Topic	Introduction to SQL	
Class Description	Students will learn how to use Structured Query Language (SQL) and learn about different ways of querying a database with the SELECT statement	
Class	C-231	
Class time	45 mins	
Goal	● Understand about Structured Query Language ● Understand about Database ● SELECT statement in SQL	
Resources Required	● Teacher Resources: ○ Laptop with internet connectivity ○ Earphones with mic ○ Notebook and pen ○ Visual Studio Code ● Student Resources: ○ Laptop with internet connectivity ○ Earphones with mic ○ Notebook and pen ○ Visual Studio Code	
Class structure	Warm-Up Teacher-led Activity 1 Student-led Activity 1 Wrap-Up	10 mins 20 mins 10 mins 5 mins

WARM-UP SESSION - 10mins

Teacher Action	Student Action

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Hey <student's name>. How are you? It's great to see you! Are you excited to learn something new today? Up until this time, we have learnt a lot of things in networking like sockets, ports, protocols like TCP, UDP, etc. We have also covered quite a few things about cyber security. We attempted a phishing attack by using the mailer of the video chat application, and we have also learnt about different encryptions, etc. Before starting a session let's have sharing time. You know what is sharing time, Sharing time is a dedicated period where teachers and students can share what is going on in their lives. There are no rules about what they can share during this time. *Teachers and students might talk about plans for the weekend, a good thing that happened throughout the week, or things you're looking forward to.* *Have a discussion with students and share good thoughts with each other.*	**ESR**: Hi, thanks, yes, I am excited about it!

Q&A Session

Question	Answer
Which of these harmful effects of computer viruses? A. Slow down your computer B. Destroy your files C. Takes extra space D. All of the above	**D**

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Which software is used to detect viruses? A. Anti-Virus B. Computer-Virus C. Worms D. None of the above	**A**
TEACHER-LED ACTIVITY - 20mins	
Teacher Initiates Screen Share	
ACTIVITY ● **Create Query for Table** ● **Select and Update SQL Queries**	
Teacher Action	**Student Action**
What do you mean by data?	**ESR** Any information we store in a computer is called data!
We have an abundance of data nowadays, don't we?	**ESR** Yes!
Where can we store the data?	**ESR** Database
Absolutely Right! We need a database to store the data. We have used Firebase until now, time and again, as our primary database. Can you explain how the database works?	**ESR** Varied!
Earlier, we learned how to connect and disconnect with the database. In today's class, we will learn about SQL and in the following classes, we will see how it can be used to	

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perform a very famous technique - SQL injection. It is another kind of database, which is different from Firebase! I'm sure you've heard of it. Do you know what kind of database is Firebase? Great! Now, as the name suggests, firebase is a NoSQL database while we are going to learn about some basics of SQL databases. Do you know what is the difference between the two databases? Here are some of the major differences b/w SQL and NoSQL databases -	**ESR:** No-SQL **ESR:** Varied!

SQL Database	NoSQL Database
SQL databases are table based. Different tables are created for different data.	NoSQL databases are JSON based. Usually it's key-value pairs.
SQL databases strictly rely on relations. This means that that data is present in separate tables with a relation between them.	NoSQL databases do not use relations.
SQL databases have structured predefined schemas. All the columns in a particular table define the data type of all the data.	NoSQL databases do not have schemas and are not structured. You can have as many key-value pairs with any data type you want to use.
SQL databases are better with multi row based structured data.	NoSQL databases are better for JSON like or unstructured data.

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Let’s talk about examples. For a social media app, where a user can post both images and videos, update their statuses and do whatever they want, what kind of database do you think is more feasible for the company to maintain all the data? That’s right! How about a banking app, where they track each and every transaction that occurs, maintain account balances, etc. What kind of database should the company use?	**ESR:** NoSQL **ESR:** SQL
Databases are used just about everywhere including banks, retail, websites, eCommerce store, warehouses, and many more Banks use databases to keep track of customer accounts, balances, and deposits. Retail/Ecommerce stores can use databases to store prices, customer, order id, address, information, sales information, and quantity on hand. Even social media like Facebook, WhatsApp used to store user information So let's focus on SQL Databases Data can be searched easily, eg “find all students who are taking network classes”'. Data can also be sorted easily, for example into 'According to date”, or “According to the name” Basically, we need good database management where we can manage things easily. So when we talk about database management we used to say this **“DBMS”.**	

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When we focus on database, we need to learn about “DBMS” or **“Database Management System”**

A **Database Management System** is system software for easy, efficient, and reliable data processing and management. It can be used for:

- Creation of a database.
- Retrieval of information from the database.
- Updating the database.
- Managing a database.

It provides us with many functionalities and is more advantageous than the traditional file system in many ways listed below: To manage a database, we must know the database language.

Yes! We have “**SQL**”

“SQL stands for Structured Query Language which is basically a language used by databases”

I know you must be wondering why we suddenly start talking about databases and what’s its connection to cyber security or ethical hacking?

ESR:
Varied!

If you want to be a good hacker you must know about databases. That’s why we are going to focus on databases!

Before we start learning about SQL, let me show you what I mean!

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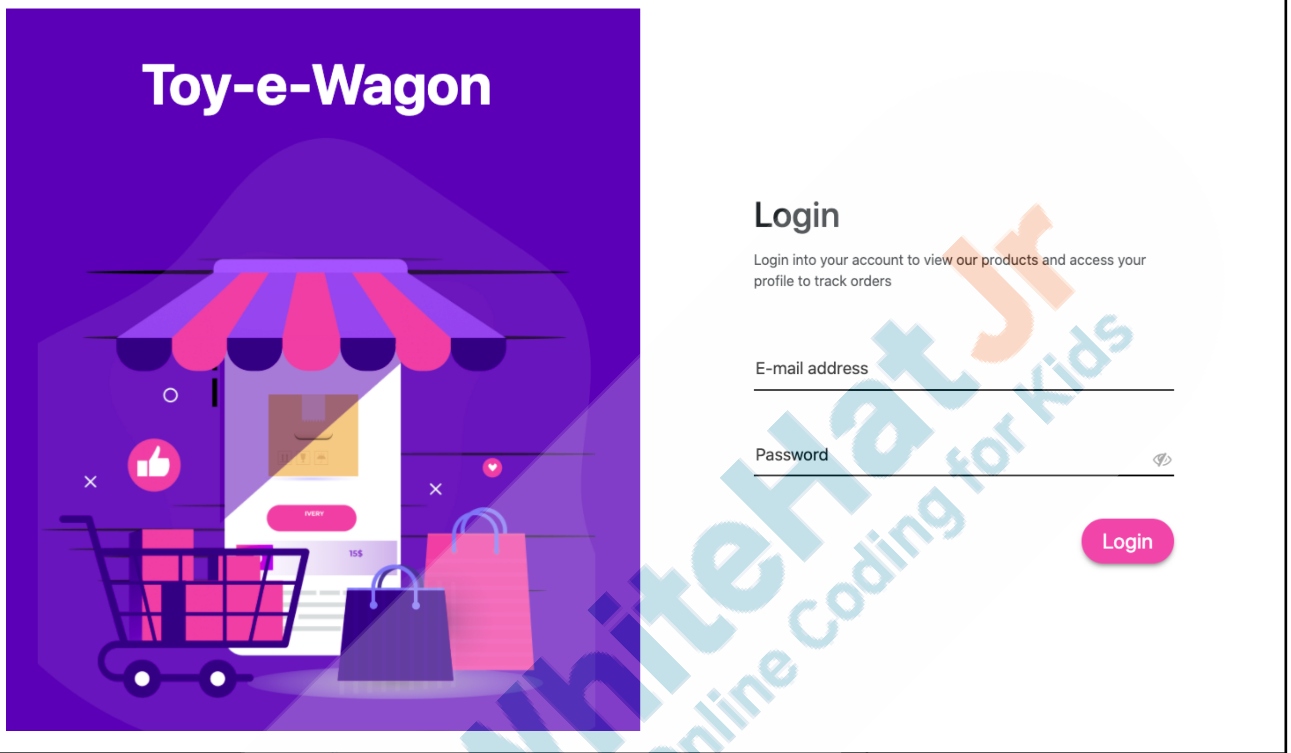
Teacher Opens Teacher Activity 1	*Student opens Student Activity 1*
 Login Login into your account to view our products and access your profile to track orders E-mail address Password 	
As you can see, this is a website in the ecommerce industry. This website follows a SQL database too. Now, in this website, we have a test account - *john.doe@gmail.com* Let me login into the account - Credentials - Email - *john.doe@gmail.com* Password - ***random' or 1=1 or password='*** *Teacher enters the exact credentials without showing the student the password and logs in*	

