```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import warnings
import seaborn as sns
from datetime import datetime, timedelta
from google.colab import drive
warnings.filterwarnings('ignore')
```

```
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
orders = pd.read_csv("/content/drive/MyDrive/olist_orders_dataset.csv")
order_reviews = pd.read_csv("/content/drive/MyDrive/olist_order_reviews_dataset.csv")
customers = pd.read_csv("/content/drive/MyDrive/olist_customers_dataset.csv")
products = pd.read_csv("/content/drive/MyDrive/olist_products_dataset.csv")
order_items = pd.read_csv("/content/drive/MyDrive/olist_order_items_dataset.csv")
```

```
orders.head()
```

	order_id	customer_id	order_status	order_purchase_timestamp	order_approved_at	order_delivered_carrier_date	order_delivered_customer_date
0	e481f51cbdc54678b7cc49136f2d6af7	9ef432eb6251297304e76186b10a928d	delivered	2017-10-02 10:56:33	2017-10-02 11:07:15	2017-10-04 19:55:00	2017-10-10 21:25:13
1	53cdb2fc8bc7dce0b6741e2150273451	b0830fb4747a6c6d20dea0b8c802d7ef	delivered	2018-07-24 20:41:37	2018-07-26 03:24:27	2018-07-26 14:31:00	2018-08-07 15:27:45
2	47770eb9100c2d0c44946d9cf07ec65d	41ce2a54c0b03bf3443c3d931a367089	delivered	2018-08-08 08:38:49	2018-08-08 08:55:23	2018-08-08 13:50:00	2018-08-17 18:06:29
3	949d5b44dbf5de918fe9c16f97b45f8a	f88197465ea7920adcdbec7375364d82	delivered	2017-11-18 19:28:06	2017-11-18 19:45:59	2017-11-22 13:39:59	2017-12-02 00:28:42
4	ad21c59c0840e6cb83a9ceb5573f8159	8ab97904e6daea8866dbdbc4fb7aad2c	delivered	2018-02-13 21:18:39	2018-02-13 22:20:29	2018-02-14 19:46:34	2018-02-16 18:17:02

Next steps: Generate code with orders New interactive sheet

```
order_reviews.head()
```

	review_id	order_id	review_score	review_comment_title	review_comment_message	review_creation_date	review_answer_timestamp
0	7bc2406110b926393aa56f80a40eba40	73fc7af87114b39712e6da79b0a377eb	4	NaN	NaN	2018-01-18 00:00:00	2018-01-18 21:46:59
1	80e641a11e56f04c1ad469d5645fdfde	a548910a1c6147796b98fdf73dbeba33	5	NaN	NaN	2018-03-10 00:00:00	2018-03-11 03:05:13
2	228ce5500dc1d8e020d8d1322874b6f0	f9e4b658b201a9f2ecdecbb34bed034b	5	NaN	NaN	2018-02-17 00:00:00	2018-02-18 14:36:24
3	e64fb393e7b32834bb789ff8bb30750e	658677c97b385a9be170737859d3511b	5	NaN	Recebi bem antes do prazo estipulado.	2017-04-21 00:00:00	2017-04-21 22:02:06

Next steps: Generate code with order_reviews New interactive sheet

```
customers.head()
```

	customer_id	customer_unique_id	customer_zip_code_prefix	customer_city	customer_state
0	06b8999e2fba1a1fbc88172c00ba8bc7	861eff4711a542e4b93843c6dd7febb0	14409	franca	SP
1	18955e83d337fd6b2def6b18a428ac77	290c77bc529b7ac935b93aa66c333dc3	9790	sao bernardo do campo	SP
2	4e7b3e00288586ebd08712fdd0374a03	060e732b5b29e8181a18229c7b0b2b5e	1151	sao paulo	SP
3	b2b6027bc5c5109e529d4dc6358b12c3	259dac757896d24d7702b9acbbff3f3c	8775	mogi das cruzes	SP
4	4f2d8ab171c80ec8364f7c12e35b23ad	345ecd01c38d18a9036ed96c73b8d066	13056	campinas	SP

Next steps: Generate code with customers New interactive sheet

```
products.head()
```

	product_id	product_category_name	product_name_lenght	product_description_lenght	product_photos_qty	product_weight_g	product_length_cm	product_height_cm	proc
0	1e9e8ef04dbcff4541ed26657ea517e5	perfumaria	40.0	287.0	1.0	225.0	16.0	10.0	
1	3aa071139cb16b67ca9e5dea641aaa2f	artes	44.0	276.0	1.0	1000.0	30.0	18.0	
2	96bd76ec8810374ed1b65e291975717f	esporte_lazer	46.0	250.0	1.0	154.0	18.0	9.0	
3	cef67bcfe19066a932b7673e239eb23d	bebes	27.0	261.0	1.0	371.0	26.0	4.0	
4	9dc1a7de274444849c219cff195d0b71	utilidades_domesticas	37.0	402.0	4.0	625.0	20.0	17.0	

