

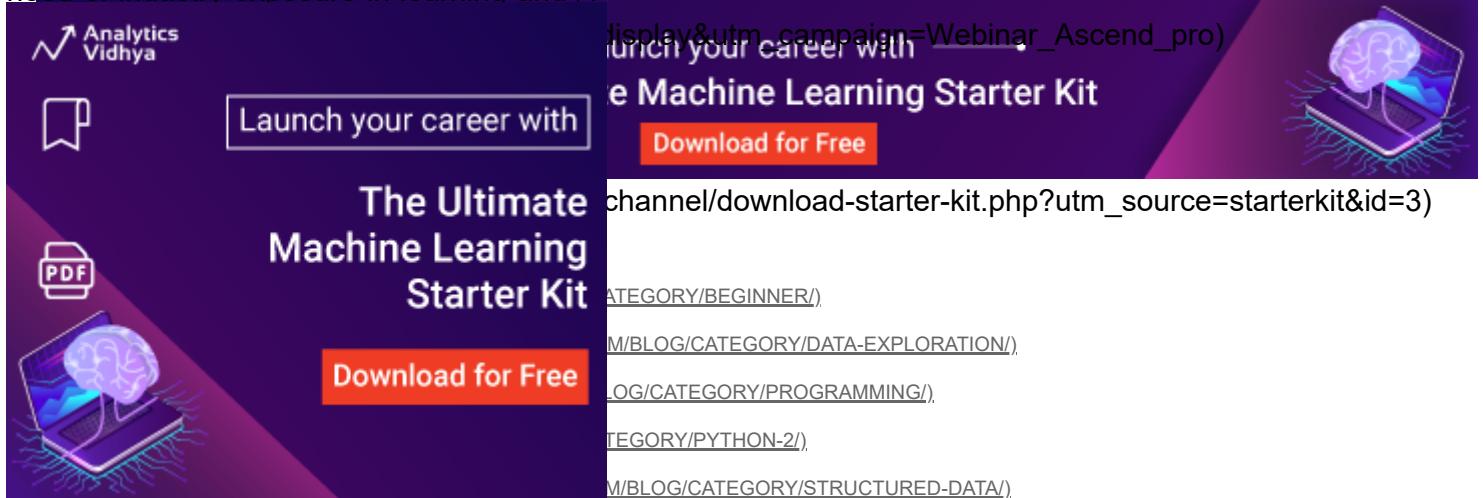
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https://courses.analyticsvidhya.com/bundles/certified-natural-language-processing-master-s-program?utm_source=flashstrip&utm_campaign=NLP_Program_prelaunch



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(<https://www.analyticsvidhya.com/blog/2020/02/joins-in-pandas-master-the-different-types-of-joins-in-python/>)

need-of-industry-exposure-in-learning-and-/?



The banner has a dark purple background with a brain icon on a smartphone. It features the Analytics Vidhya logo at the top left. In the center, there is a white button labeled 'Launch your career with'. Below it, the text 'The Ultimate Machine Learning Starter Kit' is displayed, with a 'Download for Free' button underneath. To the left, there are icons for a bookmark and a PDF file. The right side contains text about launching a career with the kit and a 'Download for Free' button. There are also links to various blog categories like DATA EXPLORATION, PROGRAMMING, PYTHON, and STRUCTURED DATA.

(https://www.analyticsvidhya.com/back-channel/download-starter-kit.php?utm_source=starterkit&id=3)

Joins in Pandas: Master the Different Types of Joins in Python

ABHISHEK SHARMA (<https://www.analyticsvidhya.com/blog/author/abhishek-sharma/>), FEBRUARY 27, 2020 [LOGIN TO BOOKMARK](#)...

Introduction to Joins in Pandas

"I have two different tables in Python but I'm not sure how to join them. What are the different ways I can join these tables?"



This question has been asked plenty of times on online discussion forums. Working with one table is usually straightforward, but it becomes challenging when we have data spread across two or more tables.

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(https://datahack.analyticsvidhya.com/contest/webinar-need-of-industry-exposure-in-learning-and/?utm_source=blog&utm_medium=display&utm_campaign=Webinar_Ascend_pro)



I cannot emphasize the number of times I have used these Joins in [courses/pandas-for-data-analysis-in-python?](#) [das-master-the-different-types-of-joins-in-python!](#) They've come in especially [nancy ouYang data science packtutorials](#) (http://datahack.analyticsvidhya.com/?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python) when I needed to quickly join multiple tables.