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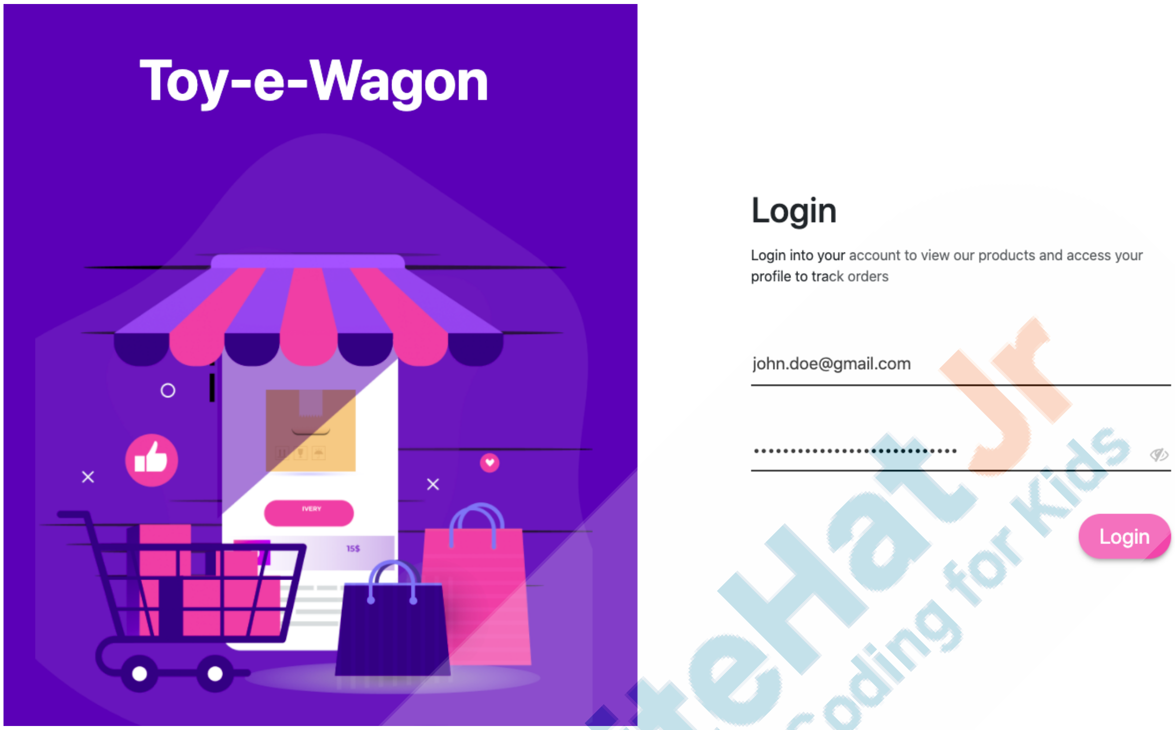

Login

Login into your account to view our products and access your profile to track orders

john.doe@gmail.com

••••••••••••••••••••••••••••••••••

And after login -

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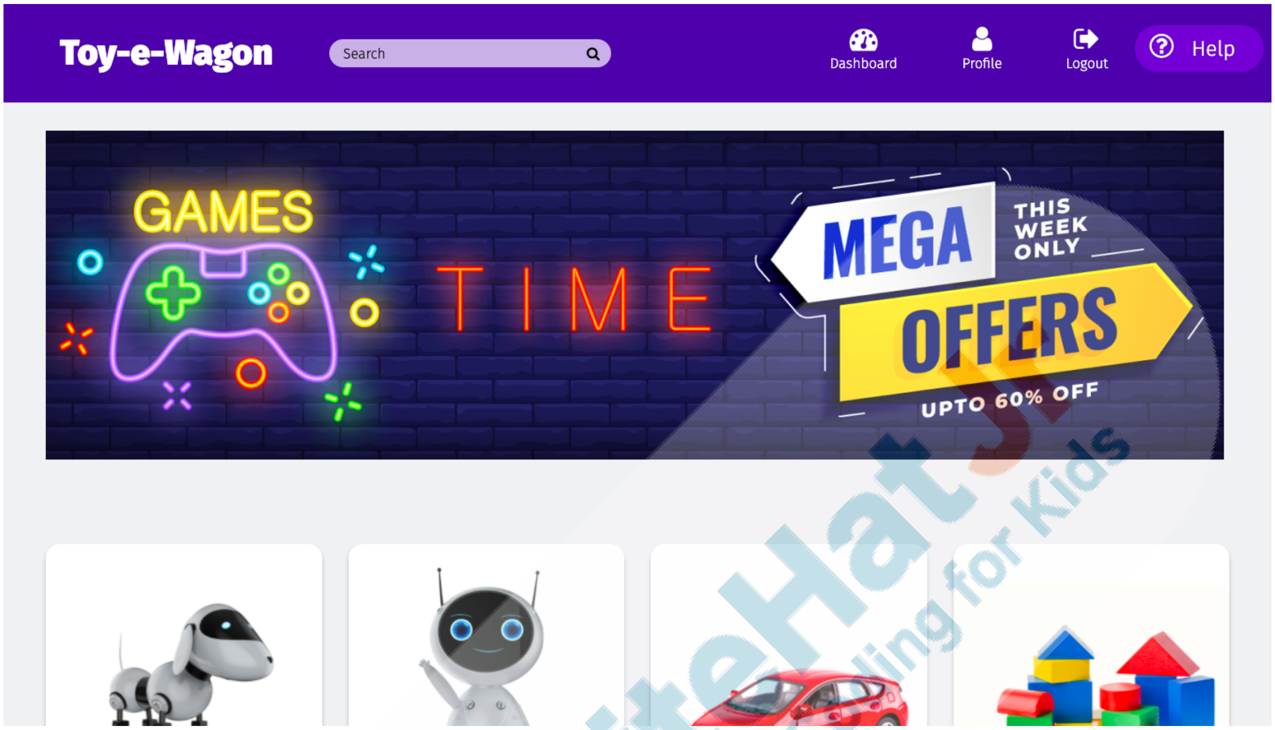

We just logged into this website with an unknown account.

How did I do it? Let's see by logging out of this page and again entering the credentials, but this time, I will show you what I'm entering -

Teacher logs out from the navbar and again enters the credentials. Teacher clicks on the "eye" icon next to the password field to show the student the password.

