B2B COURIER CHARGES ACCURACY ANALYSIS

BUSINESS PROBLEM

- In today's fast-paced e-commerce industry, fast and efficient order delivery is crucial to business success. To ensure seamless order fulfilment, businesses often partner with courier companies to ship their products to customers. However, managing the charges collected by these courier companies can be difficult, especially when dealing with a high volume of orders. It is one of the real-time problems B2B businesses experience when their estimated charges for the same invoice don't match.
- B2B courier charges accuracy analysis focuses on assessing the accuracy of fees charged by courier companies for the delivery of goods in B2B transactions. The aim is to ensure that companies are billed appropriately for the services provided by courier companies.

In [81]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

In [82]:

```
order_report = pd.read_csv('Order Report.csv')
sku_master = pd.read_csv('SKU Master.csv')
pincode_mapping = pd.read_csv('pincodes.csv')
courier_invoice = pd.read_csv('Invoice.csv')
courier_company_rates = pd.read_csv('Courier Company - Rates.csv')
```

In [83]:

```
order_report.head()
```

Out[83]:

	ExternOrderNo	SKU	Order Qty	Unnamed: 3	Unnamed: 4
0	2001827036	8904223818706	1.0	NaN	NaN
1	2001827036	8904223819093	1.0	NaN	NaN
2	2001827036	8904223819109	1.0	NaN	NaN
3	2001827036	8904223818430	1.0	NaN	NaN
4	2001827036	8904223819277	1.0	NaN	NaN

In [84]:

```
sku_master.head()
```

Out[84]:

	SKU	Weight (g)	Unnamed: 2	Unnamed: 3	Unnamed: 4
0	8904223815682	210	NaN	NaN	NaN
1	8904223815859	165	NaN	NaN	NaN
2	8904223815866	113	NaN	NaN	NaN
3	8904223815873	65	NaN	NaN	NaN
4	8904223816214	120	NaN	NaN	NaN

In [85]:

```
pincode_mapping.head()
```

Out[85]:

	Warehouse Pincode	Customer Pincode	Zone	Unnamed: 3	Unnamed: 4
0	121003	507101	d	NaN	NaN
1	121003	486886	d	NaN	NaN
2	121003	532484	d	NaN	NaN
3	121003	143001	b	NaN	NaN
4	121003	515591	d	NaN	NaN

In [86]:

```
courier_invoice.head()
```

Out[86]:

	AWB Code	Order ID	Charged Weight	Warehouse Pincode	Customer Pincode	Zone	Type of Shipment	Billing Amount (Rs.)
0	1091117222124	2001806232	1.30	121003	507101	d	Forward charges	135.0
1	1091117222194	2001806273	1.00	121003	486886	d	Forward charges	90.2
2	1091117222931	2001806408	2.50	121003	532484	d	Forward charges	224.6
3	1091117223244	2001806458	1.00	121003	143001	b	Forward charges	61.3
4	1091117229345	2001807012	0.15	121003	515591	d	Forward charges	45.4

In [87]:

```
courier_company_rates.head()
```

Out[87]:

	fwd_a_fixed	fwd_a_additional	fwd_b_fixed	fwd_b_additional	fwd_c_fixed	fwd_c_addition
0	29.5	23.6	33	28.3	40.1	38

DATA CLEANING

In [88]:

```
def missing_to_df(df):
    #Number and percentage of missing data in training data set for each column
    total_missing_df = df.isnull().sum().sort_values(ascending =False)
    percent_missing_df = (df.isnull().sum()/df.isnull().count()*100).sort_values(as
    missing_data_df = pd.concat([total_missing_df, percent_missing_df], axis=1, key
    return missing_data_df
```

In [89]:

```
missing_df = missing_to_df(order_report)
missing_df[missing_df['Total'] > 0]
```

Out[89]:

