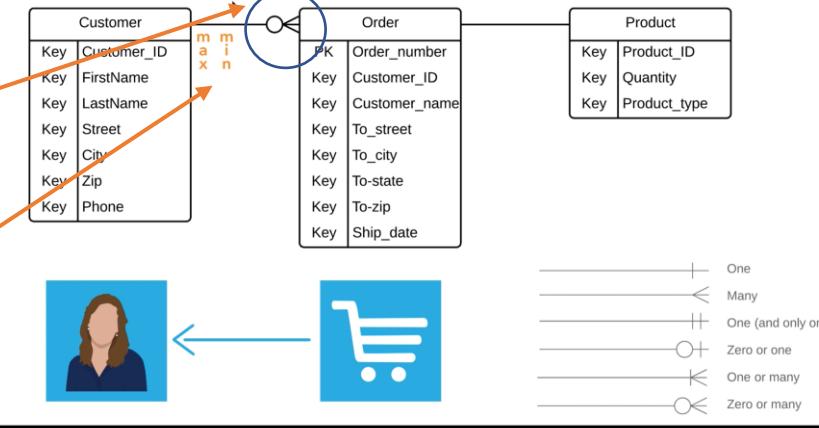
<https://www.lucidchart.com/pages/er-diagrams>





Ask questions in both directions

- Customer can have how many orders (min and max)?
- Order can have how many customers?

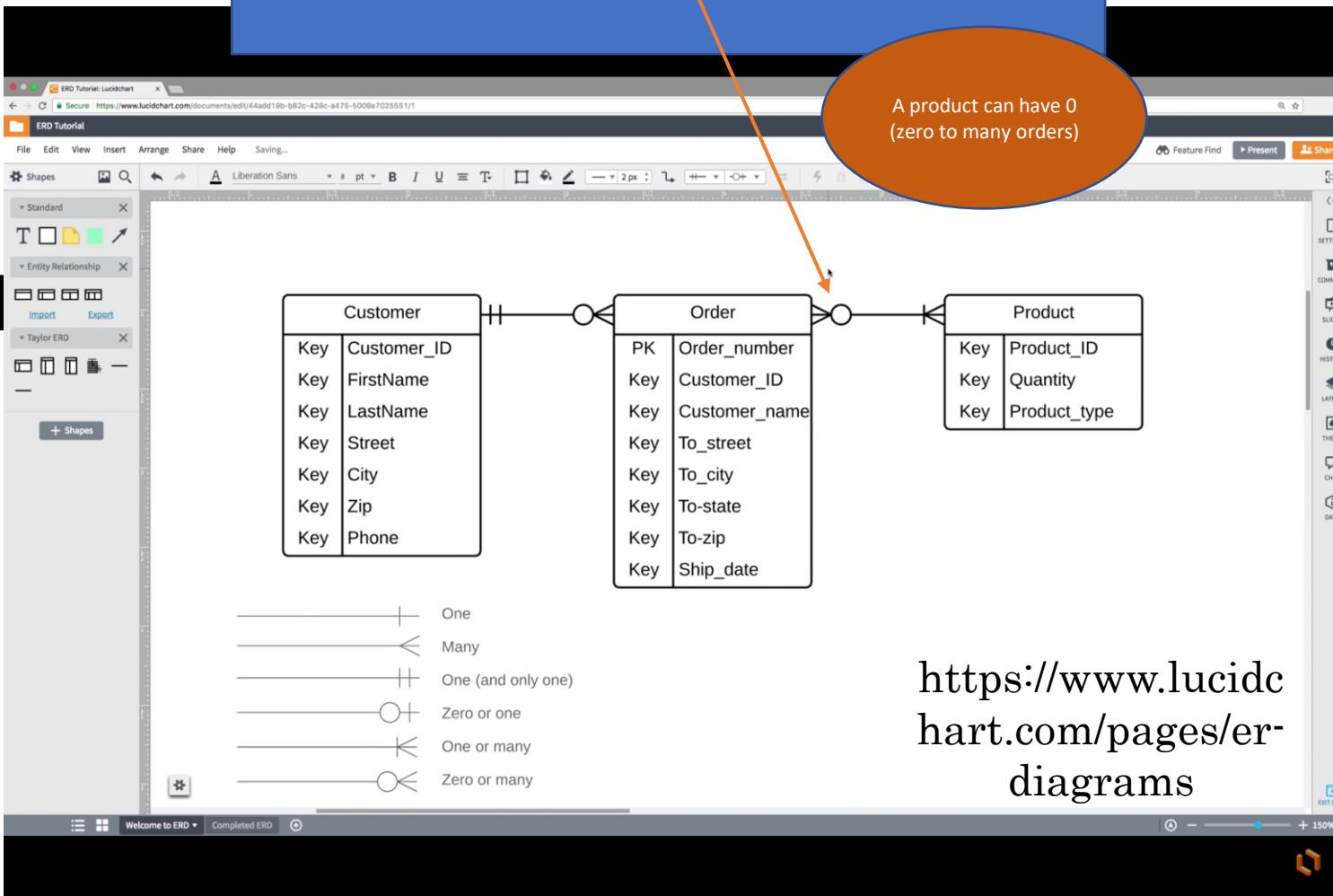


<https://www.lucidchart.com/pages/er-diagrams>

Customer	
Key	Customer_ID
Key	FirstName
Key	LastName
Key	Street
Key	City
Key	Zip
Key	Phone

Order	
PK	Order_number
Key	Customer_ID
Key	Customer_name
Key	To_street
Key	To_city
Key	To-state
Key	To-zip
Key	Ship_date

An order can have many products



<https://www.lucidchart.com/pages/er-diagrams>

DBMS – What Is Entity Relationship Diagram (ERD) ? **Strong Entity**

An entity is said to be a **strong entity** when, it has a **key attribute** that is prime attribute that can uniquely identify each instance of an entity.