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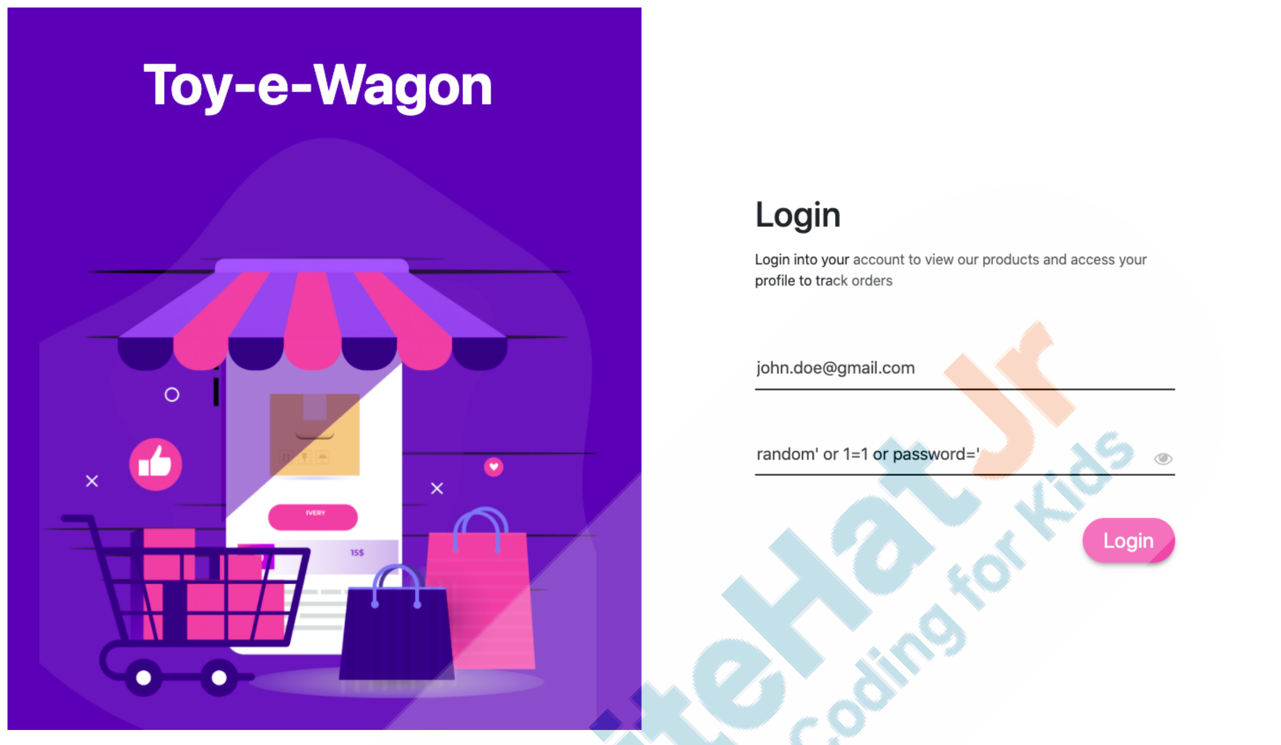

Login

Login into your account to view our products and access your profile to track orders

john.doe@gmail.com

random' or 1=1 or password='

Now, this random string ***random' or 1=1 or password='*** can't be the password right?

Then, how am I logging in then?

That's right! With the help of a very famous SQL injection technique, I was able to login to some unknown account into a website because this website is vulnerable and prone to attacks from hackers.

Now that we know what we can do with SQL injection and why we are learning it, let's get right into it.

"SQL is a standard language for accessing and manipulating databases."

We know whenever we learn about new languages we must learn their syntax too, same is the case with ***"SQL"***

ESR

Through SQL injection!

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First, the most important thing in **SQL databases** is to create the **database** and then the **tables** where we can store data. We just discussed how SQL databases have tables, which consists of rows and columns and each and every column in a table has a predefined data type. If a column accepts only integers, then trying to insert a string into it will throw an error as it is not allowed, unlike in Firebase where you can use any data type. This is known as the schema of the database table. Columns tell the database what to store, such as an **ID, Name, Age, Class, Course**. The rows make up the data. Let's discuss an example. Suppose we have a student's database in school. Which columns would the database have for a student?	
What things will be covered in the student database?	**ESR:** 1. Name 2. Age 3. Class 4. Course 5. etc.
Now, what data type would these fields use? Can a name be an integer? *Teacher discusses the data type of the fields the student listed should be in the database.*	**ESR:** No *Students discuss the data type of the fields they listed should be in the database.*
With all the data, the table would look somewhat like this -	

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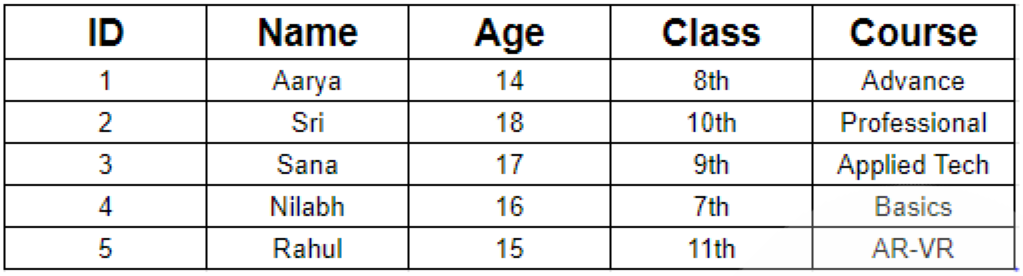

ID	Name	Age	Class	Course
1	Aarya	14	8th	Advance
2	Sri	18	10th	Professional
3	Sana	17	9th	Applied Tech
4	Nilabh	16	7th	Basics
5	Rahul	15	11th	AR-VR

All the rows in all the tables in SQL have a unique identifier called ID, which is used to form relations. We will understand more about them later!

First, let’s understand how the syntax of a SQL query works.

We have a SQL editor to work on. Please open *Student Activity 2*

Teacher opens Teacher Activity 2

Student opens Student Activity 2

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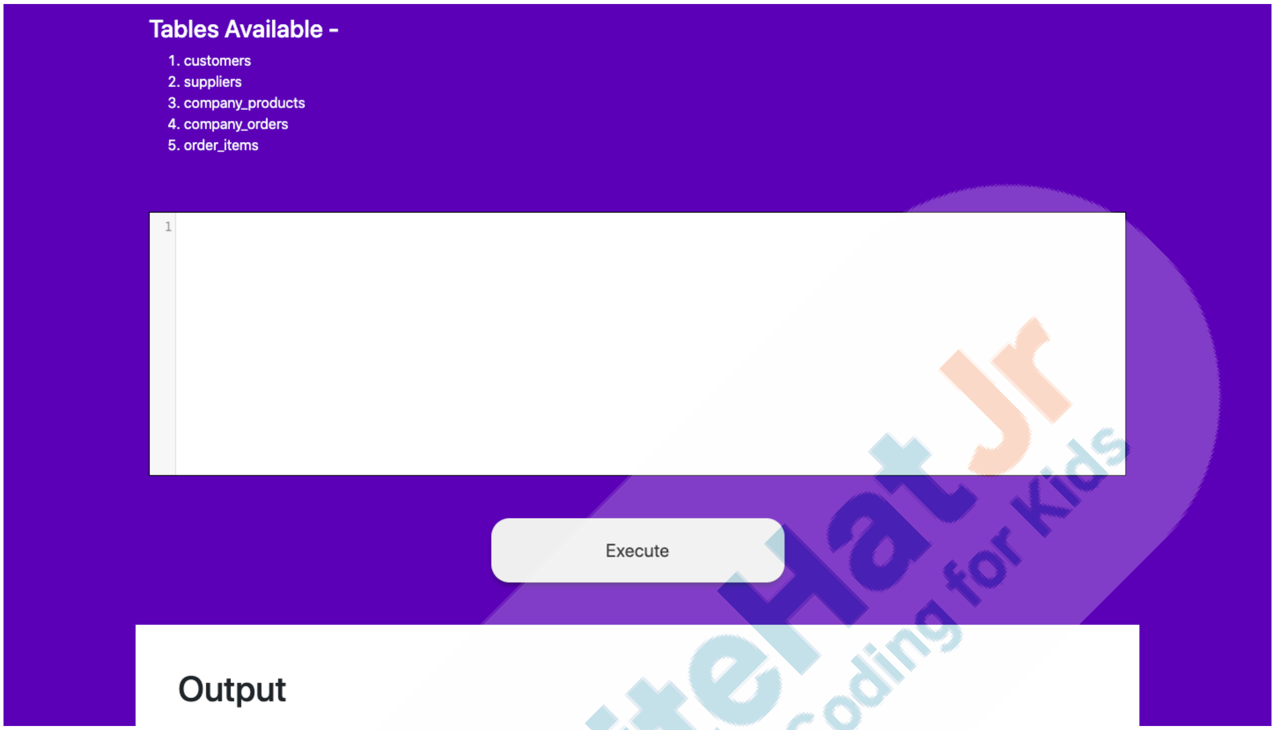