	Total	Percent
Unnamed: 3	400	100.0
Unnamed: 4	400	100.0

In [90]:

```
missing_df = missing_to_df(sku_master)
missing_df[missing_df['Total'] > 0]
```

Out[90]:

	Total	Percent
Unnamed: 2	66	100.0
Unnamed: 3	66	100.0
Unnamed: 4	66	100.0

In [91]:

```
missing_df = missing_to_df(pincode_mapping)
missing_df[missing_df['Total'] > 0]
```

Out[91]:

	Total	Percent
Unnamed: 3	124	100.0
Unnamed: 4	124	100.0

In [92]:

```
missing_df = missing_to_df(courier_invoice)
missing_df[missing_df['Total'] > 0]
```

Out[92]:

Total	Percent

In [93]:

```
missing_df = missing_to_df(courier_company_rates)
missing_df[missing_df['Total'] > 0]
```

Out[93]:

Total	Percent

In [94]:

```
order_report = order_report.drop(columns=["Unnamed: 3","Unnamed: 4"])
sku_master = sku_master.drop(columns=["Unnamed: 3","Unnamed: 4","Unnamed: 2"])
pincode_mapping = pincode_mapping.drop(columns=["Unnamed: 3","Unnamed: 4"])
```

In [95]:

```
order_report.head()
```

Out[95]:

	ExternOrderNo	SKU	Order Qty
0	2001827036	8904223818706	1.0
1	2001827036	8904223819093	1.0
2	2001827036	8904223819109	1.0
3	2001827036	8904223818430	1.0
4	2001827036	8904223819277	1.0

In [96]:

```
sku_master.head()
```

Out[96]:

	SKU	Weight (g)
0	8904223815682	210
1	8904223815859	165
2	8904223815866	113
3	8904223815873	65
4	8904223816214	120

In [97]:

```
pincode_mapping.head()
```

Out[97]:

	Warehouse Pincode	Customer Pincode	Zone
0	121003	507101	d
1	121003	486886	d
2	121003	532484	d
3	121003	143001	b
4	121003	515591	d

In [98]:

```
merged_data = pd.merge(order_report,sku_master,on="SKU")
merged_data.head()
```

Out[98]:

	ExternOrderNo	SKU	Order Qty	Weight (g)
0	2001827036	8904223818706	1.0	127
1	2001821995	8904223818706	1.0	127
2	2001819252	8904223818706	1.0	127
3	2001816996	8904223818706	1.0	127
4	2001814580	8904223818706	1.0	127

In [99]:

```
merged_data = merged_data.rename(columns={"ExternOrderNo":"Order ID"})
```

In [100]:

```
merged_data.head()
```

Out[100]:

	Order ID	SKU	Order Qty	Weight (g)
0	2001827036	8904223818706	1.0	127
1	2001821995	8904223818706	1.0	127
2	2001819252	8904223818706	1.0	127
3	2001816996	8904223818706	1.0	127
4	2001814580	8904223818706	1.0	127

In [101]:

```
#merging the courier invoice and pincode mapping dataset
abc_courier = pincode_mapping.drop_duplicates(subset=["Customer Pincode"])
courier_abc= courier_invoice[['Order ID', 'Customer Pincode','Type of Shipment']]
pincodes = courier_abc.merge(abc_courier,on='Customer Pincode')

```

In [102]:

```
pincodes.head()
```

Out[102]:

	Order ID	Customer Pincode	Type of Shipment	Warehouse Pincode	Zone
0	2001806232	507101	Forward charges	121003	d
1	2001806273	486886	Forward charges	121003	d
2	2001806408	532484	Forward charges	121003	d
3	2001806458	143001	Forward charges	121003	b
4	2001807012	515591	Forward charges	121003	d

In [103]:

```
data = merged_data.merge(pincodes,on="Order ID")
```

In [104]:

```
data.head()
```

Out[104]:

