```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
```

from google.colab import files
uploaded = files.upload()

import io

filename = list(uploaded.keys())[0]

customer_orders = pd.read_csv(io.BytesIO(uploaded[filename]))

customer_orders.head()

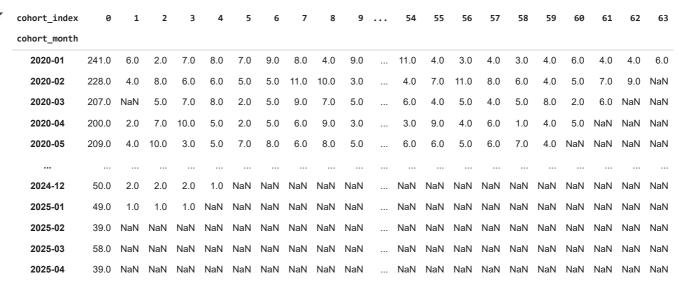
→ *	Choose Files No file chosen	Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to									
	enable.										
	Saving customer orders.csv to customer orders (5).csv										

	order_id	customer_id	order_date	order_amount	shipping_address	order_status
0	d27d8139-a252-4402-9fd0- 23a85592285e	2824	2023-05-28	22.26	32181 Johnson Course Apt. 389, New Jamesside,	pending
1	31d3bfde-52dd-4d35-bca6- ee6bddf1eb60	5012	2022-05-23	119.37	65423 Garcia Light, West Melanieview, AS 06196	delivered
2	c381a67d-68e6-4d40-912d- 77cdc343036f	2679	2023-11-19	341.58	84959 Janet Cape Apt. 413, South Joshuastad, G	delivered

customer_orders['order_date'] = pd.to_datetime(customer_orders['order_date'])
customer_orders['cohort_month'] = customer_orders.groupby('customer_id')['order_date'].transform('min').dt.to_period('N
customer_orders['order_month'] = customer_orders['order_date'].dt.to_period('M')
customer_orders['cohort_index'] = (customer_orders['order_month'].dt.year - customer_orders['cohort_month'].dt.year) *
customer_orders[['customer_id', 'order_date', 'cohort_month', 'order_month', 'cohort_index']].head()

→		customer_id	order_date	cohort_month	order_month	cohort_index			
	0	2824	2023-05-28	2021-03	2023-05	26			
	1	5012	2022-05-23	2022-05	2022-05	0			
	2	2679	2023-11-19	2021-10	2023-11	25			
	3	2424	2021-11-21	2021-05	2021-11	6			
	4	1488	2021-03-21	2021-03	2021-03	0			

cohort_data = customer_orders.groupby(['cohort_month', 'cohort_index'])['customer_id'].nunique().reset_index()
cohort_counts = cohort_data.pivot(index='cohort_month', columns='cohort_index', values='customer_id')
cohort_counts



64 rows × 64 columns

```
cohort_sizes = cohort_counts.iloc[:,0]
retention = cohort_counts.divide(cohort_sizes, axis=0).round(3) * 100
```