Tables Available -

1. customers
2. suppliers
3. company_products
4. company_orders
5. order_items

Now here we can see that we have 5 tables - 1. customers 2. suppliers 3. company_products 4. company_orders 5. order_items Let’s take a look at all the customers that we have in the database. For that, we will write the following statement in the code editor - ***Select * from customers;*** *Teacher types the query in the editor and clicks on **execute** button to check the output*	*Student observes*

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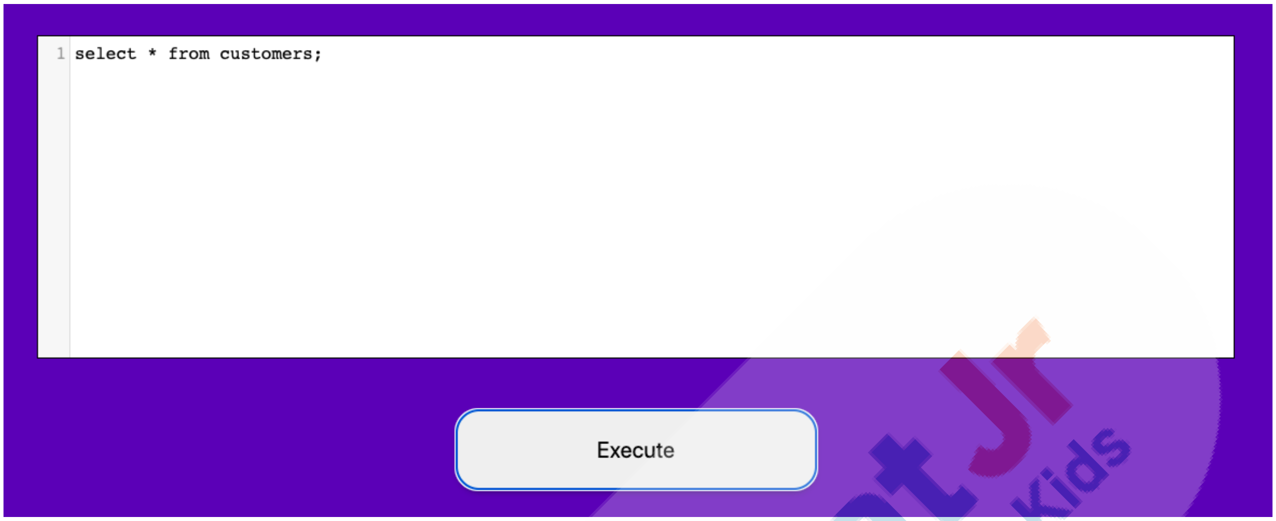
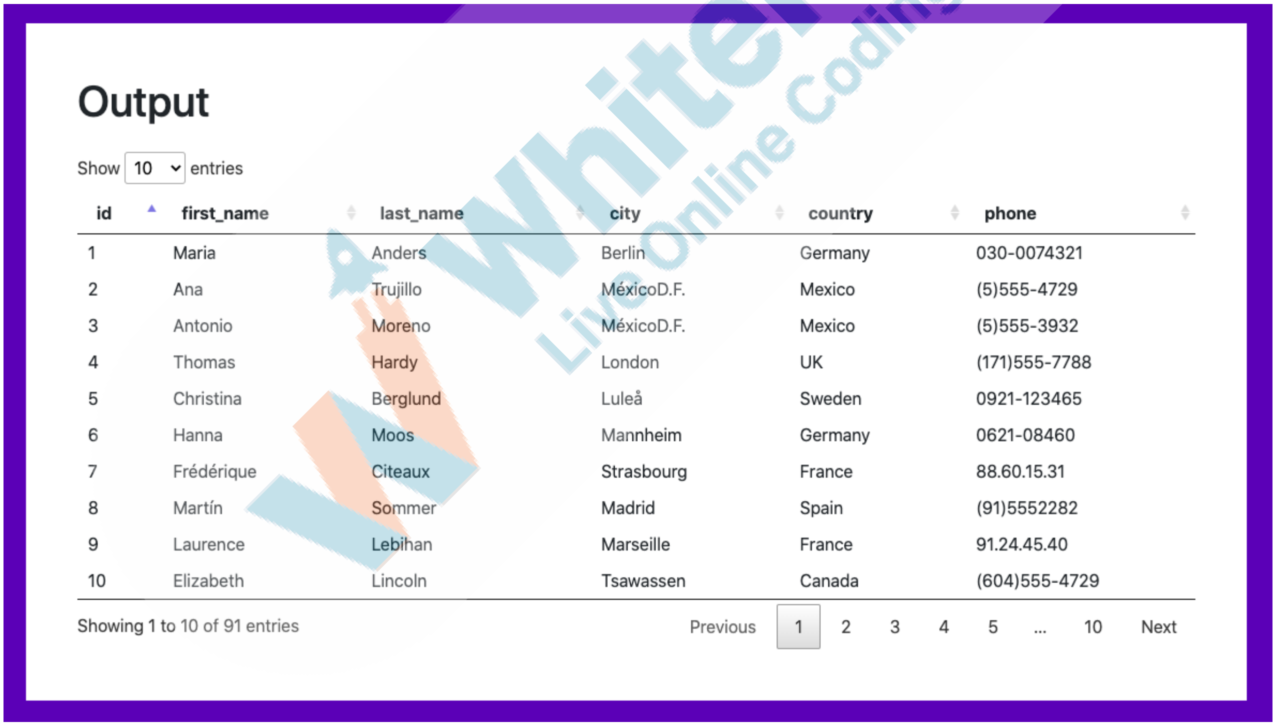


```
select * from customers;
```

Output -



Output

Show 10 entries

id	first_name	last_name	city	country	phone
1	Maria	Anders	Berlin	Germany	030-0074321
2	Ana	Trujillo	MéxicoD.F.	Mexico	(5)555-4729
3	Antonio	Moreno	MéxicoD.F.	Mexico	(5)555-3932
4	Thomas	Hardy	London	UK	(171)555-7788
5	Christina	Berglund	Luleå	Sweden	0921-123465
6	Hanna	Moos	Mannheim	Germany	0621-08460
7	Frédérique	Citeaux	Strasbourg	France	88.60.15.31
8	Martín	Sommer	Madrid	Spain	(91)5552282
9	Laurence	Lebihan	Marseille	France	91.24.45.40
10	Elizabeth	Lincoln	Tsawassen	Canada	(604)555-4729

Showing 1 to 10 of 91 entries

Here, we will see the output of the query -

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Select * from customers; Let’s break this down. ***Select*** statement is used to select data from a particular table. Next, we have ***an asterisk (*)*** which tells the database to select all the columns. Next, we have the ***from*** keyword, after which we have the table’s name on which we want to execute the select query - ***customers*** Do observe the ***semicolon (;)*** at the end of the statement. Semicolon is mandatory in SQL at the end of a query. For convenience, this editor adds a semicolon at the end if you forget it, but it is very important. This way, we can query any table that is listed in the editor and exists in the database. We saw an example above of what we need to do if we want to fetch all the columns from the table using an asterisk (*), but sometimes there are too many columns in a table and we just want some columns. Do you know what we can do in that case? We can use the name of the columns that we want to fetch from the table! Let’s take a look - *Teacher executes the following query in the editor -* ***Select first_name, last_name from customers;***	**ESR:** Varied! *Student observes*