	Order ID	SKU	Order Qty	Weight (g)	Customer Pincode	Type of Shipment	Warehouse Pincode	Zone
0	2001827036	8904223818706	1.0	127	173213	Forward charges	121003	e
1	2001827036	8904223819093	1.0	150	173213	Forward charges	121003	e
2	2001827036	8904223819109	1.0	100	173213	Forward charges	121003	e
3	2001827036	8904223818430	1.0	165	173213	Forward charges	121003	e
4	2001827036	8904223819277	1.0	350	173213	Forward charges	121003	e

In [105]:

```
data["Weight (kg)"] = data["Weight (g)"] / 1000
```

In [106]:

```
#calculate the weight slabs
def weight_slab(weight):
    i = round(weight % 1, 1)
    if i == 0.0:
        return weight
    elif i > 0.5:
        return int(weight) + 1.0
    else:
        return int(weight) + 0.5
```

In [107]:

```
data["Weight (kg)"] = data["Weight (kg)"].apply(weight_slab)
```

In [108]:

```
data.head()
```

Out[108]:

	Order ID	SKU	Order Qty	Weight (g)	Customer Pincode	Type of Shipment	Warehouse Pincode	Zone	Wei (
0	2001827036	8904223818706	1.0	127	173213	Forward charges	121003	e	
1	2001827036	8904223819093	1.0	150	173213	Forward charges	121003	e	
2	2001827036	8904223819109	1.0	100	173213	Forward charges	121003	e	
3	2001827036	8904223818430	1.0	165	173213	Forward charges	121003	e	
4	2001827036	8904223819277	1.0	350	173213	Forward charges	121003	e	

In [109]:

```
courier_invoice = courier_invoice.rename(columns={'Zone': 'Delivery Zone Charged by
data = data.rename(columns={'Zone': 'Delivery Zone As Per ABC'})
data = data.rename(columns={'Weight (kg)': 'Weight Slab As Per ABC'})
```

In [110]:

```
courier_invoice.head()
```

Out[110]:

	AWB Code	Order ID	Charged Weight	Warehouse Pincode	Customer Pincode	Delivery Zone Charged by Courier Company	Type of Shipment	Billir Amou (Rs
0	1091117222124	2001806232	1.30	121003	507101	d	Forward charges	135
1	1091117222194	2001806273	1.00	121003	486886	d	Forward charges	90
2	1091117222931	2001806408	2.50	121003	532484	d	Forward charges	224
3	1091117223244	2001806458	1.00	121003	143001	b	Forward charges	61
4	1091117229345	2001807012	0.15	121003	515591	d	Forward charges	45

In [111]:

```
data.head()
```

Out[111]:

	Order ID	SKU	Order Qty	Weight (g)	Customer Pincode	Type of Shipment	Warehouse Pincode	Delivery Zone As Per ABC
0	2001827036	8904223818706	1.0	127	173213	Forward charges	121003	e
1	2001827036	8904223819093	1.0	150	173213	Forward charges	121003	e
2	2001827036	8904223819109	1.0	100	173213	Forward charges	121003	e
3	2001827036	8904223818430	1.0	165	173213	Forward charges	121003	e
4	2001827036	8904223819277	1.0	350	173213	Forward charges	121003	e