For example, the **Employee ID** attribute for an employee entity and similarly the **Student ID** attribute for the student entity are examples of the **Strong Entity**.

In ER diagram the strong entity is shown by a **single line Rectangle**.

Weak Entity

Visit - www.learncomputerscienceonline.com

Pause (k)

II ▶ 🔍 4:32 / 14:11

DBMS – What Is Entity Relationship Diagram (ERD) ? **Strong Entity**

An entity is said to be a **weak entity** when it does not have a **key attribute** that is prime attribute that can uniquely identify each instance of an entity.

Weak Entity

The **weak entity** is dependent upon other strong entity for its existence into the database schema.

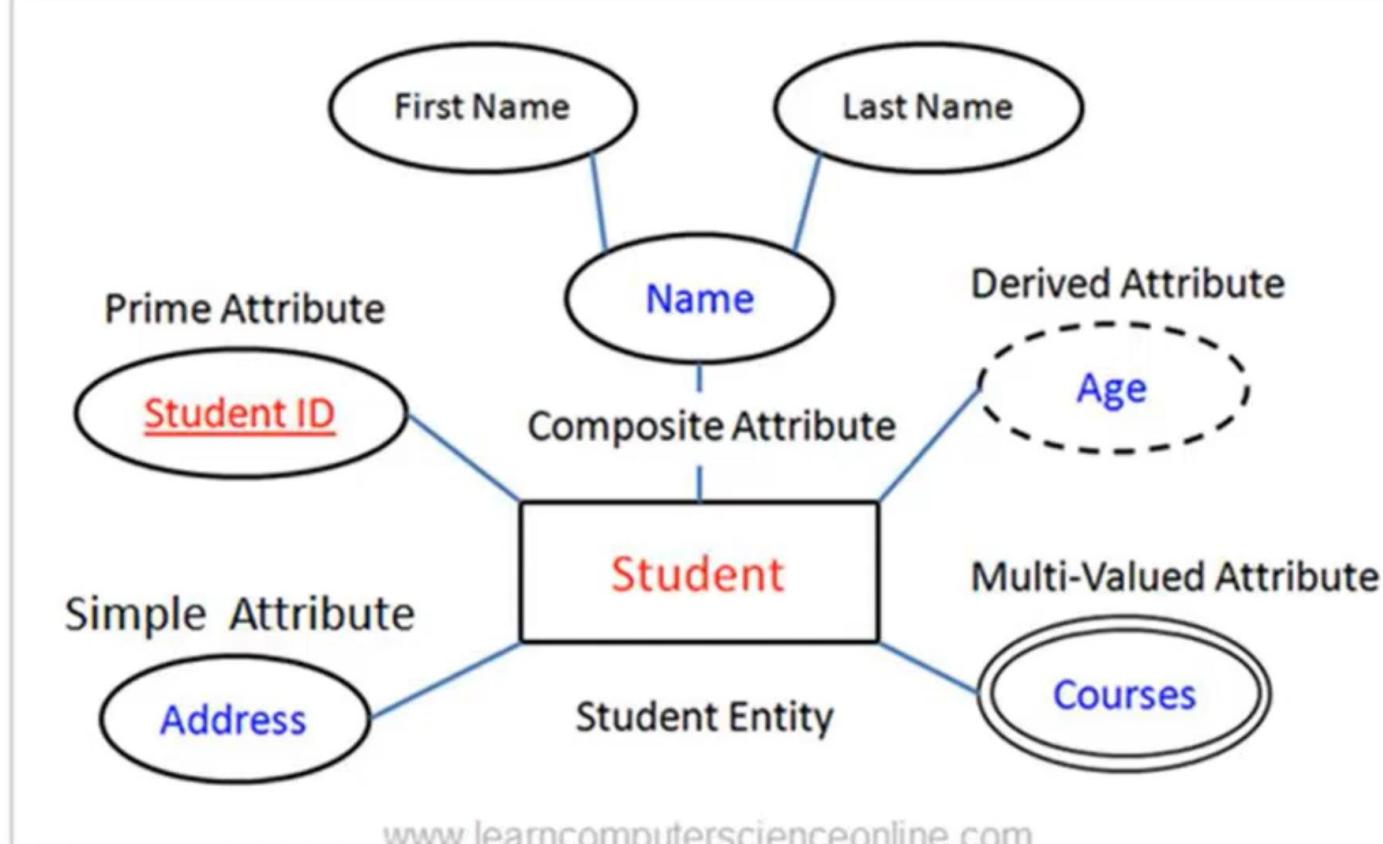
In E R diagram , the **weak entity** is shown by a **double line rectangle**.

Visit - www.learncomputerscienceonline.com



<https://www.youtube.com/watch?v=BaN7Ng7a82Y>

DBMS – What Is Entity Relationship Diagram (ERD) ?