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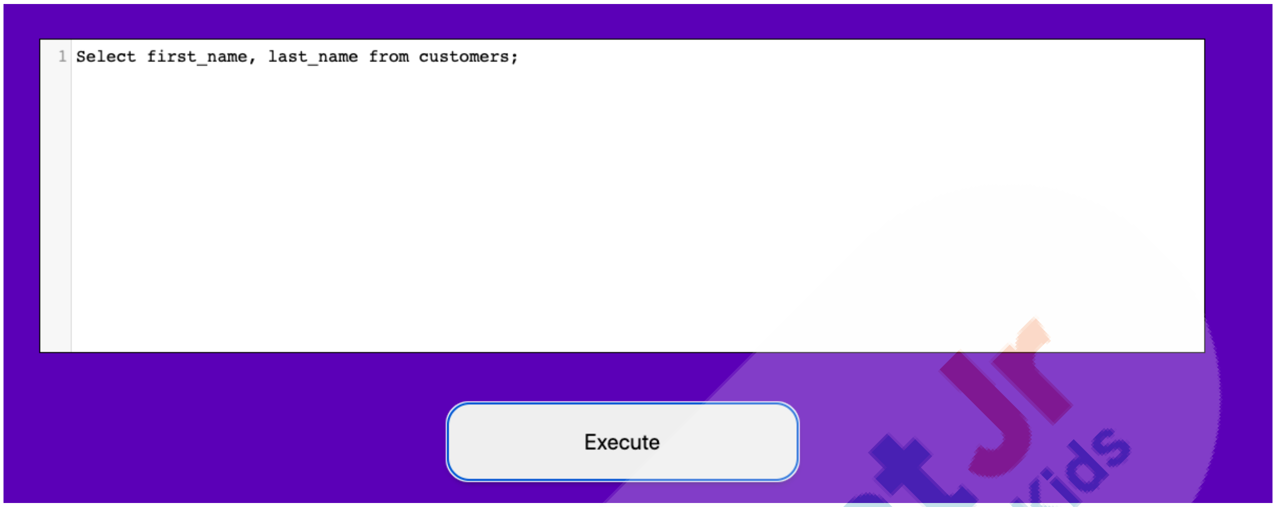
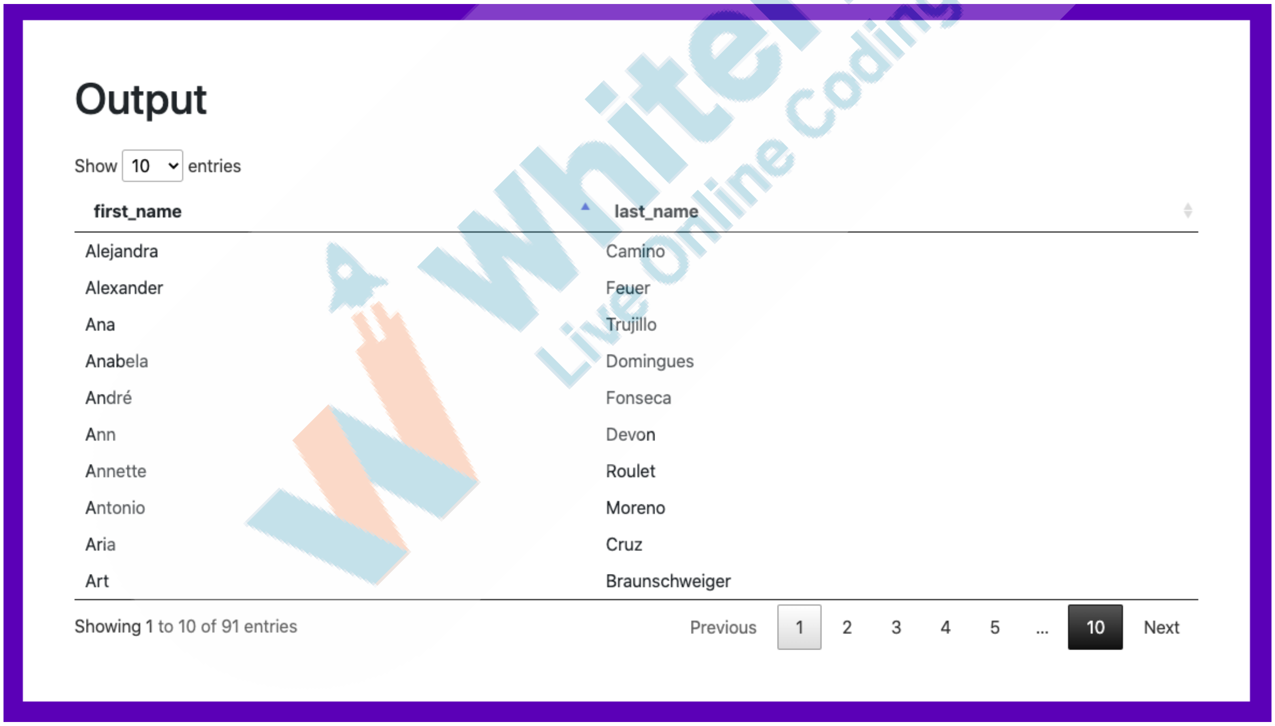


```
Select first_name, last_name from customers;
```

Output -



Output

Show 10 entries

first_name	last_name
Alejandra	Camino
Alexander	Feuer
Ana	Trujillo
Anabela	Domingues
André	Fonseca
Ann	Devon
Annette	Roulet
Antonio	Moreno
Aria	Cruz
Art	Braunschweiger

Showing 1 to 10 of 91 entries

This time, we can observe that we have only got the ***first_name*** and ***last_name*** of the customers from the table.

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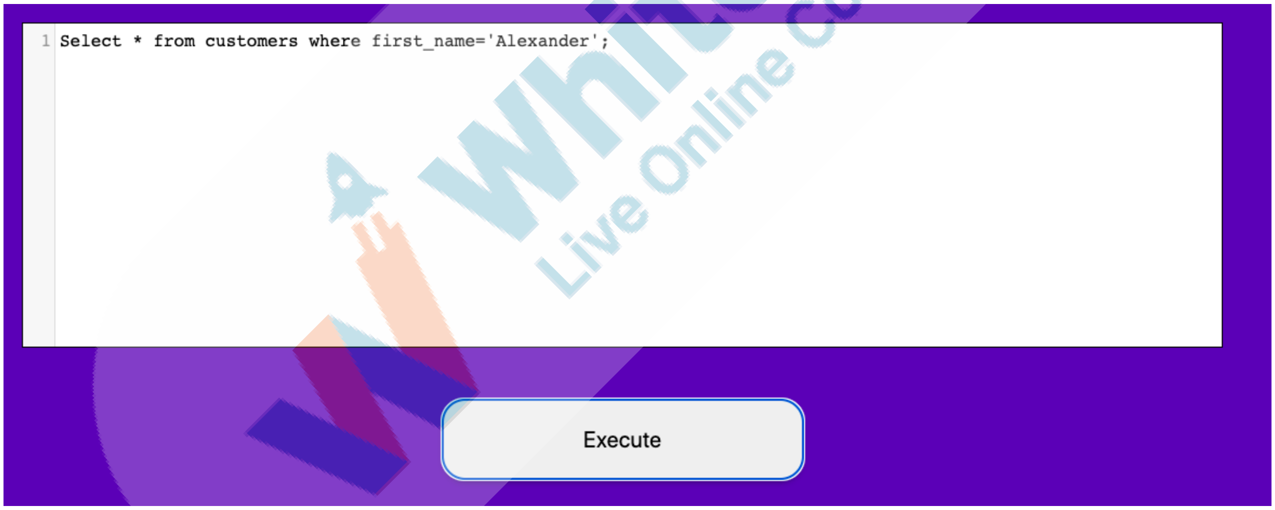
Easy, right? Now, we just observed that chaging asterisk (*) column names reduce the number of columns, but what if we want limited rows and not just so much data? For that, we have a ***where*** clause, which we can use to set conditions. Let’s take a look at an example - *Teacher executes the following query in the editor -* *Select * from customers where first_name='Alexander';*	**ESR:** Yes! **ESR:** Varied! *Student observes*



```
Select * from customers where first_name='Alexander';
```

