


- 07 - Programming Foundations: Databases

🔗 Certificate	CertificateOfCompletion_Programming Foundations Databases.pdf
# Completed Sections	6
🔗 Course Links	https://www.linkedin.com/learning/programming-foundations-databases-2/?resume=false
# Goal Sections	6
☰ Quick note	https://www.linkedin.com/learning/certificates/49bdbcf645fb4b58f9f87e0ca420b9544e6897bbd8d07b5f30e0:trk=share_certificate
📅 Start and Finish Date	
🖼️ Thumbnail	
⌵ Time	1h 25m 15s
⌵ Understanding %	
Σ نسبة الإنتهاء	✅ Done

Intro

▼ What is Database

- The make the work with a big amount of data more efficient.
- Provide structure for data
- Allow enforcement of rules for data
- Protect data from unauthorized access or changes
- A database is a structure that stores information in an organized , consistent, reliable, and searchable way.
- Spreadsheets

Field				
Record	Name	Phone	Birthday	Email
	Cullin Parminter	(954) 294-7424	5/21/61	
	Allyson Jira		1/23/96	ajira@wisdompets.com
	Herby Aspinal	(916) 942-8188	3/28/34	

-
- Structured data
- When you store data in a database, what is one advantage you get over a plain spreadsheet
 - Rows of data can be associated with each other across table
 - While some spreadsheets can simulate this capability with lookup functions, the ability to create relationships between tables is a core function of relational databases.

Customers		
Name	Phone	Birthday
Cullin Parminter	(954) 294-7424	5/21/1961
Amby Harber	(919) 557-3321	6/21/1925
Herby Aspinal	(916) 942-8188	3/28/1934

Orders	
Order	
Classic Burger	
Apple Pie	
Cheesecake	
Cafe Latte	
Crème Brûlée	
Garden Buffet	

- The definition of how data in a database will be organized is called the **schema**.
 - The database's schema includes the information about the layout of tables and other information about the database itself.

Database Foundation

▼ Relational databases

- In a relational database, tables are made up of rows, which represent instances of a given entity, and columns, which represent attributes of each entity.
 - Example
 - Customer = Entity

Customers			
FirstName	LastName	Email	Phone
Maggi	Domney	mdomney0@...	760-702-5469
Javier	Dawks	jdawks1@red...	860-906-1459
Aleen	Fasey	afasey2@kine...	561-410-2222
Maggi	Jenkins	tjenkins@rox...	954-294-7424
Imogen	Kabsch	ikabsch@lad...	864-326-7456
Dunc	Winny	dwinny5@kine...	706-389-4923

- Dis=Entity

Dishes			Customers			
Name	Price	Description	FirstName	LastName	Email	Phone
French Onion Soup	\$7.00	Caramelized onion...	Maggi	Domney	mdomney0@...	760-702-5469
Mini Cheeseburgers	\$8.00	These mini cheese...	Javier	Dawks	jdawks1@red...	860-906-1459
Stuffed Mushrooms	\$7.00	Large mushroom...	Aleen	Fasey	afasey2@kine...	561-410-2222
Garden Buffet	\$9.99	Chose from our fr...	Maggi	Jenkins	tjenkins@rox...	954-294-7424
House Salad	\$7.00	Our house salad is...	Imogen	Kabsch	ikabsch@lad...	864-326-7456
Chef's Salad	\$7.00	The chef's salad...	Dunc	Winn	dwinny5@kine...	706-389-4923

▼ Keys and unique values

- Unique values appear only once within a given column

Customers		
FirstName	LastName	Phone
Taylor	Jenkins	(954) 294-7424
Taylor	Jenkins	(202) 765-8011

Not unique Possibly unique

- Composite Key
 - Two or more fields taken together to act as a unique identifier
- Keys refer to only one record

Primary Key			
Customers			
CustomerID	FirstName	LastName	Phone
1	Taylor	Jenkins	(954) 294-7424
2	Cullin	Parminster	(919) 557-3321
3	Amby	Harber	(916) 942-8188
4	Allyson	Jira	(812) 301-6915
5	Paco	Yarranton	(785) 691-3913

▼ Relationships

- If we need to tell the database that particular records should be associated with each other.
 1. One-to-many (most common)

- a. This associates one record in one table with multiple records in another table.

One-to-many

Primary key

Foreign key

Dishes

DishID	Name	Description
8	Chef's Salad	The Chef's Salad has...
10	Classic Burger	Our Classic Burger...
14	Family Fiesta Platter	This platter is...
15	Crème Brûlée	Elegantly crafted...
16	Cheesecake	Our New York style...