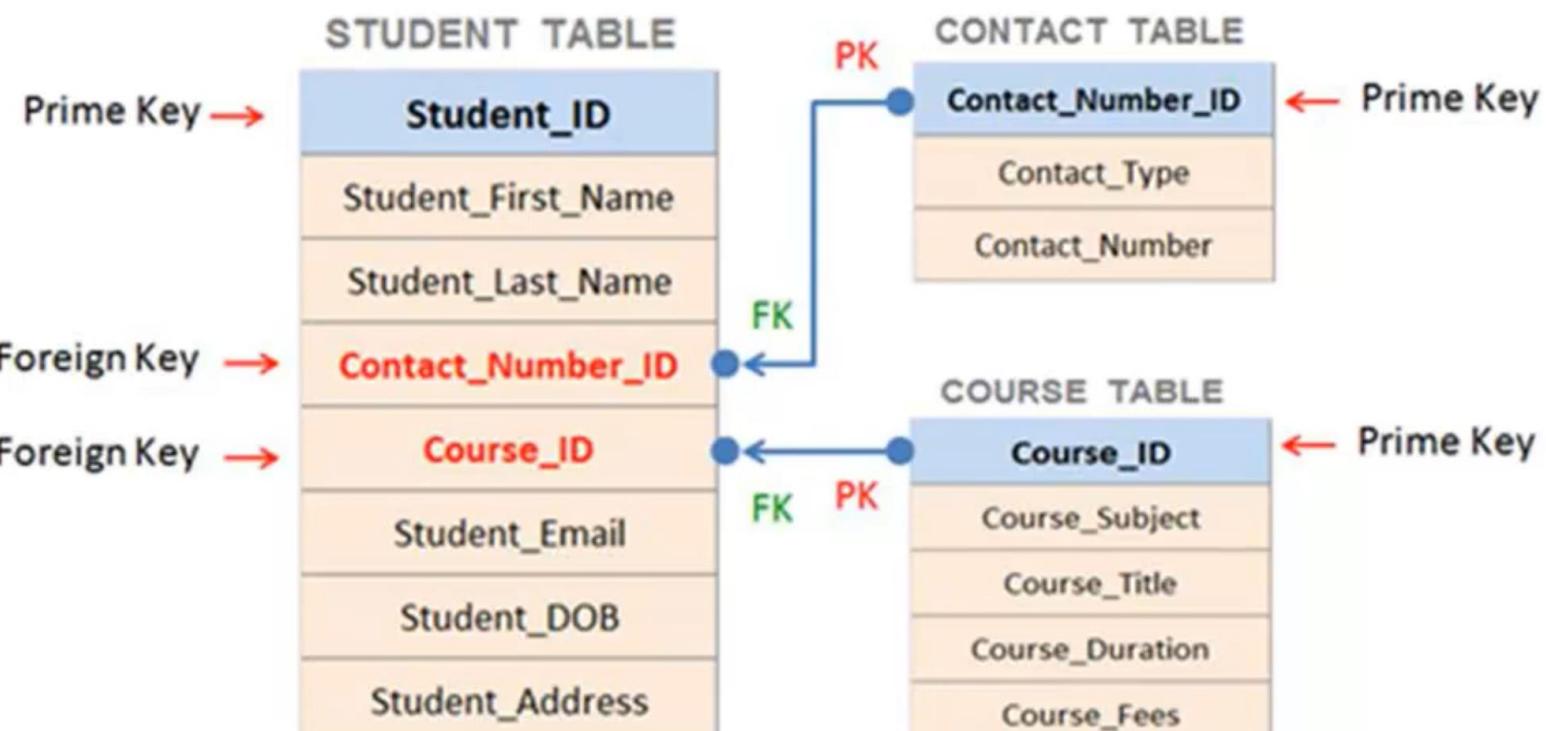
www.learncomputerscienceonline.com

Visit - www.learncomputerscienceonline.com



<https://www.youtube.com/watch?v=BaN7Ng7a82Y>

DBMS – What Is Entity Relationship Diagram (ERD) ?



www.learncomputerscienceonline.com

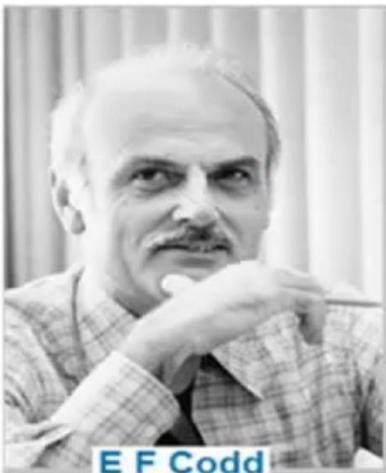
Visit - www.learncomputerscienceonline.com