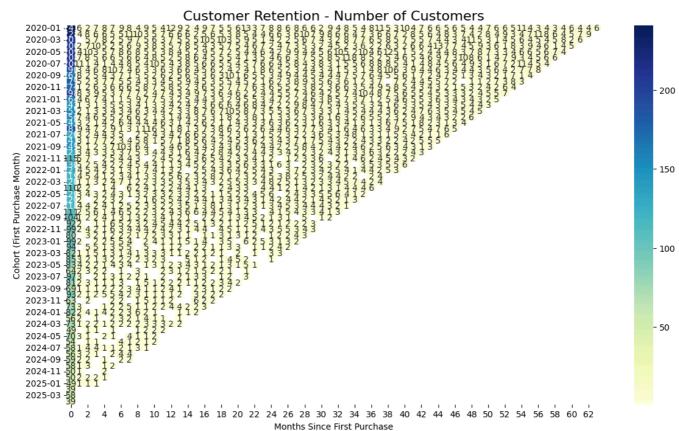
retention

∑ *	cohort_index	0	1	2	3	4	5	6	7	8	9	 54	55	56	57	58	59	60	61	62	63
	cohort_month																				
	2020-01	100.0	2.5	0.8	2.9	3.3	2.9	3.7	3.3	1.7	3.7	 4.6	1.7	1.2	1.7	1.2	1.7	2.5	1.7	1.7	2.5
	2020-02	100.0	1.8	3.5	2.6	2.6	2.2	2.2	4.8	4.4	1.3	 1.8	3.1	4.8	3.5	2.6	1.8	2.2	3.1	3.9	NaN
	2020-03	100.0	NaN	2.4	3.4	3.9	1.0	2.4	4.3	3.4	2.4	 2.9	1.9	2.4	1.9	2.4	3.9	1.0	2.9	NaN	NaN
	2020-04	100.0	1.0	3.5	5.0	2.5	1.0	2.5	3.0	4.5	1.5	 1.5	4.5	2.0	3.0	0.5	2.0	2.5	NaN	NaN	NaN
	2020-05	100.0	1.9	4.8	1.4	2.4	3.3	3.8	2.9	3.8	2.4	 2.9	2.9	2.4	2.9	3.3	1.9	NaN	NaN	NaN	NaN
	•••											 									
	2024-12	100.0	4.0	4.0	4.0	2.0	NaN	NaN	NaN	NaN	NaN	 NaN	NaN								
	2025-01	100.0	2.0	2.0	2.0	NaN	NaN	NaN	NaN	NaN	NaN	 NaN	NaN								
	2025-02	100.0	NaN	 NaN	NaN																
	2025-03	100.0	NaN	 NaN	NaN																
	2025-04	100.0	NaN	 NaN	NaN																

64 rows × 64 columns

```
plt.figure(figsize=(14,8))
sns.heatmap(cohort_counts, annot=True, fmt='.0f', cmap='YlGnBu')
plt.title('Customer Retention - Number of Customers', fontsize=16)
plt.xlabel('Months Since First Purchase')
plt.ylabel('Cohort (First Purchase Month)')
plt.show()
```





```
plt.figure(figsize=(20,18))
sns.heatmap(retention, annot=True, fmt='.1f', cmap='Blues')
plt.title('Customer Retention Rates (%)', fontsize=16)
plt.xlabel('Months Since First Purchase')
plt.ylabel('Cohort (First Purchase Month)')
plt.show()
```