Next steps: Generate code with products New interactive sheet

```
#handling missing data in the datases
if 'Order(s)' in orders:
  missing_orders = orders['Order(s)'].isnull().sum()
  orders['Order(s)'].fillna(0, inplace=True)

if 'Order_Review' in order_reviews:
  missingorder_review = order_reviews['Order_Review'].isnull.sum()
  order_reviews['Order_Review'].fillna(0, inplace=True)

if 'Customer(s)' in customers:
  missing_customers = customers['Customer(s)'].isnull().sum()
  customers['Customer(s)']
```

```
date_cols = [
    'order_purchase_timestamp',
    'order_approved_at',
    'order_delivered_carrier_date',
    'order_delivered_customer_date',
    'order_estimated_delivery_date'
]
```

```python
for col in date_cols:
    if col in orders.columns:
        orders[col] = pd.to_datetime(orders[col], errors='coerce')
    else:
        print(f"⚠️ Warning: Column '{col}' not found in orders DataFrame")
```

```python
if 'review_score' in order_reviews.columns:
    imp = SimpleImputer(strategy='median')
    order_reviews['review_score'] = imp.fit_transform(order_reviews[['review_score']])
```

```python
#Schema Builder [merging customers, orders and reviews]
reviews_per_order = order_reviews.groupby('order_id').agg({
    'review_score': 'mean',
    'review_creation_date': 'max'
}).reset_index()

#Orders and Reviews
order_and_review = pd.merge(orders, reviews_per_order, on=['order_id'], how='inner')

#Orders, Reviews and Customers
overall = pd.merge(order_and_review, customers[['customer_id', 'customer_unique_id', 'customer_state', 'customer_city']], on=['customer_id'], how='left')
```

```python
if order_items is not None and products is not None:
    order_cat = pd.merge(order_items[['order_id', 'product_id']],
                         products[['product_id', 'product_category_name']],
                         on='product_id', how='left')
```

```python
if order_items is not None and products is not None:
    order_cat = pd.merge(order_items[['order_id', 'product_id']],
                         products[['product_id', 'product_category_name']],
                         on='product_id', how='left')
    order_cat = order_cat.groupby('order_id')['product_category_name'].agg(
      lambda x: x.mode()[0] if len(x.mode()) > 0 else 'unknown'
 ).reset_index()
    overall = pd.merge(overall, order_cat, on='order_id', how='left')
else:
    overall['product_category_name'] = 'unknown'
```

```python
#Real Delay Calculator

overall['Days_Difference'] = (
    overall['order_delivered_customer_date'] -
    overall['order_estimated_delivery_date']
).dt.days
```

```python
#Classification Status
overall['Delivery_Status'] = 'Unknown'
```

```
# Step 2: Flag non-delivered / problematic statuses first (highest priority)
non_delivered_statuses = ['canceled', 'cancelled', 'unavailable', 'invoiced', 'processing', 'shipped']

overall.loc[
    overall['order_status'].str.lower().isin(non_delivered_statuses) |
    overall['order_delivered_customer_date'].isna(),
    'Delivery_Status'
] = 'Not Delivered'

# Step 3: Only for rows that are actually delivered → classify based on days


delivered_mask = (
    (overall['Delivery_Status'] == 'Unknown') &                  # not yet classified
    overall['order_delivered_customer_date'].notna() &           # has real delivery date
    overall['order_estimated_delivery_date'].notna()             # has estimated date
)

# Now classify only the true delivered rows
overall.loc[delivered_mask & (overall['Days_Difference'] <= 0),   'Delivery_Status'] = 'On Time'
overall.loc[delivered_mask & (overall['Days_Difference'] > 0) &
                         (overall['Days_Difference'] <= 5),      'Delivery_Status'] = 'Late'
overall.loc[delivered_mask & (overall['Days_Difference'] > 5),    'Delivery_Status'] = 'Super Late'


still_unknown_but_has_date = (
    (overall['Delivery_Status'] == 'Unknown') &
    overall['order_delivered_customer_date'].notna()
)
if still_unknown_but_has_date.any():
    overall.loc[still_unknown_but_has_date, 'Delivery_Status'] = 'Unknown (Date Mismatch)'


#Validation
print("\nDelivery Status distribution:")
print(overall['Delivery_Status'].value_counts(dropna=False))

print("\nCross-check with order_status:")
print(pd.crosstab(overall['order_status'], overall['Delivery_Status'], margins=True))

print("\nSample of 'Not Delivered' rows:")
print(overall[overall['Delivery_Status'] == 'Not Delivered'][
    ['order_id', 'order_status', 'order_delivered_customer_date', 'Days_Difference']
].head(6))
```