<https://www.youtube.com/watch?v=BaN7Ng7a82Y>

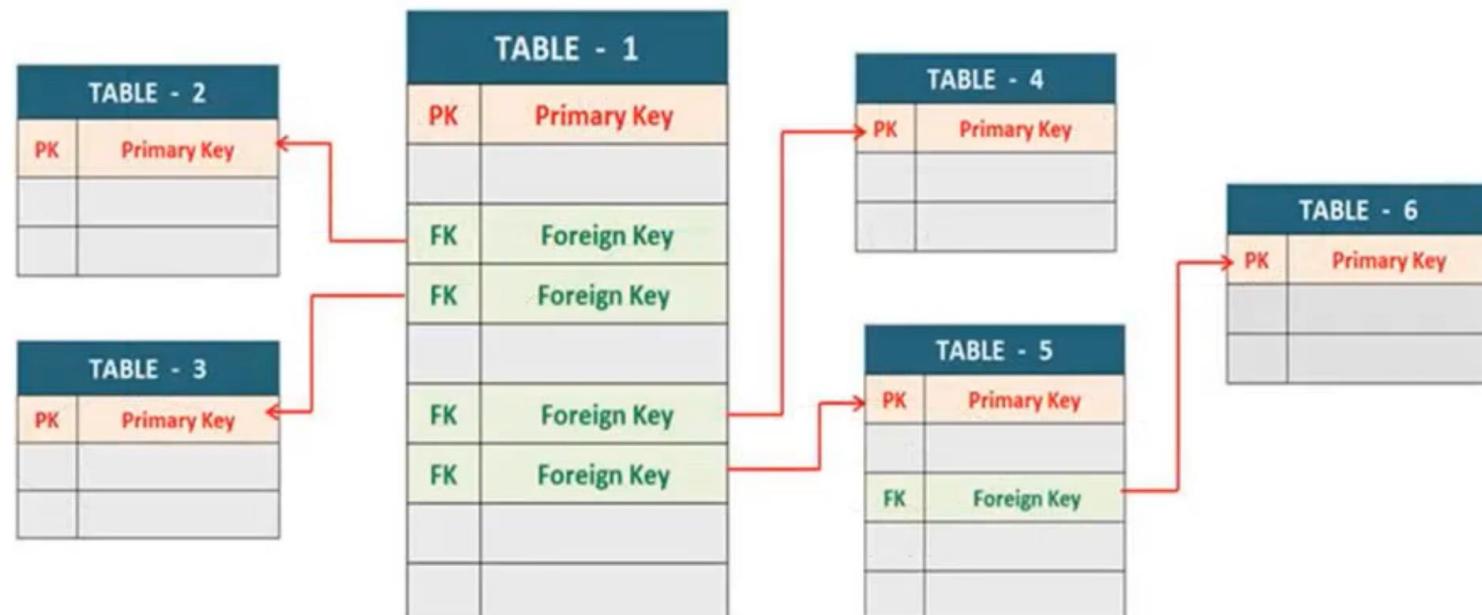




What Is Relational Database ?



E F Codd



www.learncomputerscienceonline.com

Visit - www.learncomputerscienceonline.com

<https://www.youtube.com/watch?v=BaN7Ng7a82Y>



DBMS – What Is Entity Relationship Diagram (ERD) ?



ER Model Explained - Cardinality

Cardinality (Entity Set Diagram) :

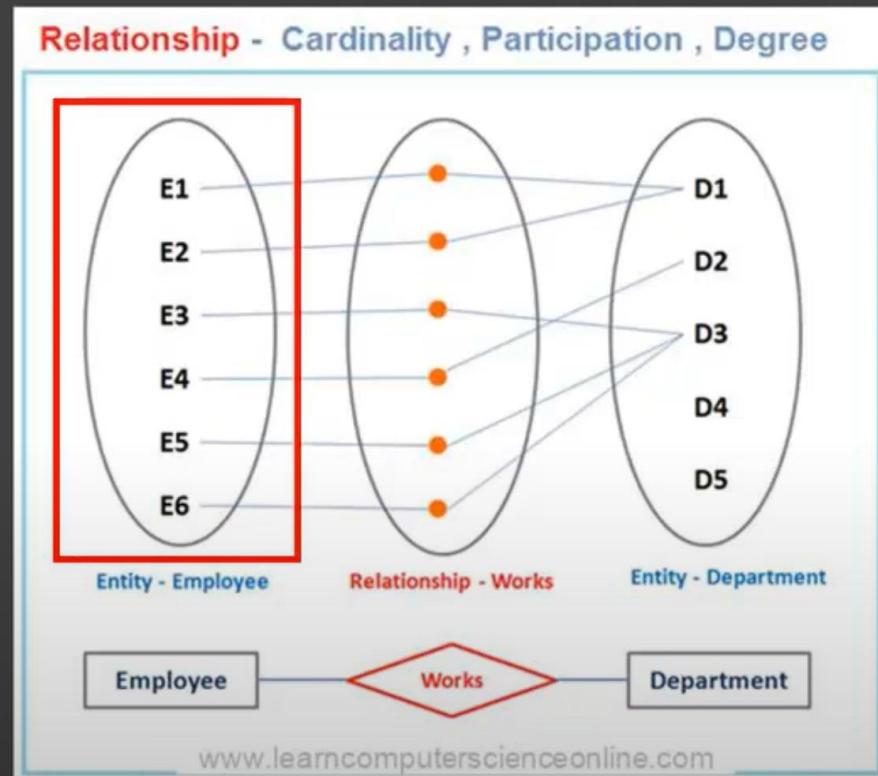
- There are **two entities** (Employee And Department) participating in this **relationship** (Works).
- The **cardinality** is defined as **maximum relationship** in which an **entity** can **participate**.

Cardinality For Employee Entity = 1 (One)

(Each Employee can work for only one Department)

Cardinality For Department Entity = N (Many)

(Each Department can have many employees)



Visit - www.learncomputerscienceonline.com



<https://www.youtube.com/watch?v=BaN7Ng7a82Y>

Customer Table

1	Customer_ID	FirstName	LastName	Street	City	Zip	Phone
2	30001	Jacob	Henderson	32 Myers St.	Phoenix	84635	895-698-4314
3	30002	Noelle	Sanderson	24 Hill Drive	Banning	72025	597-502-3005
4	30003	Spencer	Marlin	8406 St Margarets St.	Langhorne	90025	226-457-1686
5	30004	Solange	Carr	8272 Durham St.	Beckley	93382	478-870-3240
6	30005	Tony	Bell	70 Hawthorne Street	Meriden	57812	935-295-0925
7	30006	Laurel	Hudson	722 Newcastle Ave.	West Fargo	11814	429-793-0704
8	30007	Karen	Turner	8579 Vernon Rd.	Menasha	84699	249-928-4530
9	30008	Charlotte	Turner	44 Jones Road	Chicago	44476	997-192-5311
10	30009	Ben	Ellison	8533 S. Purple Finch Lane	Easton	54985	100-576-0463
11	30010	Danika	Marshall	1249 N. Bow Ridge St.	Manchester	16685	610-934-2799
12	30011	Jeremy	Nash	7135 North Rocky River Court	El Mitchell	23358	903-296-6663
13	30012	Iris	Edmunds	76 Strawberry Court	Yorktown	5120	728-849-9825
14	30013	Leanne	Peters	696 Fawn Court	Albany	97083	821-271-9463
15	30014	Ranee	Peters	64 Pennington Ave.	Jacksonville	33490	545-041-1643
16	30015	Steven	Langdon	7411 Shirley Street	Springfield	41437	522-287-2538
17	30016	John	Smith	68 Hopper St.	Wellesville	30476	172-245-1141
18	30017	David	Chapman	7627 N. 27th Ct.	Watertown	70728	111-267-2814
19	30018	Jeremy	Nash	7862 21st St.	Lorton	97924	147-612-1745
20	30019	Rhett	Buckland	243 Mayflower St.	Springfield	48852	648-246-5531
21	30020	Carmen	Jones	8318 Mammoth Ave.		41437	822-287-2538
22	30021	Marylynn	Smith	7411 Shirley Street		511720 52577	

A Primary Key is an attribute (or field) that uniquely identifies every record in a certain table.