(http://datahack.analyticsvidhya.com/?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python?utm_source=starterkit&id=3)

We will learn about different types of Joins in Pandas here:

- Inner Join in Pandas
- Full Join in Pandas
- Left Join in Pandas
- Right Join in Pandas

We will also discuss how to handle redundancy or duplicate values using joins in Pandas. Let's begin!

Note: If you're new to the world of Pandas and Python, I recommend taking the below free courses:

- [Pandas for Data Analysis in Python](https://courses.analyticsvidhya.com/courses/pandas-for-data-analysis-in-python?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python) (https://analyticsvidhya.com/courses/introduction-to-data-science?utm_pandas-master-the-different-types-of-joins-in-python)

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Amazon and Flipkart these days. We are bombarded by targeted marketing brand here. We are given two tables – one which contains customer-level information.

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PDF

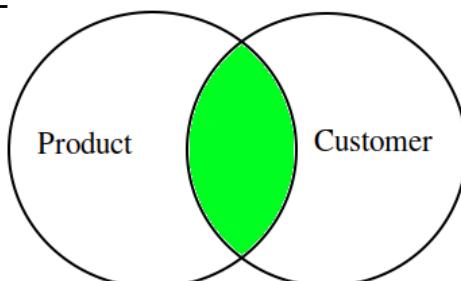
A laptop screen showing a brain, with a brain icon above it.

(https://www.analyticsvidhya.com/back-channel/download-starter-kit.php?utm_source=starterkit&id=3)

ent

the different types of joins work using Pandas.

Inner Join



(<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/02/jip14.png>)

Inner join is the most common type of join you'll be working with. It returns a new dataframe that have common characteristics.

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```
import pandas as pd
(pd.read_csv("https://datahack.analyticsvidhya.com/contest/webinar-
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```