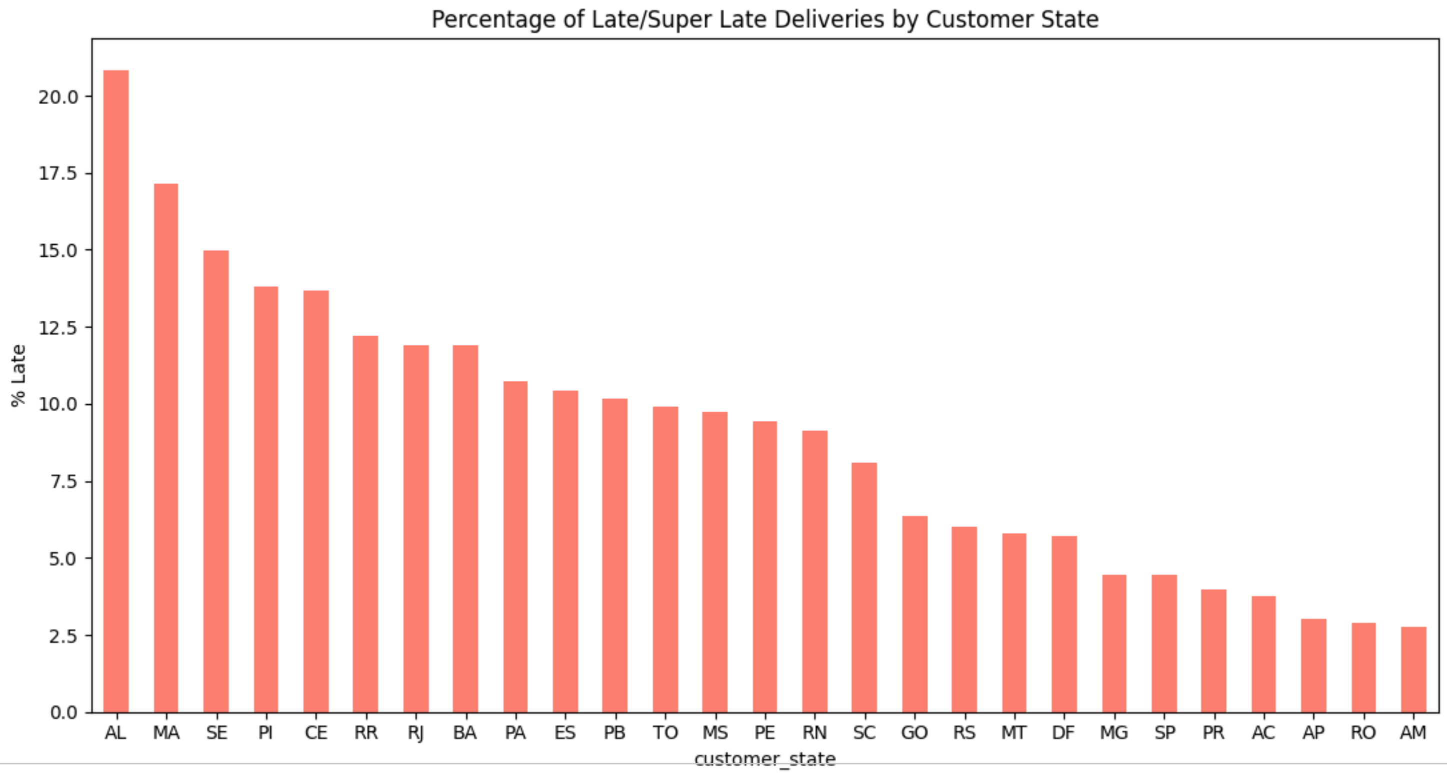
```
Delivery Status distribution:
Delivery_Status
On Time          89443
Super Late        3659
Not Delivered     2849
Late              2722
Name: count, dtype: int64

Cross-check with order_status:
Delivery_Status  Late  Not Delivered  On Time  Super Late    All
```

```
order_status
approved           0            2       0          0      2
canceled           0          605       0          0    605
created            0            3       0          0      3
delivered       2722            8   89443       3659  95832
invoiced           0          309       0          0    309
processing         0          295       0          0    295
shipped            0         1032       0          0   1032
unavailable        0          595       0          0    595
All             2722         2849   89443       3659  98673

Sample of 'Not Delivered' rows:
                             order_id order_status  \
6    136cce7faa42fdb2cefd53fdc79a6098     invoiced
43   ee64d42b8cf066f35eac1cf57de1aa85      shipped
102  0760a852e4e9d89eb77bf631eaaf1c84     invoiced
127  15bed8e2fec7fdbadb186b57c46c92f2   processing
160  36530871a5e80138db53bcfd8a104d90      shipped
229  4d630f57194f5aba1a3d12ce23e71cd9      shipped

    order_delivered_customer_date  Days_Difference
6                             NaT              NaN
43                            NaT              NaN
102                           NaT              NaN
127                           NaT              NaN
160                           NaT              NaN
229                           NaT              NaN
```

```python
est = overall['order_estimated_delivery_date']
overall['Year']      = est.dt.year
overall['Month']     = est.dt.month
overall['Quarter']   = est.dt.quarter
overall['DayofWeek'] = est.dt.dayofweek
overall['DayName']   = est.dt.day_name()
overall['MonthName'] = est.dt.month_name()
```