1 Primary Key per entity.

just one primary key per entity.



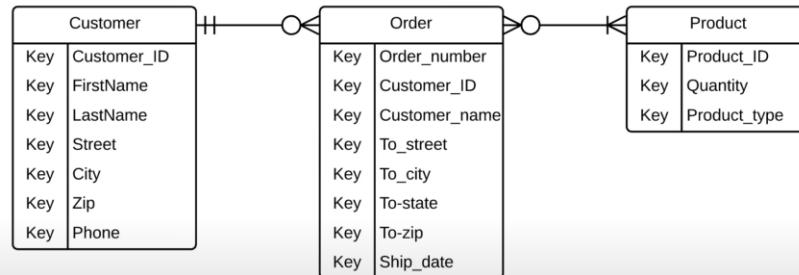
Customer Table

1	Customer_ID	FirstName	LastName	Street	City	Zip	Phone
2	30001	Jacob	Henderson	32 Myers St.	Phoenix	84635	895-698-4314
3	30002	Noelle	Sanderson	24 Hill Drive	Banning	72025	597-502-3005
4	30003	Spencer	Marlin	8406 St Margarets St.	Langhorne	90025	226-457-1686
5	30004	Solange	Carr	8272 Durham St.	Beckley	93382	478-870-3240
6	30005	Tony	Bell	70 Hawthorne Street	Meriden	57812	935-295-0925
7	30006	Laurel	Hudson	722 Newcastle Ave.	West Fargo	11814	429-793-0704
8	30007	Ben	Turner	8579 Vernon Rd.	Menasha	84699	249-928-4530
9	30008	Charlotte	Turner	44 Jones Road	Chicago	44476	997-192-5311
10	30009	Ben	Ellison	8533 S. Purple Finch Lane	Easton	54985	100-576-0463
11	30010	Danika	Marshall	1249 N. Bow Ridge St.	Manchester	16685	610-934-2799
12	30011	Jeremy	Nash	7135 North Rocky River Court	El Mitchell	23358	903-296-6663
13	30012	Iris	Edmunds	76 Strawberry Court	Yorktown	5120	728-849-9825
14	30013	Leanne	Peters	696 Fawn Court	Albany	97083	821-271-9463
15	30014	Ranee	Peters	64 Pennington Ave.	Jacksonville	33490	545-041-1643
16	30015	Steven	Langdon	7411 Shirley Street	Springfield	41437	522-287-2538
17	30016	John	Smith	68 Hopper St.	Wellesville	30476	172-245-1141
18	30017	David	Chapman	7627 N. 27th Ct.	Watertown	70728	111-267-2814
19	30018	Jeremy	Nash	7862 21st St.	Lorton	97924	147-612-1745
20	30019	Rhett	Buckland	243 Mayflower St.	Springfield	48852	648-246-5531
21	30020	Carmen	Jones	8318 Mammoth Ave.		41437	822-287-2538
22	30021	Marylynn	Smith	7411 Shirley Street		511720 52577	

- 1. Unique
- 2. Never changing
- 3. Never null

That just means there wouldn't be an occasion where the value could be left blank.

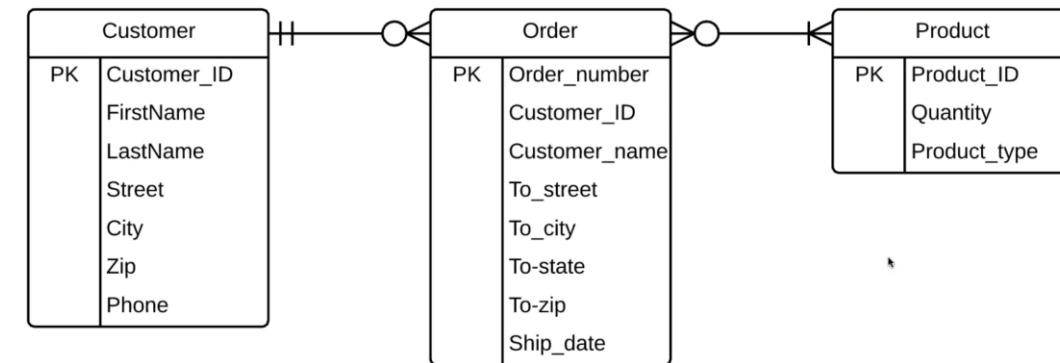




Primary Keys & Foreign Keys

Let's start with primary keys.