Output -

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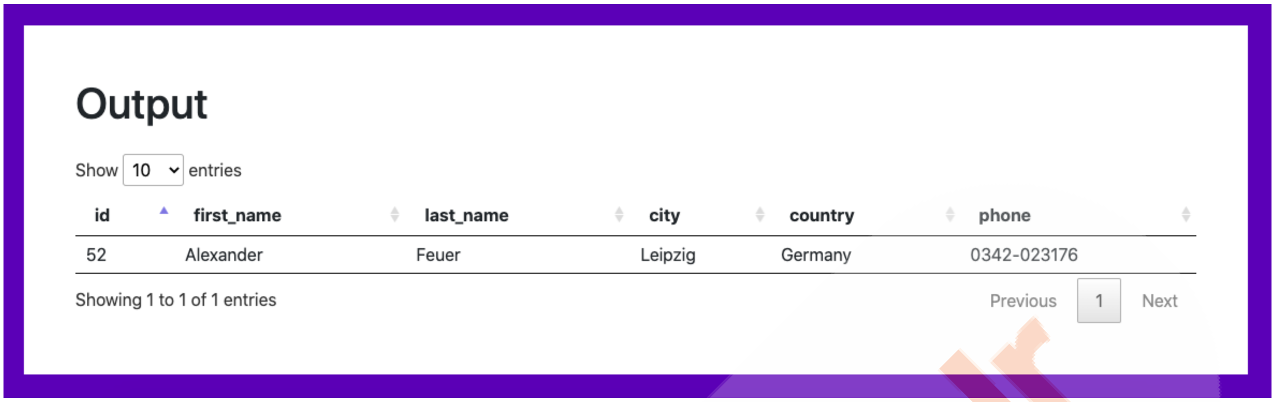


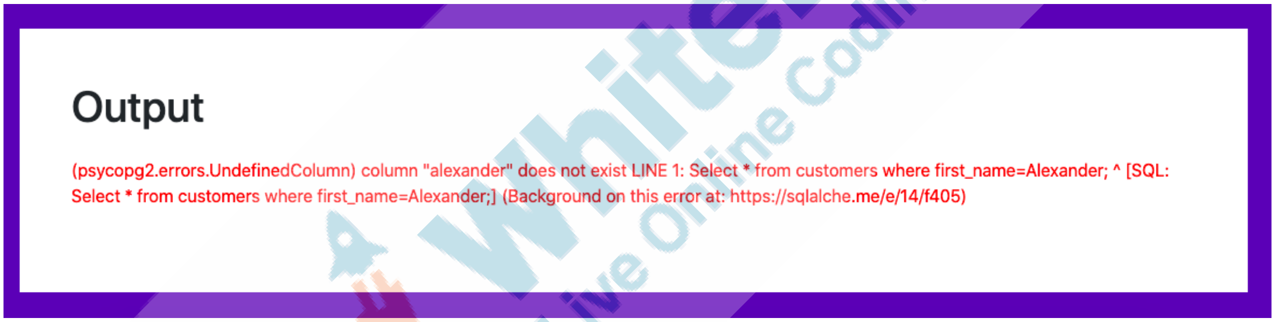
Output

Show 10 entries

id	first_name	last_name	city	country	phone
52	Alexander	Feuer	Leipzig	Germany	0342-023176

Showing 1 to 1 of 1 entries

This time, we got just one row, as we specified with the ***where*** clause, that we want the ***first_name*** column to be equal to Alexander. Strings only work with ***single quotes*** (‘’) in SQL. Therefore, if you miss the single quotes around the name, it will throw an error -



Output

```
(psycopg2.errors.UndefinedColumn) column "alexander" does not exist LINE 1: Select * from customers where first_name=Alexander; ^ [SQL: Select * from customers where first_name=Alexander;] (Background on this error at: https://sqlalche.me/e/14/f405)
```

Similarly, we have ***AND*** and ***OR*** boolean operators too.

We can write the following using AND and OR -

*Select * from customers where first_name='Alexander' and last_name='Feuer';*

OR

*Select * from customers where first_name='Alexander' or last_name='Feuer';*

Now, you can start querying the database!

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STUDENT-LED ACTIVITY - 10 mins

- **Ask the student to press the ESC key to come back to the panel.**
- **Guide the student to start Screen Share.**
- **The teacher gets into Full Screen.**

ACTIVITY

- **Querying the Database**

Teacher Action	Student Action
In this student activity, the students will query the other databases based on the problem statements. Okay, we have a table on the Editor called ***suppliers*** Can you query all the data in that table? *Teacher helps the student in writing the query and executing it. Let the student try and execute it himself without your help* *Select * from suppliers;*	**ESR:** Yes! *Student writes the query and executes it*

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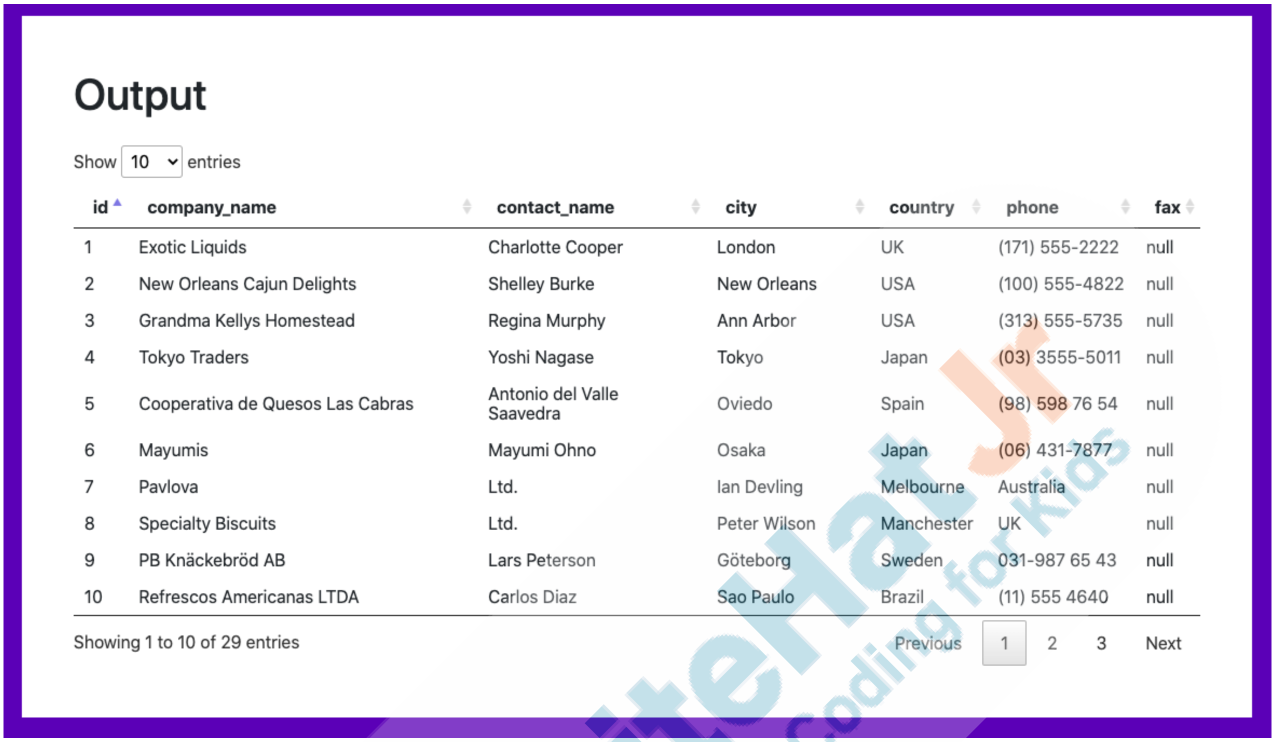