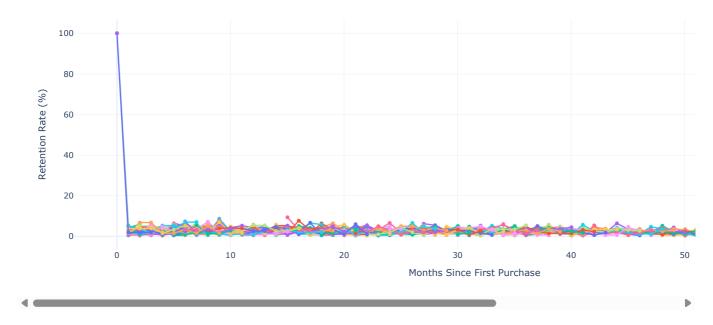
```
→▼
```

```
Customer Retention Rates (%)
                     2.50.82.93.22.93.73.31.73.72.11.75.03.70.81.73.72.92.12.12.55.41.22.93.33.32.53.32.52.50.88.71.73.32.11.73.34.62.11.24.11.72.92.52.52.12.52.11.71.72.92.52.52.52.14.61.71.21.71.21.72.51.71.72.5
 2020-01
                      1.83.52. @. 62. ;2, 24.84.41.32, 23.12.62. @. 60. 92, 22. 62. 21.33.52, 21.81.82. @. 61. 32. 64.43.13.93.52. @. 61.83.11.32. @. 63. 10. 93.52. 22. 61.83.51.33.11.80.93.51.83.91.31.83.14.83.52. 61.82. 23.13.59.
 2020-03
                         2.43.43.91.02.44.33.42.42.91.43.42.42.42.44.81.42.44.82.44.81.42.44.51.91.01.02.42.93.41.91.41.03.93.43.42.92.43.92.43.42.42.43.41.91.91.41.95.32.41.40.51.92.42.91.92.43.91.02.93.41.92.43.91.02.93.43.91.02.93.43.91.02.93.43.91.02.93.43.91.02.93.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.91.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43.92.43
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                     5.30.51.90.51.91.93.92.41.94.92.41.91.53.92.42.92.92.42.41.92.43.42.92.91.92.43.91.51.50.52.42.42.93.93.93.92.41.90.51.93.93.92.42.91.94.41.50.52.93.41.05.31.92.41.90.51
                      1.@.13.24.25.33.72.13.21.61.63.21.63.23.22.12.63.21.21.11.12.10.54.23.22.61.11.62.12.11.62.10.59.61.60.52.14.25.33.21.64.72.12.13.21.62.12.12.12.12.63.22.11.13.73.74.2
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                      2.81.11.73.93.92.82.82.21.71.72.22.82.85.02.22.81.72.82.82.22.81.10.63.41.11.74.55.01.72.83.41.73.40.61.11.73.9 3.91.12.22.22.82.83.91.1 0.60.61.13.91.74.51.7
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 2020-11
                 2021-01
                      2.43.74.32.40.60.63.05.54.34.33.01.81.23.02.42.41.81.81.25.53.03.01.82.44.31.21.22.43.71.84.93.04.31.84.30.61.23.02.43.73.03.01.83.71.82.41.82.41.81.23.0
                      2021-03
                    1,30.61.91.92.61.92.63.91.92.62.61.31.91.95.24.53.94.56.53.25.24.51.93.23.21.93.94.51.91.91.90.62.63.22.62.62.61.93.91.32.64.53.91.93.22.63.22.63.2
                      4.52.63.83.23.21.33.83.81.30.61.90.62.62.61.93.21.90.65.11.31.95.10.60.61.91.91.31.91.93.80.63.81.91.33.83.23.21.31.91.35.82.61.92.61.91.31.33.8
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                     2.11.40.72.81.44.12.82.82.82.84.12.10.72.81.44.11.40.70.72.82.12.12.14.11.42.10.74.12.12.12.12.10.72.14.14.83.40.75.51.42.10.72.12.8
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 2021-08 -002.10.74.94.91.42.12.83.55.60.73.54.90.75.63.54.22.81.42.83.52.14.21.42.12.82.14.90.74.93.52.82.11.41.42.82.12.11.41.42.81.43.53.53.5
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 2021-10 -002.43.32.42.42.45.74.12.43.33.32.40.84.93.31.61.66.53.31.61.63.33.32.42.43.31.61.62.41.63.32.40.82.42.44.92.41.61.61.63.32.4