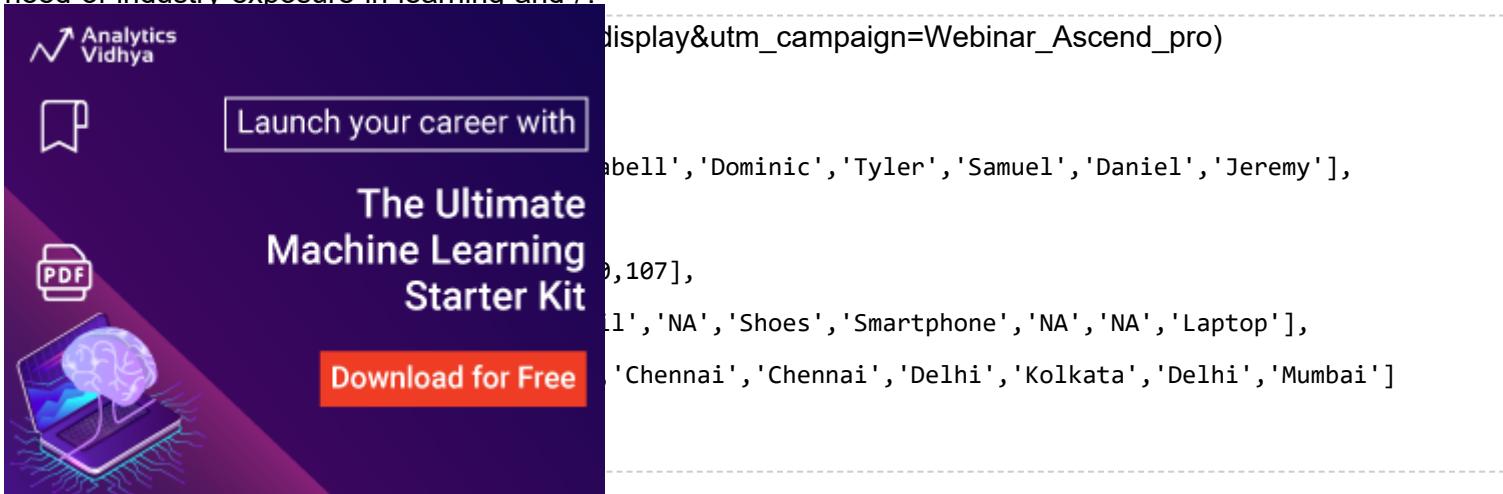
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```
[5,107],  
, 'Smartphone', 'Books', 'Oil', 'Laptop'],  
(https://www.analyticsvidhya.com/book-', 'Fashion', 'Electronics', 'Study', 'Grocery', 'Electronics'],  
channel/download_starterkit.php?3, 299.0, 14999.0, 145.0, 110.0, 79999.0],  
utm_source=starterkit&id=3)  
Seller_city:[ 'Delhi', 'Mumbai', 'Chennai', 'Kolkata', 'Delhi', 'Chennai', 'Bengalore']  
})
```

Product_ID	Product_name	Category	Price	Seller_City
0	101	Watch	299.0	Delhi
		Bag	1350.5	Mumbai
		Shoes	2999.0	Chennai
		Smartphone	14999.0	Kolkata
		Books	145.0	Delhi
		Oil	110.0	Chennai
		Laptop	79999.0	Bengalore

(<https://datahack.analyticsvidhya.com/execute/join-pandas/jip1.png>)

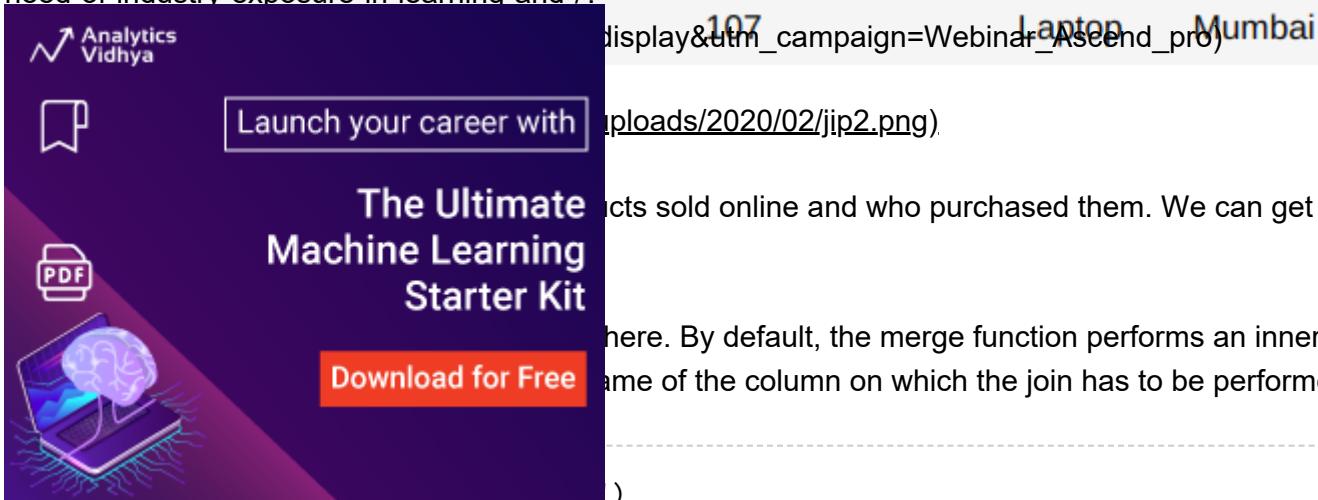
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(https://www.analyticsvidhya.com/back-channel/download-starter-kit.php?utm_source=starterkit&id=3)

id	name	age	Product_ID	Purchased_Product	City
1	Olivia	20	101	Watch	Mumbai
2	Dominic	30	0	NA	Delhi
3	Tyler	65	106	Oil	Bangalore
4	Cory	15	0	NA	Chennai
5	Jeremy	23	103	Shoes	Chennai
6			104	Smartphone	Delhi
7			0	NA	Kolkata
8			105	NA	Delhi

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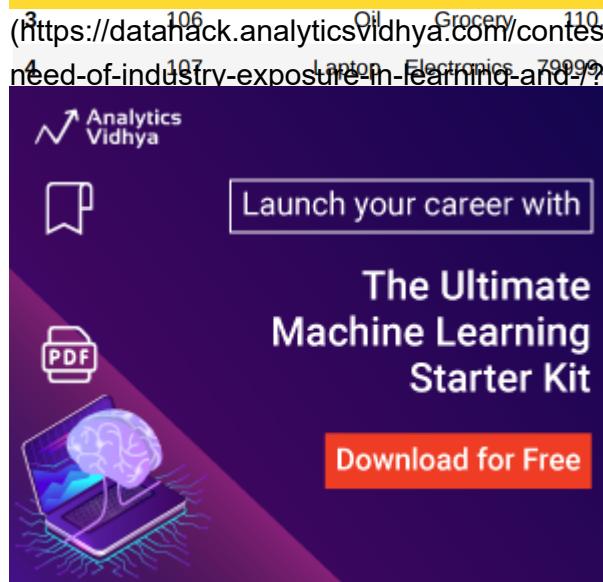
(<https://datahack.analyticsvidhya.com/contest/webinar-need-of-industry-exposure-in-learning-and/>)

utm_source	utm_medium	utm_campaign	Category	Price	Seller_City	id	name	age	Purchased_Product	City
0	101	Ascend_pro	Watch	299.0	Delhi	1	Olivia	20	Watch	Mumbai
1	103	Ascend_pro	Shoes	2999.0	Chennai	5	Dominic	30	Shoes	Chennai
2	104	Ascend_pro	Smartphone	14999.0	Kolkata	6	Tyler	65	Smartphone	Delhi
3	106	Ascend_pro	Oil	110.0	Chennai	3	Cory	15	Oil	Bangalore
4	107	Ascend_pro	Laptop	79999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai

(<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/02/jip3.png>)

Here, I have performed inner join on the product and customer dataframes on the 'Product_ID' column.

But, what if the column names are different in the two dataframes? Then, we have to explicitly mention both the column names.



Let's take things up a notch. The leadership team now wants more details about the products sold. *They want to know about all the products sold by the seller to the same city i.e., seller and customer both belong to the same city.*

In this case, we have to perform an inner join on both *Product_ID* and *Seller_City* of product and *Product_ID* and *City* columns of the customer dataframe.