Output

Show 10 entries

id	company_name	contact_name	city	country	phone	fax
1	Exotic Liquids	Charlotte Cooper	London	UK	(171) 555-2222	null
2	New Orleans Cajun Delights	Shelley Burke	New Orleans	USA	(100) 555-4822	null
3	Grandma Kellys Homestead	Regina Murphy	Ann Arbor	USA	(313) 555-5735	null
4	Tokyo Traders	Yoshi Nagase	Tokyo	Japan	(03) 3555-5011	null
5	Cooperativa de Quesos Las Cabras	Antonio del Valle Saavedra	Oviedo	Spain	(98) 598 76 54	null
6	Mayumis	Mayumi Ohno	Osaka	Japan	(06) 431-7877	null
7	Pavlova	Ltd.	Ian Devling	Melbourne	Australia	null
8	Specialty Biscuits	Ltd.	Peter Wilson	Manchester	UK	null
9	PB Knäckebröd AB	Lars Peterson	Göteborg	Sweden	031-987 65 43	null
10	Refrescos Americanas LTDA	Carlos Diaz	Sao Paulo	Brazil	(11) 555 4640	null

Showing 1 to 10 of 29 entries

Okay, now can you select the ***company_name*** and ***contact_name*** of all the companies who are based out of either the ***USA*** or ***UK?*** Try to find it! *Teacher helps the student in writing the query and executing it. Let the student try and execute it himself without your help* *Select company_name, contact_name from suppliers where country='USA' or country='UK';*	**ESR:** Yes! *Student writes the query and executes it*

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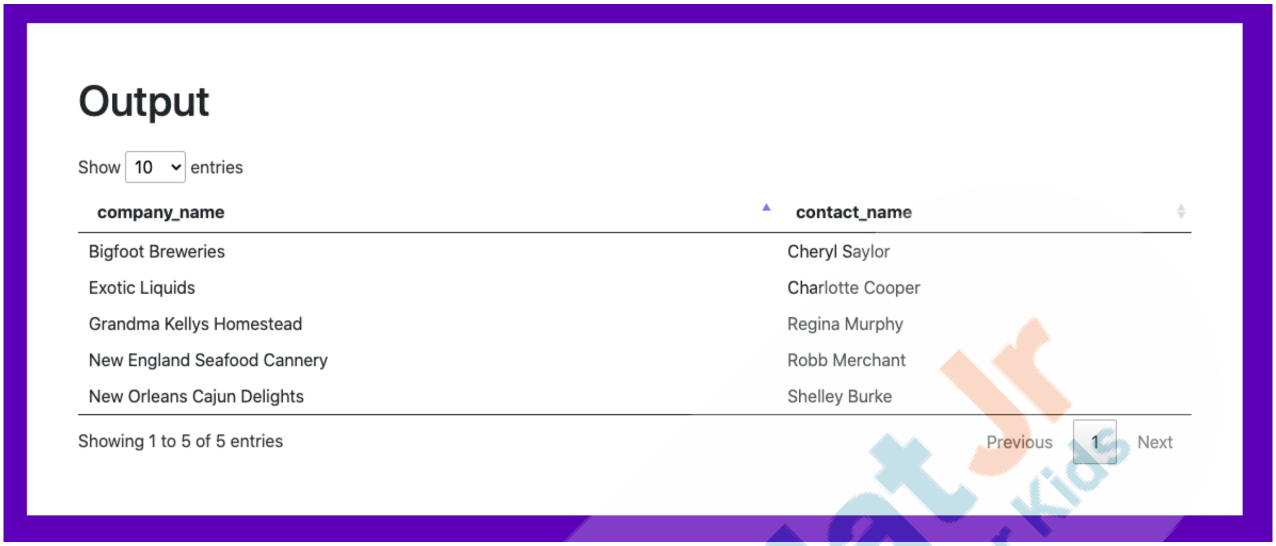

Output

Show 10 entries

company_name	contact_name
Bigfoot Breweries	Cheryl Saylor
Exotic Liquids	Charlotte Cooper
Grandma Kellys Homestead	Regina Murphy
New England Seafood Cannery	Robb Merchant
New Orleans Cajun Delights	Shelley Burke

Showing 1 to 5 of 5 entries

Great! Now let's get back to ***Student Activity 1*** *Teacher Opens Teacher Activity 1*	*Student Opens Student Activity 1*

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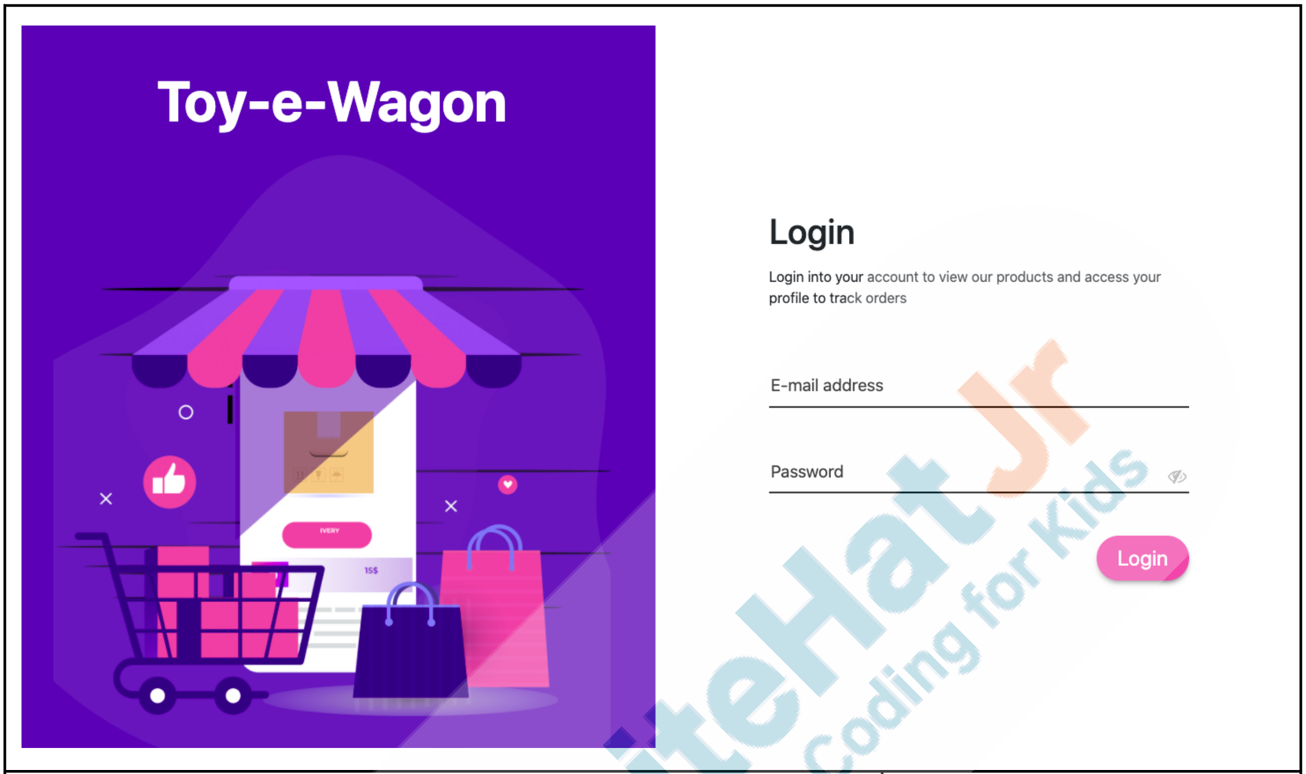

Login into your account to view our products and access your profile to track orders

Here, we performed SQL injection earlier. We used the password as - random' or 1=1 or password=' Do you understand now, how it works? Let’s first try to figure out what is happening behind the scenes here. The backend of this code would take the email and the password, and would insert their values in a SQL statement - ***Select * from users where email=’{}’ and password=’{}’;*** Now here, all it has to do it, replace the values of email and password fetched from the page that the user enters, and	**ESR:** Varied!