2021-11 -004.36.1 1.74.33.53.52.6 1.73.54.31.73.52.65.24.33.51.72.62.65.50.91.7 0.91.72.62.65.2 1.70.93.55.21.73.54.33.52.61.7 2021-12 -003.81.53.83.11.51.53.13.83.13.10.80.82.33.13.81.51.52.32.33.84.62.32.30.84.62.3 1.52.31.52.35.41.5 2.33.82.33.83.84.6 2022-01 -003.13.93.11.62.40.82.40.85.53.10.82.41.6 1.63.93.12.44.73.11.63.93.12.4 2.45.51.62.43.11.63.93.10.83.13.11.63.92.4 2022-02 -003.44.23.40.81.72.53.40.82.52.51.74.25.01.72.51.76.75.90.81.72.51.73.44.22.56.71.74.22.51.73.43.41.71.7 1.73.4
 2022-03 -00 0.80.82.51.73.35.80.81.71.72.52.54.22.53.32.51.74.24.22.52.53.36.71.74.20.82.51.72.52.53.34.25.83.31.73.3 2022-04 -00 1.81.8 0.93.6 5.51.83.60.91.81.83.63.60.92.7 1.83.62.72.7 3.63.60.91.80.98.61.80.92.70.98.63.63.65.5
 2022-05 - 02.53.32.51.73.32.50.82.51.72.52.51.72.52.51.71.70.80.84.21.71.73.34.25.0 1.73.32.52.54.24.25.03.30.81.7 2022-06 - 001.7 1.71.72.51.7 1.70.85.04.24.23.31.73.33.30.82.53.32.53.32.50.83.31.73.33.31.70.83.34.21.70.82.5 2022-07 - 003.43.41.73.40.81.74.21.72.52.51.71.72.54.20.82.56.80.82.50.81.72.50.82.53.44.22.53.43.43.24.51.70.8
                  00<mark>1.84.55.40.93.65.44.51.81.82.71.83.62.75.45.43.63.64.53.60.92.72.7 3.60.94.53.62.72.73.60.92.7</mark>
 2022-09 -001.01.91.93.81.02.91.02.91.92.93.81.01.91.0 1.91.91.91.02.93.84.81.91.02.91.0 4.8 1.01.9 2022-10 -102.2 1.11.16.55.42.23.32.24.35.44.34.32.25.41.13.32.21.11.12.25.41.12.21.12.22.22.23.3
 2022-11 -00 2.04.02.01.06.13.04.04.04.02.04.02.03.01.04.04.0 4.05.11.01.02.04.03.05.15.13.04.03.0 2022-12 -00 3.82.51.22.52.52.51.28.82.53.83.81.21.2 1.21.23.81.23.81.23.81.22.5 1.22.52.55.03.8
2023-01 -002.0 2.@.05.15.14.0 2.04.01.01.01.05.11.04.0 3.05.1 6.12.05.13.01.03.02.0 2023-02 -00 5.55.31.13.25.55.3 5.3 1.11.12.1 2.12.11.11.13.23.2 1.11.12.14.22.1 2023-03 -001.21.26.11.23.71.24.91.23.73.73.71.21.22.42.41.22.41.2 2.4 1.2 3.73.7 2023-04 003.52.41.23.52.42.42.43.52.45.5 5.91.22.4 1.24.75.92.4 1.2
 2023-05 -904.82. 42. 41.24.83.64.8 1.23.61.22. 43.64.83.61.22. 41.23.61.26.0 2023-06 -90.81.47.31.31 1.6 4.7 31.471.63.11.67.88.11.311.6 1.6 2023-07 -90.81 2.11.08.11.02.12.11.0 2.1 2.11.08.13.1 1.02.1 3.1 2023-08 -90.2.53.71.21.21.23.7 1.26.21.22.52.52.51.21.22.52.53.74.92.5 2023-09 -90.14.41.42.92.92.94.35.81.41.42.95.81.4 2.94.31.42.92.9 2023-10 -90.2.52.71.21.25.45.44.32.23.21.11.11.11.22.2 3.22.22.22.22 2023-11 -90.32.32 3.23.2 1.67.91.61.63.2 9.53.23.2
                      3.2 3.23.2 1.67.91.61.03.2 ......
4.1 1.42.72.76.81.41.42.72.75.55.52.72.74.1
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2024-09 -003.43.4 1.7 3.43.4
2024-10 -001.75.2 1.73.4
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2024-12 -00.4.04.04.02.0
 2025-01 -002.02.02.0
 2025-02
 2025-03 -0
 2025-04 -00
                  0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
```

```
fig.update_layout(template="plotly_white")
fig.show()
```