So, how we can do this?



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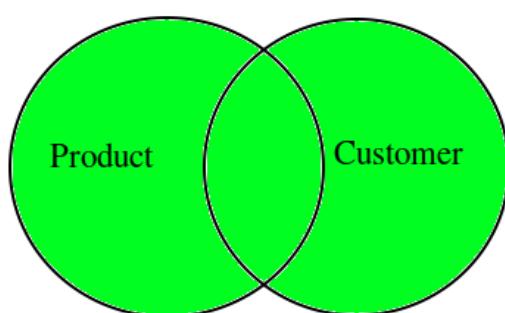
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Full JOIN In Pandas

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Full Outer Join



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Here's another interesting task for you. We have to combine both dataframes so that we can find all the products that are not sold and all the customers who didn't purchase anything from us.

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We can perform Full join by just passing the `how` argument as '`outer`' to the `merge()` function:

	Price	Seller_City	id	name	age	Purchased_Product	City
1	299.0	Delhi	1.0	Olivia	20.0	Watch	Mumbai
2	350.5	Mumbai	Nan	Nan	Nan	Nan	NaN
3	999.0	Chennai	5.0	Dominic	30.0	Shoes	Chennai
4	999.0	Kolkata	6.0	Tyler	65.0	Smartphone	Delhi
5	145.0	Delhi	Nan	Nan	Nan	Nan	NaN
6	110.0	Chennai	3.0	Cory	15.0	Oil	Bangalore
7	79999.0	Laptop	Electronics	Bengalore	9.0	Jeremy	23.0
8	Nan	NaN	NaN	NaN	2.0	Aditya	25.0
9	0	NaN	NaN	NaN	7.0	Samuel	35.0
10	0	NaN	NaN	NaN	8.0	Daniel	18.0

(<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/02/jip6-e1582610938663.png>).

Did you notice what happened here? All the non-matching rows of both the dataframes have NaN values for the columns of other dataframes. But wait – we still don't know which row belongs to which dataframe.

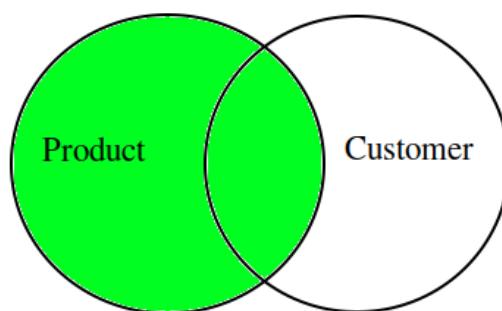
For this, Pandas provides us with a fantastic solution. We just have to mention the **indicator** argument as **True** in the function, and a new column of name **_merge** will be created in the resulting dataframe:

	Seller_City	id	name	age	Purchased_Product	City	_merge
0	Delhi	1.0	Olivia	20.0	Watch	Mumbai	both
1	Mumbai	NaN	NaN	NaN	NaN	NaN	left_only
2	Chennai	5.0	Dominic	30.0	Shoes	Chennai	both
3	Kolkata	6.0	Tyler	65.0	Smartphone	Delhi	both
4	Delhi	NaN	NaN	NaN	NaN	NaN	left_only
5	Chennai	3.0	Cory	15.0	Oil	Bangalore	both
6	Bengalore	9.0	Jeremy	23.0	Laptop	Mumbai	both
7	NaN	2.0	Aditya	25.0	NA	Delhi	right_only
8	NaN	4.0	Isabell	10.0	NA	Chennai	right_only
9	NaN	7.0	Samuel	35.0	NA	Kolkata	right_only
10	NaN	8.0	Daniel	18.0	NA	Delhi	right_only

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Left Join



(<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/02/jip16.png>)