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execute the query. If a user exists, Bravo, you’re logged in. If not, then incorrect email ID or password it would tell you. In this scenario, let’s try to replace the values that we logged in with. The statement would now become - *Select * from users where email=’john.doe@gmail.com’ and password=’**random’ or 1=1 or password=’**’;* Now, you see, this has become a complete query that can be executed in the database. It will try to first figure out a boolean from ***password=’random’ or 1=1 or password=”*** Out of here, the password = random would be false, and password = ‘’ will be false too, but 1=1 is true. Since these conditions are separated by ***OR*** operator, it makes it True and therefore, since email=***john.doe@gmail.com*** exists, and ***password=’random’ or 1=1 or password=”*** concludes to True, the statement becomes True and hence, it lets you pass.	
Interesting isn’t it?	**ESR:** Yes!
Great! So, do you think you can try to implement this SQL injection on your own now?	**ESR:** Yes!
Let’s do that! *Teacher helps the student in writing the query and executing it. Let the student try and execute it himself without your help*	*Student writes the query and executes it*

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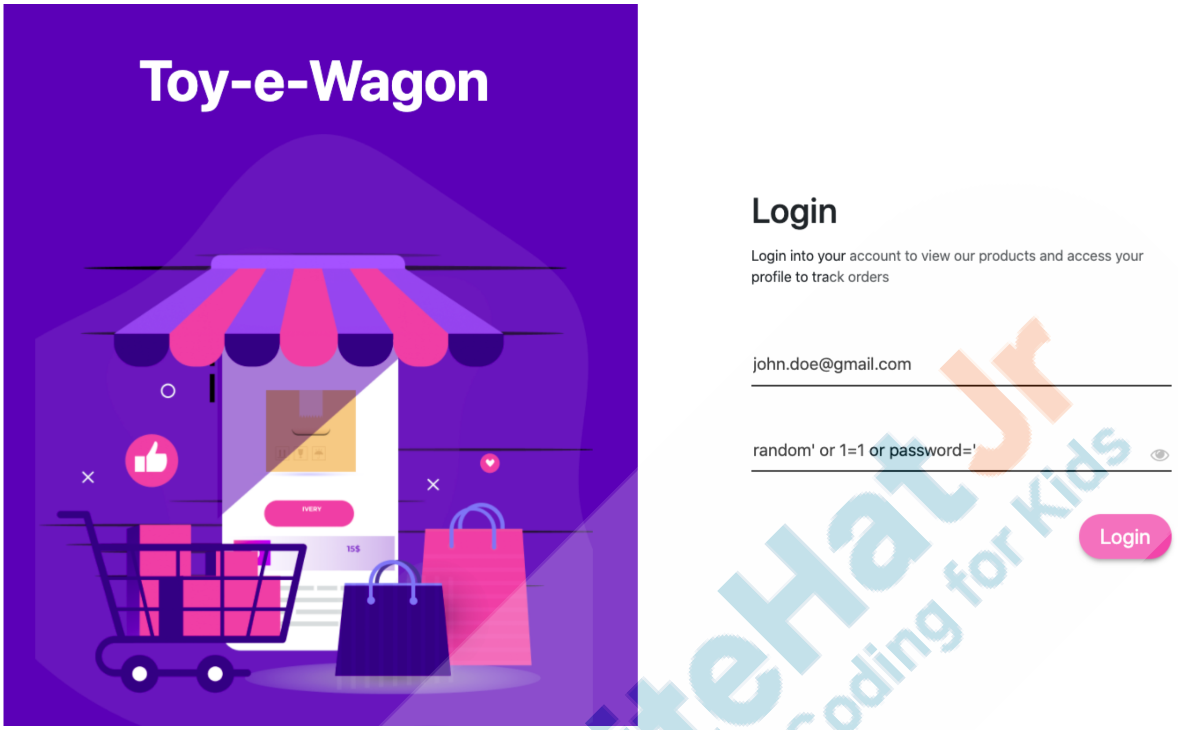

Login

Login into your account to view our products and access your profile to track orders

john.doe@gmail.com

random' or 1=1 or password='

In today’s class, we saw how knowing SQL can help you perform SQL injection to any website that may be vulnerable. Since so many websites collect sensitive data, and SQL injection is a very common technique, cyber security experts make sure that this cannot happen anywhere in the website.

In the next class, we will be learning about different types of Joins in SQL!

Teacher Guides Student to Stop Screen Share	
WRAP UP SESSION - 5 Mins	
Quiz time - Click on in-class quiz	
Question	**Answer**
What do you mean by SQL?	**A**

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<table>
<tr><td>A. Structured Query Language
B. Structure Question Language
C. Strict Query Language
D. None of the above</td><td></td></tr>
<tr><td>What is used to select all the columns of the table?
A. &amp;
B. #
C. *
D. @</td><td><b>C</b></td></tr>
<tr><td>Which statement is used to add a condition to the select statement?
A. AND
B. WHERE
C. IF
D. OR</td><td><b>B</b></td></tr>
<tr><td colspan="2"><b>End the quiz panel</b></td></tr>
<tr><td colspan="2"><b><u>FEEDBACK</u></b>
● <b>Appreciate the students for their efforts in the class.</b>
● <b>Ask the student to make notes for the reflection journal along with the code they wrote in today's class.</b></td></tr>
<tr><td><b>Teacher Action</b></td><td><b>Student Action</b></td></tr>
<tr><td>You get Hats off for your excellent work!
In the next class</td><td><i>Make sure you have given at least 2 Hats Off during the class for:</i>
Creatively Solved Activities +10</td></tr>
</table>

WhiteHat Jr Live online Coding for Kids

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Project Discussion You were approached by a friend, who is trying to learn MySQL and is stuck on trying to find answers to simple questions like getting all the users who are from a particular state, or which neighborhood has the most number of users. Your task is to help your friend in trying to find these data attributes.	
Teacher Clicks 	
ADDITIONAL ACTIVITIES	
Additional Activities *Encourage the student to write reflection notes in their reflection journal using markdown.* Use these as guiding questions: ● What happened today? ○ Describe what happened. ○ The code I wrote. ● How did I feel after the class? ● What have I learned about programming and developing games?	*The student uses the markdown editor to write her/his reflections in the reflective journal.*

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- What aspects of the class helped me? What did I find difficult?	

ACTIVITY LINKS		
Activity Name	**Description**	**Link**
Teacher Activity1	Ecommerce Website	http://ec2-3-108-196-161.ap-south-1.compute.amazonaws.com/
Teacher Activity 2	SQL Editor	http://ec2-3-108-196-161.ap-south-1.compute.amazonaws.com/editor
Student Activity 1	Ecommerce Website	http://ec2-3-108-196-161.ap-south-1.compute.amazonaws.com/
Student Activity 2	SQL Editor	http://ec2-3-108-196-161.ap-south-1.compute.amazonaws.com/editor

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