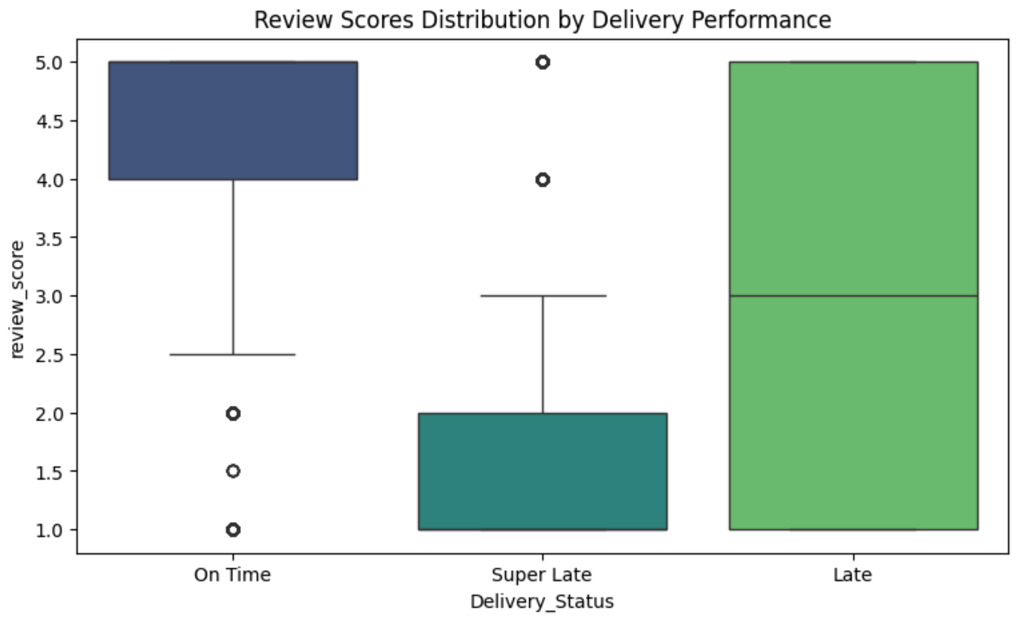
```python
#Geographic Analysis
delivered = overall[overall['Delivery_Status'] != 'Not Delivered']
late = delivered[delivered['Delivery_Status'].isin(['Late', 'Super Late'])]

state_late_pct = (late.groupby('customer_state').size() /
                  delivered.groupby('customer_state').size() * 100).round(2)

state_late_pct = state_late_pct.sort_values(ascending=False)

print("\nLate delivery % by state (top 8):")
print(state_late_pct.head(8))

plt.figure(figsize=(11,6))
state_late_pct.plot(kind='bar', color='salmon')
plt.title('Percentage of Late/Super Late Deliveries by Customer State')
plt.ylabel('% Late')
plt.xticks(rotation=0)
plt.tight_layout()
plt.show()
```

```
Late delivery % by state (top 8):
customer_state
AL    20.81
MA    17.13
SE    14.97
PI    13.80
CE    13.67
RR    12.20
RJ    11.92
BA    11.89
dtype: float64
```



```
#Sentiment Correlation

valid = overall[(overall['review_score'].notna()) &
               (overall['Delivery_Status'] != 'Not Delivered')]

print("\nAverage review score by delivery status:")
print(valid.groupby('Delivery_Status')['review_score'].mean().round(2))

plt.figure(figsize=(9,5))
sns.boxplot(data=valid, x='Delivery_Status', y='review_score', palette='viridis')
plt.title('Review Scores Distribution by Delivery Performance')
plt.show()
```

```
Average review score by delivery status:
Delivery_Status
Late          2.99
On Time       4.29
Super Late    1.74
Name: review_score, dtype: float64
```



```
overall.to_csv("/content/drive/MyDrive/master_logistic_audit.csv", index=False)
print("\nSaved master_logistic_audit.csv to Drive")
print("Ready for Gradio ")
```

```
Saved master_logistic_audit.csv to Drive
Ready for Gradio
```