Now, let's say the leadership team wants information about only those customers who bought something from us. You guessed it – we can use the concept of Left Join here.



Outer Join, returns a dataframe containing all the

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The ad features the Analytics Vidhya logo and a purple background. It includes icons for a bookmark, PDF, and a brain on a laptop. Text reads 'Launch your career with The Ultimate Machine Learning Starter Kit' and 'Download for Free'. To the right is a table showing customer purchase data.

Price	Seller_City	id	name	age	Purchased_Product	City
299.0	Delhi	1.0	Olivia	20.0	Watch	Mumbai
350.5	Mumbai	NaN	NaN	NaN	NaN	NaN
999.0	Chennai	5.0	Dominic	30.0	Shoes	Chennai
999.0	Kolkata	6.0	Tyler	65.0	Smartphone	Delhi
145.0	Delhi	NaN	NaN	NaN	NaN	NaN
110.0	Chennai	3.0	Cory	15.0	Oil	Bangalore
999.0	Bengalore	9.0	Jeremy	23.0	Laptop	Mumbai

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Here, you can clearly see that all the unsold products contain NaN for the columns belonging to the customer dataframe.

Right Join in Pandas

Right Join

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	Product_ID	Product_name	Category	Price	Seller_City	id	name	age	Purchased_Product	City
0	101	Watch	Fashion	299.0	Delhi	1	Olivia	20	Watch	Mumbai
1	103	Shoes	Fashion	2999.0	Chennai	5	Dominic	30	Shoes	Chennai
2	104	Smartphone	Electronics	14999.0	Kolkata	6	Tyler	65	Smartphone	Delhi
3	106	Oil	Grocery	110.0	Chennai	3	Cory	15	Oil	Bangalore
4	107	Laptop	Electronics	79999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai
5	0	Nan	Nan	Nan	Nan	2	Aditya	25	NA	Delhi
6	0	Nan	Nan	Nan	Nan	4	Isabell	10	NA	Chennai
7	0	Nan	Nan	Nan	Nan	7	Samuel	35	NA	Kolkata
8	0	Nan	Nan	Nan	Nan	8	Daniel	18	NA	Delhi

(<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/02/jip9.png>)

Take a look carefully at the above dataframe – we have NaN values for columns of the product dataframe. Pretty

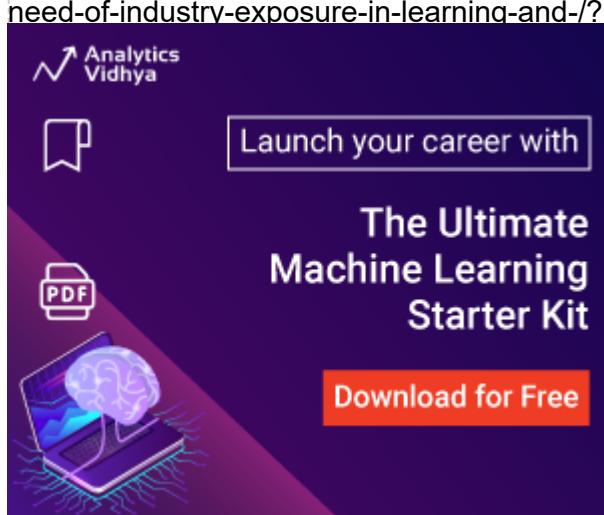


NaN Joins

Any can cause problems while performing joins. These values won't add any value in our resulting dataframe. I'm sure you can imagine how harmful

such duplicate details about products:

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```
display&utm_campaign=Webinar_Ascend_pro)
[1, 103, 107],
['Smartphone', 'Books', 'Oil', 'Laptop', 'Shoes', 'Laptop',
 'Electronics', 'Study', 'Grocery', 'Electronics', 'Fashion', 'El
5.0, 110.0, 79999.0, 2999.0, 79999.0],
['Kolkata', 'Delhi', 'Chennai', 'Bengalore', 'Chennai', 'Bengalor
```