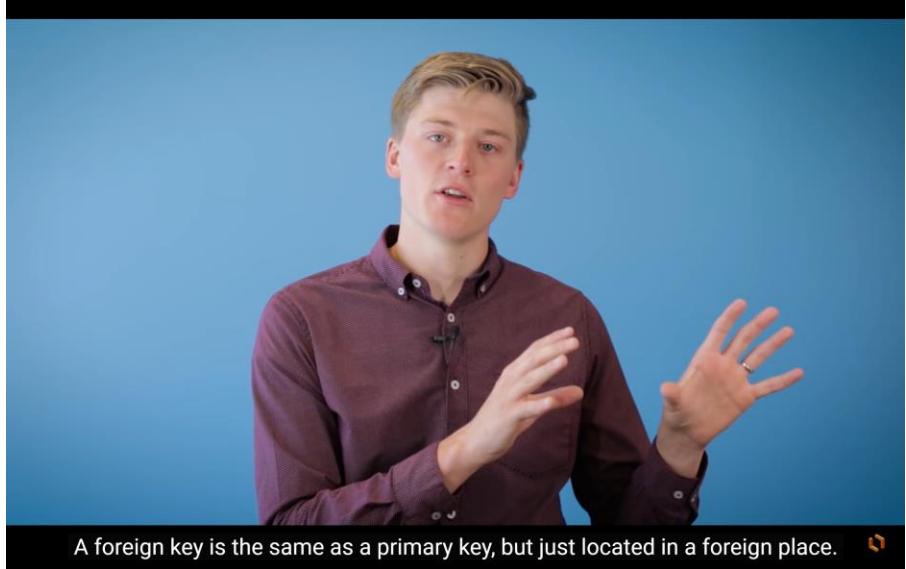
0:33 / 13:50



Each of these primary keys is unique, never changing, and never-null.



<https://www.youtube.com/watch?v=-CuY5ADwn24>



A foreign key is the same as a primary key, but just located in a foreign place.

Order Table							
Order_number	Customer_ID	Customer_name	To_street	To_city	To_state	To_zip	Ship_date
202349913	20082	Kerry Maysen	7240 N. Bow Ridge St.	Ft. Mitchell	NV	23386	6/20/2017 11:18:52
202349914	20421	John Wiley	7138 North Rocky River Court	Yonkers	AL	59720	6/20/2017 11:18:53
202349915	20420	John Wiley	7138 North Rocky River Court	Cohoes	NJ	27759	6/20/2017 11:18:53
202349916	20421	John Wiley	7138 North Rocky River Court	Albany	NY	97083	6/20/2017 11:18:53
202349917	20420	John Wiley	7138 North Rocky River Court	Jacksonville	FL	33490	6/20/2017 11:18:53
202349918	20420	John Wiley	7138 North Rocky River Court	St. Louis	MO	41437	6/20/2017 11:18:53
202349919	20018	John Smith	7138 North Rocky Street	St. Louis	MO	30478	6/20/2017 11:18:53
202349920	20772	Ryan Keeler	243 Mayflower Dr.	West Jordan	UT	87024	6/20/2017 11:17:18
202349921	20895	Isabella Hayes	821 Cardinal Court	Tempe	CO	33408	6/20/2017 11:17:18
202349922	31419	Plumb Walls	9827 Morris Ave.	Veolia	DE	75922	6/20/2017 11:17:18
202349923	37388	Linsey Cottle	14 Lakewood Ave.	Norwich	NY	87480	6/20/2017 11:17:18
202349924	30018	John Smith	7411 Bradley Street	Edison	CA	62761	6/20/2017 11:18:31
202349925	28037	Alynn Donovan	9807 Summer Street	Centerville	TN	31740	6/20/2017 11:18:31
202349926	42094	Darren Moss	7538 Fairground Ave.	Springfield	MO	41437	6/20/2017 11:18:33
202349927	38671	Lori Hartman	820 Main St.	South Lyon	IA	87143	6/20/2017 11:18:40
202349928	26311	Samuel Hartman	820 Main St.	Pottawatt	VT	99563	6/20/2017 11:18:40
202349929	26312	Samuel Hartman	820 Main St.	Wyoming	RI	74177	6/20/2017 11:18:43
202349930	26313	Samuel Hartman	820 Main St.	SC	69236	6/20/2017 11:19:09	

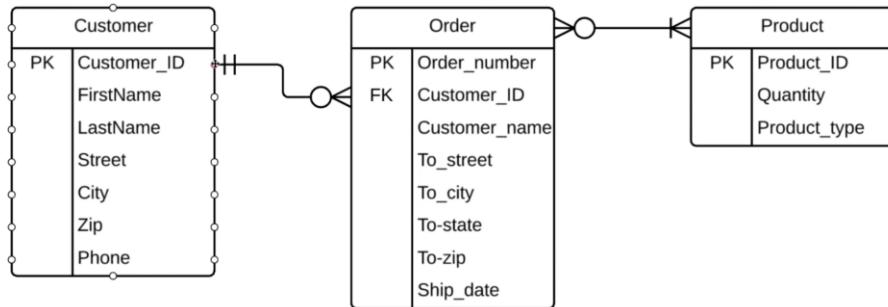
Foreign keys don't have to be unique.

They can be repeated in a table.

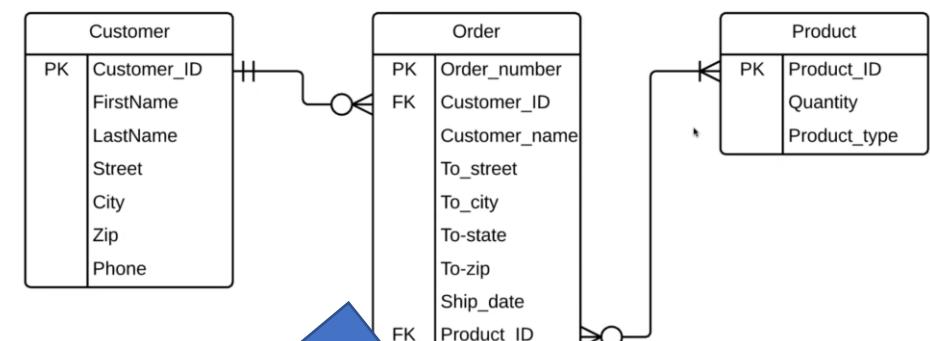
If John's an avid shopper, his Customer ID is going to be repeated a lot.

There can be multiple foreign keys in one entity.

Let's say for each order, we also want to know what product is being sold.