Customers

CustomerID	FirstName	LastName	...	FavoriteDish
1	Taylor	Jenkins		8
27	Yves	Dell'Abette		8
28	Culley	Cawood		12
31	Osgood	Saunter		14

2. Many-to-many

- a. we create a new table called an associative or linking table that contains columns for the foreign keys from the tables we're associating.

Many-to-many

linking table

Customers

CustomerID	FirstName	LastName	...	FavoriteDish
98	Iver	Palke		16
7	Cammi	Kynett		5
24	Tybie	Balme		14

CustomersDishes

CustomerID	DishID
7	5
98	16
24	14

Dishes

DishID	Name	Description	Price
5	Panko Stuffed Mushrooms	Large mushroom...	\$7.00
15	Crème Brûlée	Elegantly crafted...	\$9.00
14	Fiesta Family Platter	This platter is...	\$9.99

3. One-to-one

- a. Unlike a one to many relationship, a one to one relationship associates only one record on one table **with only one record on another table**,

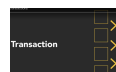
Customers				
CustomerID	FirstName	LastName	...	FavoriteDish
98	Iver	Palke		16
7	Cammi	Kynett		5
24	Tybie	Balme		14

SpecialRequests	
CustomerID	RequestNotes
7	Table by window
24	Extra sauce on pizza
98	Extra espresso shot

1.

▼ ACID and transactions

- the transaction have to be very accurate.
 - A transaction is a set of operations that must all be completed, and if for some reason any of the individual operations aren't completed, **no changes are made to the database.**



- They have to be ACID
 - Atomic
 - there are indivisible, that pieces of it can't be separated out.
 - Consistent
 - it means that whatever the transaction does, it needs to leave the database in a valid or consistent state. The actions in a transaction can't violate integrity rules that are defined for the database.
 - Isolation
 - means that while the activities in the transaction are being completed, nothing else can make changes to the data involved.
 - Durability
 - means that the information we change in the transaction is reported as complete, the data is there.

▼ Basic SQL

- is a database language
 - Structured
 - Query
 - Language
- Allows statements to be written for DBMS to interpret how to interact with data
- Offers feature to manage the database itself, such as creating of r modifying tables and controlling access to tables
- Examples

"Show me the first name and last name for every record in the Customers table, please."

```
SELECT FirstName, LastName FROM Customers;
```

```
SELECT FirstName, LastName, Birthday FROM Customers;
```

Customers

CustomerID	FirstName	LastName	Phone	Birthday

```
ORDER BY Birthday;
```

o

Tables

▼ Modeling and planning a database

- ER Diagram

- o A diagram that uses tables , fields, and relationships to plan a database.

Customer Record

Customers

FirstName	LastName	Email	Phone	Birthday	Address	City

1.246 aktive N

Dish Record

Dishes

Name	Description	Price

Event Record

Events

Name	Date	Description

- o Naming tables

-

▼ Naming tables

- we have to name the table , with a name what describe what includes this table
 - o the column
 - we use the upperCamelCase , without spaces between the words

- eg. FirstName
- eg. LastName

▼ Columns and data types

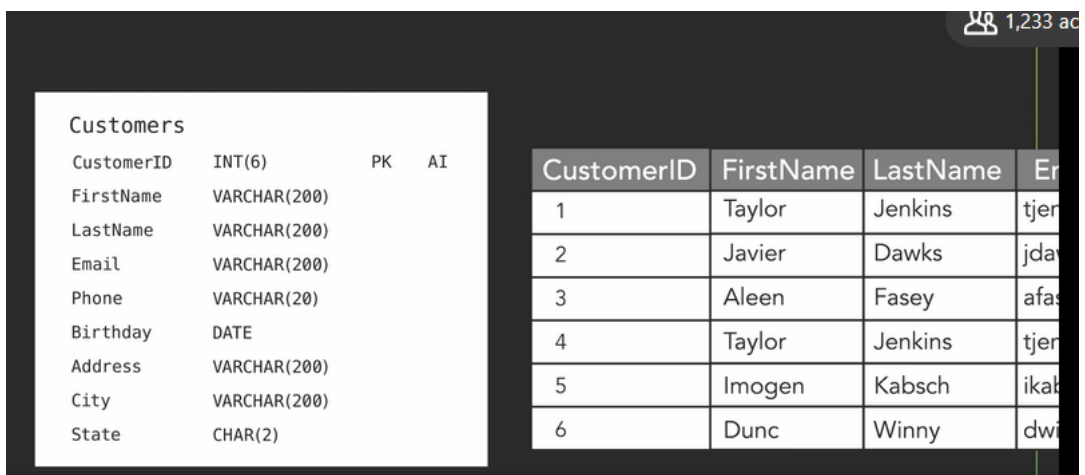
- Data types
 - Strings- alphanumeric characters and text
 - Char- fixed number of characters
 - VARCHAR- variable number of characters up to a maximum length
 - other types for longer text
 - Dates and times
 - Date 2019.03.09
 - DateTime 2019.03.09 16:51:00
 - TimeStamp (saved when record is updated)