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Product_ID	Product_name	Category	Price	Seller_City
101	Watch	Fashion	299.0	Delhi
102	Bag	Fashion	1350.5	Mumbai
103	Shoes	Fashion	2999.0	Chennai
104	Smartphone	Electronics	14999.0	Kolkata
105	Books	Study	145.0	Delhi
106	Oil	Grocery	110.0	Chennai
107	Laptop	Electronics	79999.0	Bengalore

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	Launch your career with			
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	Download for Free			

	Price	Seller_City	id	name	age	Purchased_Product	City
1	299.0	Delhi	1	Olivia	20	Watch	Mumbai
2	2999.0	Chennai	5	Dominic	30	Shoes	Chennai
3	2999.0	Chennai	5	Dominic	30	Shoes	Chennai
4	14999.0	Kolkata	6	Tyler	65	Smartphone	Delhi
5	110.0	Chennai	3	Cory	15	Oil	Bangalore
6	79999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai
7	79999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai

(<https://cdn.analyticsvidhya.com/wp-content/uploads/2020/02/jip11.png>)

As you can see, we have duplicate rows in the resulting dataset as well. To solve this, there is a **validate** argument in the **merge()** function, which we can set to '**one_to_one**', '**one_to_many**', '**many_to_one**', and '**many_to_many**'.

This ensures that there exists only a particular mapping across both the dataframes. If the mapping condition is not satisfied, then it throws a **MergeError**. To solve this, we can delete duplicates before applying join:

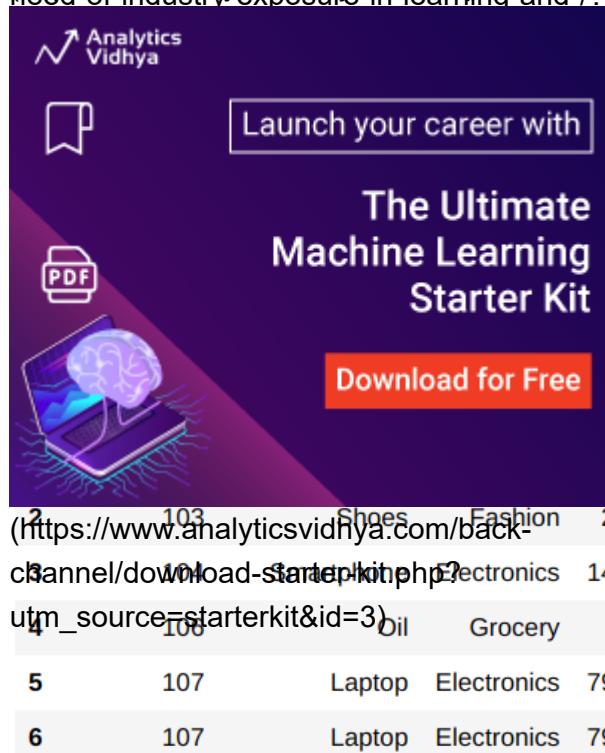


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```
customer,how='inner',on='Product_ID')
```

Price	Seller_City	id	name	age	Purchased_Product	City
299.0	Delhi	1	Olivia	20	Watch	Mumbai
2999.0	Chennai	5	Dominic	30	Shoes	Chennai
1999.0	Kolkata	6	Tyler	65	Smartphone	Delhi
110.0	Chennai	3	Cory	15	Oil	Bangalore
9999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai

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The banner features the Analytics Vidhya logo at the top. It has icons for a bookmark, PDF, and a laptop with a brain. A button says "Launch your career with". Below it is the text "The Ultimate Machine Learning Starter Kit" and a "Download for Free" button.