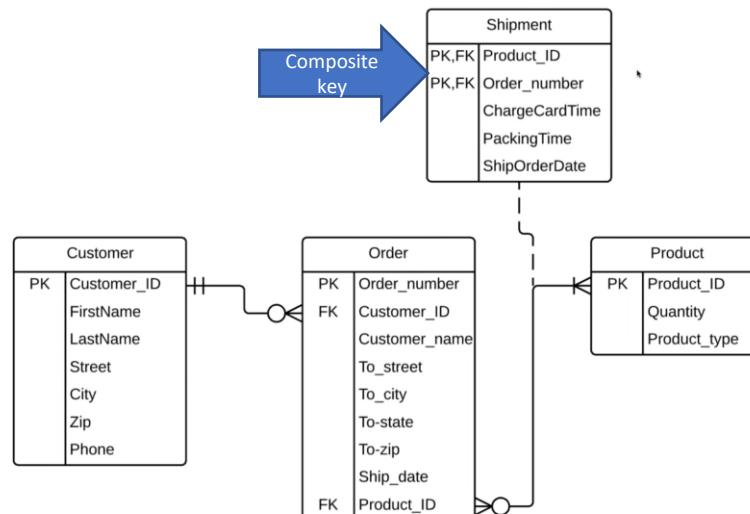
Just move these crows feet to line up with the PK and FK attributes.



There's also something called a composite primary key.

Composite primary keys are used when two or more attributes are necessary to uniquely identify every record in a table

Take two foreign keys – merge them to create a composite primary key



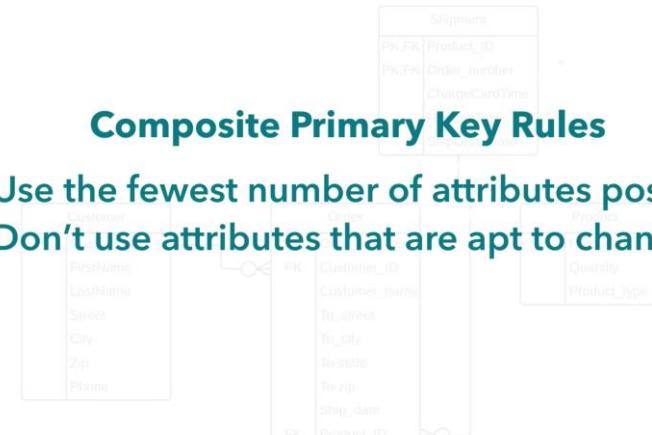
It means that both of these attributes are needed to create a composite primary key.

Composite Primary Key		Shipment Table				
		Product_ID	Order_number	ChargeCardTime	PackingTime	ShipOrderDate
13	49225	252349915	6/1/2017 9:13:34	6/2/2017 10:14:46	6/3/2017 11:15:52	
14	40807	252349916	6/1/2017 9:14:16	6/2/2017 10:15:02	6/3/2017 11:16:03	
15	76342	252349917	6/1/2017 9:14:01	6/2/2017 10:15:26	6/3/2017 11:16:13	
16	96893	252349918	6/1/2017 9:14:21	6/2/2017 10:15:39	6/3/2017 11:16:19	
17	69246	252349919	6/1/2017 9:14:34	6/2/2017 10:15:41	6/3/2017 11:16:47	
18	69253	252349919	6/1/2017 9:14:34	6/2/2017 10:15:45	6/3/2017 11:16:47	
19	99002	252349920	6/1/2017 9:15:07	6/2/2017 10:16:07	6/3/2017 11:17:11	
20	64382	252349921	6/1/2017 9:15:14	6/2/2017 10:16:07	6/3/2017 11:17:23	
21	91514	252349922	6/1/2017 9:15:33	6/2/2017 10:16:28	6/3/2017 11:17:23	
22	64244	252349923	6/1/2017 9:15:33	6/2/2017 10:16:50	6/3/2017 11:17:41	
23	94251	252349924	6/1/2017 9:16:17	6/2/2017 10:17:05	6/3/2017 11:18:00	
24	69253	252349925	6/1/2017 9:16:21	6/2/2017 10:17:17	6/3/2017 11:18:04	
25	94166	252349926	6/1/2017 9:16:38	6/2/2017 10:17:29	6/3/2017 11:18:10	
26	44199	252349927	6/1/2017 9:16:41	6/2/2017 10:17:30	6/3/2017 11:18:16	
27	40759	252349928	6/1/2017 9:16:49	6/2/2017 10:17:44	6/3/2017 11:18:25	
28	39668	252349929	6/1/2017 9:16:52	6/2/2017 10:17:53	6/3/2017 11:18:31	
29	71292	252349930	6/1/2017 9:16:59	6/2/2017 10:17:58	6/2/2017 11:18:43	
30	60424	252349931	6/1/2017 9:17:02	6/2/2017 10:18:11	6/3/2017 11:18:54	