▼ Numbers and other types

- Integers
- Double precision
- Floating point
- Decimals
- (Null) represents the absence of a value
 - if the column is empty
 - Null
 - if it is full
 - NOT NULL

▼ Primary and foreign key

- the primary key is a number what we add to the row to make the row special and don't repeat the same value



CustomerID	FirstName	LastName	Email
1	Taylor	Jenkins	tjen
2	Javier	Dawks	jda
3	Aleen	Fasey	afas
4	Taylor	Jenkins	tjen
5	Imogen	Kabsch	ikab
6	Dunc	Winny	dwi

- Composite key
 - A composite key is a combination of fields that uniquely identify a record.

Relationships

▼ Creating relationships

▼ Relationships

- If we need to tell the database that particular records should be associated with each other.

1. One-to-many (most common)

- This associates one record in one table with multiple records in another table.

i. Example



1.

One-to-many

Primary key

Foreign key

DishID	Name	Description
8	Chef's Salad	The Chef's Salad has...
10	Classic Burger	Our Classic Burger...
14	Family Fiesta Platter	This platter is...
15	Crème Brûlée	Elegantly crafted...
16	Cheesecake	Our New York style...

CustomerID	FirstName	LastName	...	FavoriteDish
1	Taylor	Jenkins		8
27	Yves	Dell'Abette		8
28	Culley	Cawood		12
31	Osgood	Saunter		14

2. Many-to-many

- we create a new table called an associative or linking table that contains columns for the foreign keys from the tables we're associating.

b. Example

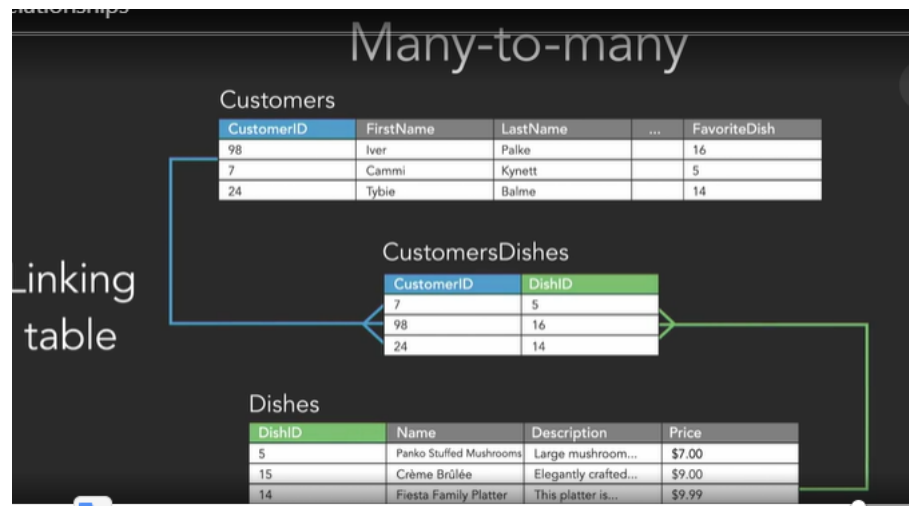
OrderID	CustomerID	OrderDate
17	1	2019-02-08 13:45:21
11	38	2019-01-25 16:31:12
8	17	2019-01-04 17:55:43
6	1	2018-12-14 12:45:16
3	16	2018-12-04 18:12:34

DishID	Name	Description
8	Chef's Salad	The Chef's Salad has...
10	Classic Burger	Our Classic Burger...
14	Family Fiesta Platter	This platter is...
15	Crème Brûlée	Elegantly crafted...
16	Cheesecake	Our New York style...

linking list

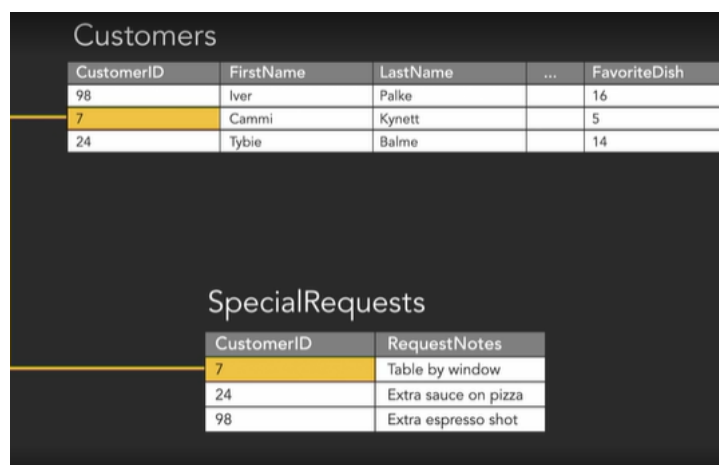
OrderID	DishID
17	8
17	10
8	10
6	16
3	14
11	16

1.