```
,on='Product_ID',validate='many_to_many')
```

Price	Seller_City	id	name	age	Purchased_Product	City			
299.0	Delhi	1	Olivia	20	Watch	Mumbai			
2999.0	Chennai	5	Dominic	30	Shoes	Chennai			
2999.0	Chennai	5	Dominic	30	Shoes	Chennai			
14999.0	Kolkata	6	Tyler	65	Smartphone	Delhi			
110.0	Grocery	3	Cory	15	Oil	Bangalore			
107	Laptop	Electronics	79999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai
107	Laptop	Electronics	79999.0	Bengalore	9	Jeremy	23	Laptop	Mumbai

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Now, you can say:

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that we can use for joining two dataframes. I encourage you to alongside what you've learned about joins in this tutorial.

If you enjoyed this article, feel free to share it in the comments section below. I have articles and courses related to data science and Python below.

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- [Data Science Hacks, Tips and Tricks](https://courses.analyticsvidhya.com/courses/data-science-hacks-tips-and-tricks?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python) (https://courses.analyticsvidhya.com/courses/data-science-hacks-tips-and-tricks?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python)
- [Introduction to Data Science](https://courses.analyticsvidhya.com/courses/introduction-to-data-science-2?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python) (https://courses.analyticsvidhya.com/courses/introduction-to-data-science-2?utm_source=blog&utm_medium=joins-in-pandas-master-the-different-types-of-joins-in-python)
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He is a data science aficionado, who loves diving into data and generating insights from it. He is always ready for making machines to learn through code and writing technical blogs. His areas of interest include Machine Learning and Natural Language Processing still open for something new and exciting.

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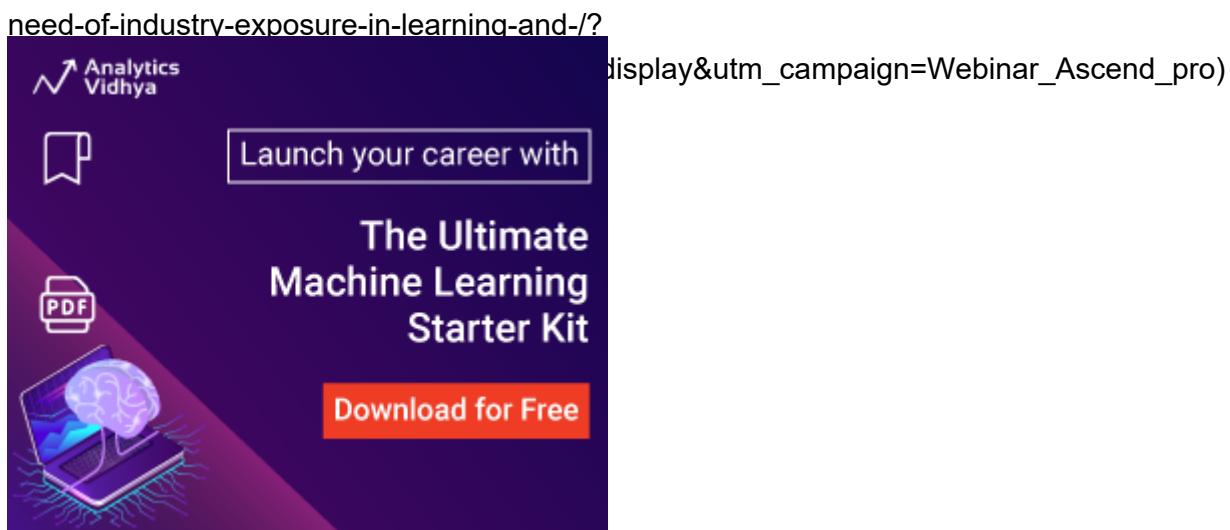
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