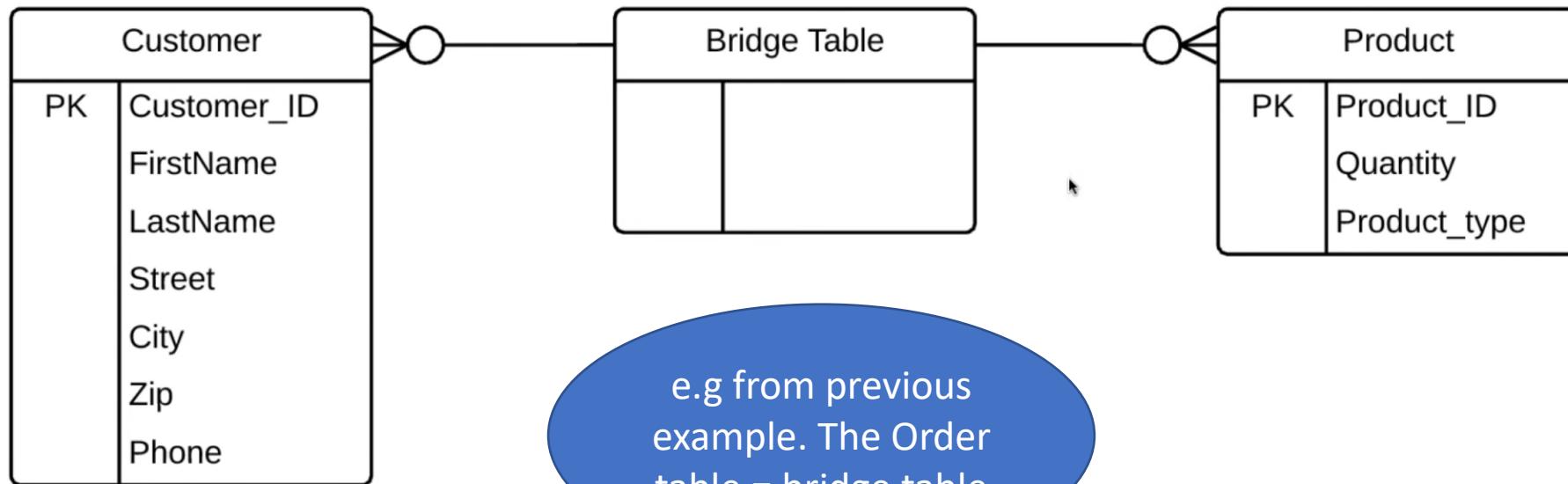
That's a composite primary key.

Composite Primary Key Rules

1. Use the fewest number of attributes possible.
2. Don't use attributes that are apt to change.



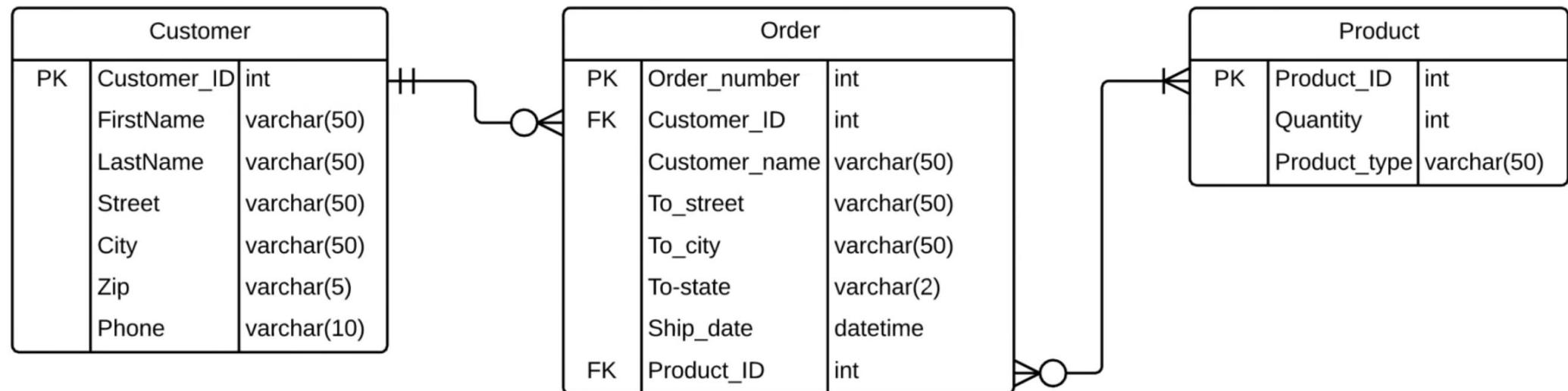
Two, don't use attributes that are apt to change because that can make things messy.



e.g from previous example. The Order table = bridge table

A bridge table allows for an intermediary one-to-many relationship and gets you the

interaction between the two tables



that you can include these in your ER diagram
if you want to get more technical.



Some terms explained (Connolly & Begg, 2015: chapter 12)

- An entity type is a group of objects with the same properties, which are identified by the enterprise as having an independent existence.
- An entity occurrence is a uniquely identifiable object of an entity type.
- A relationship type is a set of meaningful associations among entity types.
- A relationship occurrence is a uniquely identifiable association, which includes one occurrence from each participating entity type.
- The degree of a relationship type is the number of participating entity types in a relationship.
- A recursive relationship is a relationship type where the same entity type participates more than once in different roles.
- An attribute is a property of an entity or a relationship type.
- An attribute domain is the set of allowable values for one or more attributes.
- A simple attribute is composed of a single component with an independent existence.
- A composite attribute is composed of multiple components each with an independent existence.
- A single-valued attribute holds a single value for each occurrence of an entity type.
- A multi-valued attribute holds multiple values for each occurrence of an entity type.
- A derived attribute represents a value that is derivable from the value of a related attribute or set of attributes, not necessarily in the same entity.

Some terms explained:

- A candidate key is the minimal set of attributes that uniquely identifies each occurrence of an entity type.
- A primary key is the candidate key that is selected to uniquely identify each occurrence of an entity type.
- A composite key is a candidate key that consists of two or more attributes.
- A strong entity type is not existence-dependent on some other entity type. A weak entity type is existence-dependent on some other entity type.
- Multiplicity is the number (or range) of possible occurrences of an entity type that may relate to a single occurrence of an associated entity type through a particular relationship.
- Multiplicity for a complex relationship is the number (or range) of possible occurrences of an entity type in an n-ary relationship when the other ($n-1$) values are fixed.
- Cardinality describes the maximum number of possible relationship occurrences for an entity participating in a given relationship type.
- Participation determines whether all or only some entity occurrences participate in a given relationship.
- A fan trap exists where a model represents a relationship between entity types, but the pathway between certain entity occurrences is ambiguous.
- A chasm trap exists where a model suggests the existence of a relationship between entity types, but the pathway does not exist between certain entity occurrences