3. One-to-one

- a. Unlike a one to many relationship, a one to one relationship associates only one record on one table **with only one record on another table**,
- b. it separate one row to be more secure



- Relationship rules and referential integrity
 - Databases are aware of relationships and won't allow a user to modify data in a way that violates those relationships.
 - What is it called if you delete a record and the database goes on and deletes other records associated with that record?
 - a cascading delete: If configured to do so, a delete operation can cascade across records linked with a relationship.

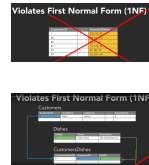
Database Optimization

▼ Normalization

- There are 3 rules to organizing data in a database
- When a normalization rule has been applied to a database, we can say that the database is in that normal form

▼ First normal form

- Values in each cell should be atomic and tables should have nonrepeating groups
 - Just one value in a cell



▼ Second normal form

- No value in a table should depend on only part of a key that can be used to uniquely identify a row
 - this means that for every column in the table that isn't a key, each of the values must rely on only the whole key. The values must describe something about that row that we can't determine from just the part of a key
 - example

Second Normal Form (2NF)

1.209 aktiv

Events

EventID	Name	...	Date	Location
6	Winter Wonderland		2019-01-01 18:00:00	Landon Hotel
14	Eating Healthy at School		2018-10-06 09:00:00	Teaching Kitchen
9	Eating Healthy at School		2018-09-01 09:00:00	Teaching Kitchen
5	Winter Wonderland		2018-01-01 18:00:00	Landon Hotel
12	Eating Healthy at School		2018-09-22 09:00:00	Teaching Kitchen

Composite Key

Second Normal Form (2NF)

Events

EventID	Name	...	Date
6	Winter Wonderland		2019-01-01 18:00:00
14	Eating Healthy at School		2018-10-06 09:00:00
9	Eating Healthy at School		2018-09-01 09:00:00
5	Winter Wonderland		2018-01-01 18:00:00
12	Eating Healthy at School		2018-09-22 09:00:00

EventsLocations

EventName	Location
Winter Wonderland	Landon Hotel
Eating Healthy at School	Teaching Kitchen

▼ Third normal form

- Values should not be stored if they can be calculated from another non-key field.

- ### ▼ Denormalization

- # Denormalization

Orders

OrderID	CustomerID	Quantity	Total
7	71	5	\$26.98
8	17		
9	51		
10	66		

OrdersDishes

OrdersDishesID	OrderID	DishID
12	7	11
13	7	10
14	7	3

Dishes

DishID	Price
10			\$9.99
11			\$9.99
3			\$7.00

- ## Querying a Database

- Creating tables
 -

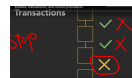
```
1 CREATE TABLE Customers (  
2   CustomerID INT(6) NOT NULL AUTO_INCREMENT  
3   FirstName VARCHAR(200) NOT NULL,  
4   LastName VARCHAR(200) NOT NULL,  
5   Email VARCHAR(200)  
6   PRIMARY KEY(CustomerID)  
7 )
```

- Writing SQL queries (specific info what we ask for)

```
SELECT FirstName, LastName, Email FROM Customers;
```

- Narrowing query results
- 8

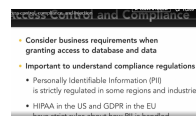
- are all features offered by most DBMS tools.
 - Indexes
 - with an index on the fields the database stores a reference to what each value is in those fields and where it's located, and using that index, the database can **return information much faster , than scanning the whole database**
 - but when we add indexes, it increases the amount of time some operations, like inserting a record, will take.
 - Transactions
 - Transactions group queries or statements into a block of activities, where, if one of the components fails for any reason, the whole group of statements is not executed, **and anything that's partially done is rolled back.**



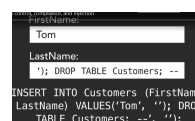
- Stored procedure
 - is kind of like a program you write that's stored on the database server.
 - Are a series of commands stored on the database
 - Allow reuse of long or detailed queries instead of writing them for each use
 - Provide a safe way to deal with sensitive data

▼ Access control, compliance and injection#

- Access control
 - User accounts
 - table and column permission



- Sql injection
 - Type of attack that includes part of a Sql command entered as a value to hijack a query and change how it works



▼ Softwares

Hadoop and Spark are often used for big data applications, database is often used in a big data context

Microsoft Access is generally considered a(n) desktop database platform.

Desktop databases are typically hosted on a workstation rather than a dedicated server, and they're designed to support a few to a few hundred users.