Customer Retention Over Time (by Cohort)



Customer Retention Analysis Explanation. This visualization shows:

- Each row represents customers who made their first purchase in a specific month.
- · Each column shows what percentage of those customers returned in subsequent months.
- · A higher value means stronger customer loyalty.

Key Observations:

- The darker the color, the more customers stayed active over time.
- Rapid drops suggest customer churn issues after initial purchase.
- · Trends can inform Alt Mobility's customer engagement and loyalty strategies.

Why Heatmap + Line Chart Together:

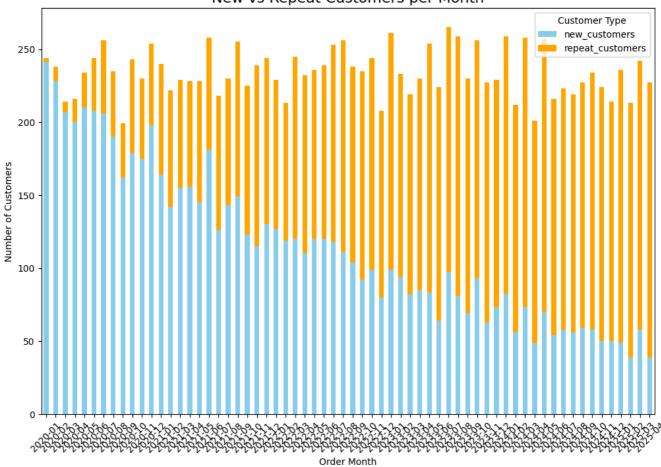
- Heatmap gives a fast snapshot across all cohorts.
- · Line chart shows how each cohort behaves over time.

```
first_orders = customer_orders.groupby('customer_id')['order_date'].min().reset_index()
customer_orders['is_first_order'] = customer_orders['order_date'] == customer_orders['customer_id'].map(first_orders.se
monthly = customer_orders.groupby(customer_orders['order_month']).agg(
    new_customers = ('is_first_order', lambda x: x.sum()),
    repeat_customers = ('is_first_order', lambda x: (~x).sum())
).reset_index()

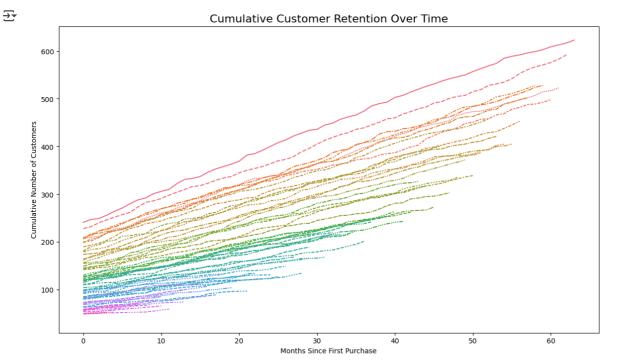
monthly.plot(x='order_month', y=['new_customers', 'repeat_customers'], kind='bar', stacked=True, figsize=(12,8), color=
plt.title('New vs Repeat Customers per Month', fontsize=16)
plt.ylabel('Number of Customers')
plt.xlabel('Order Month')
plt.xticks(rotation=45)
plt.legend(title='Customer Type')
plt.show()
```



New vs Repeat Customers per Month



```
cumulative_retention = cohort_counts.cumsum(axis=1)
plt.figure(figsize=(14,8))
sns.lineplot(data=cumulative_retention.transpose())
plt.title('Cumulative Customer Retention Over Time', fontsize=16)
plt.xlabel('Months Since First Purchase')
plt.ylabel('Cumulative Number of Customers')
plt.legend(title='Cohort Month', bbox_to_anchor=(1.05, 1), loc='upper left')
plt.show()
```



2020-03 ---- 2020-04 2020-05 2020-06 2020-07 ---- 2020-08 ---- 2020-09 2020-10 2020-11 2020-12 2021-01 2021-02 2021-03 2021-04 2021-05 2021-06 2021-07 2021-08 2021-09 2021-10 2021-11 2021-12 2022-01 2022-02 2022-03 2022-04 2022-05 2022-06 2022-07 2022-08 2022-09 2022-10 2022-11 --- 2022-12 --- 2023-01 2023-02 2023-03 2023-04 2023-05 2023-06 2023-07 2023-08 2023-09 2023-10 2023-11 2023-12 2024-01 2024-02 2024-03 2024-04 2024-05 2024-06 2024-07 2024-08 2024-09 2024-10 2024-11 2024-12 2025-01 2025-02 --- 2025-03 --- 2025-04

Cohort Month 2020-01

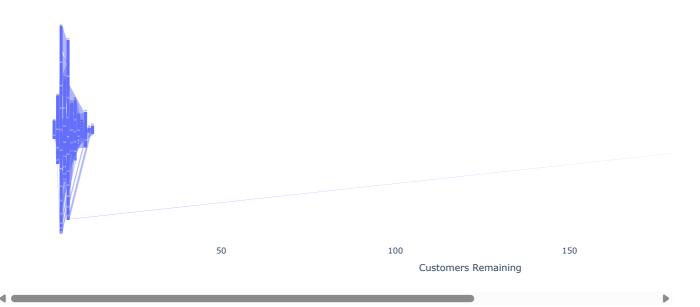
2020-02

```
Start coding or generate with AI.
```

```
sample_cohort = cohort_counts.iloc[0]
sample_cohort = sample_cohort.dropna()
```

₹

Customer Drop-off Funnel (First Cohort)



→

New Customers Acquired per Month (Cohort Size)