In [112]:

```
# calculate the expected charges

total_expected_charge = []

for _, row in data.iterrows():
    fwd_category = 'fwd_' + row['Delivery Zone As Per ABC']
    fwd_fixed = courier_company_rates.at[0, fwd_category + '_fixed']
    fwd_additional = courier_company_rates.at[0, fwd_category + '_additional']
    rto_category = 'rto_' + row['Delivery Zone As Per ABC']
    rto_fixed = courier_company_rates.at[0, rto_category + '_fixed']
    rto_additional = courier_company_rates.at[0, rto_category + '_additional']

    weight_slab = row['Weight Slab As Per ABC']

    if row['Type of Shipment'] == 'Forward charges':
        additional_weight = max(0, (weight_slab - 0.5) / 0.5)
        total_expected_charge.append(fwd_fixed + additional_weight * fwd_additional
    elif row['Type of Shipment'] == 'Forward and RTO charges':
        additional_weight = max(0, (weight_slab - 0.5) / 0.5)
        total_expected_charge.append(fwd_fixed + additional_weight * (fwd_additiona
    else:
        total_expected_charge.append(0)

data['Expected Charge as per ABC'] = total_expected_charge
print(data.head())
```

```
     Order ID            SKU  Order Qty  Weight (g)  Customer Pincode  \
0  2001827036  8904223818706        1.0         127            173213
1  2001827036  8904223819093        1.0         150            173213
2  2001827036  8904223819109        1.0         100            173213
3  2001827036  8904223818430        1.0         165            173213
4  2001827036  8904223819277        1.0         350            173213

  Type of Shipment  Warehouse Pincode Delivery Zone As Per ABC  \
0  Forward charges             121003                        e
1  Forward charges             121003                        e
2  Forward charges             121003                        e
3  Forward charges             121003                        e
4  Forward charges             121003                        e

   Weight Slab As Per ABC  Expected Charge as per ABC
0                     0.5                        56.6
1                     0.5                        56.6
2                     0.5                        56.6
3                     0.5                        56.6
4                     0.5                        56.6
```

In [117]:

```python
merged_output = data.merge(courier_invoice, on='Order ID')
print(merged_output.head())
```

```
     Order ID            SKU  Order Qty  Weight (g)  Customer Pincode_x  
\
0  2001827036  8904223818706        1.0         127              173213   
1  2001827036  8904223819093        1.0         150              173213   
2  2001827036  8904223819109        1.0         100              173213   
3  2001827036  8904223818430        1.0         165              173213   
4  2001827036  8904223819277        1.0         350              173213   

  Type of Shipment_x  Warehouse Pincode_x Delivery Zone As Per ABC  \
0    Forward charges               121003                        e   
1    Forward charges               121003                        e   
2    Forward charges               121003                        e   
3    Forward charges               121003                        e   
4    Forward charges               121003                        e   

   Weight Slab As Per ABC  Expected Charge as per ABC       AWB Code  \
0                     0.5                        56.6  1091122418320   
1                     0.5                        56.6  1091122418320   
2                     0.5                        56.6  1091122418320   
3                     0.5                        56.6  1091122418320   
4                     0.5                        56.6  1091122418320   

   Charged Weight  Warehouse Pincode_y  Customer Pincode_y  \
0             1.6               121003              173213   
1             1.6               121003              173213   
2             1.6               121003              173213   
3             1.6               121003              173213   
4             1.6               121003              173213   

  Delivery Zone Charged by Courier Company Type of Shipment_y  \
0                                        b    Forward charges   
1                                        b    Forward charges   
2                                        b    Forward charges   
3                                        b    Forward charges   
4                                        b    Forward charges   

   Billing Amount (Rs.)  
0                 117.9  
1                 117.9  
2                 117.9  
3                 117.9  
4                 117.9  
```

In [114]:

```
df_diff = merged_output
df_diff['Difference (Rs.)'] = df_diff['Billing Amount (Rs.)'] - df_diff['Expected C

df_new = df_diff[['Order ID', 'Difference (Rs.)', 'Expected Charge as per ABC']]

print(df_new.head())
```

```
     Order ID  Difference (Rs.)  Expected Charge as per ABC
0  2001827036              61.3                        56.6
1  2001827036              61.3                        56.6
2  2001827036              61.3                        56.6
3  2001827036              61.3                        56.6
4  2001827036              61.3                        56.6
```

In [115]:

```
# Calculate the total orders in each category
total_correctly_charged = len(df_new[df_new['Difference (Rs.)'] == 0])
total_overcharged = len(df_new[df_new['Difference (Rs.)'] > 0])
total_undercharged = len(df_new[df_new['Difference (Rs.)'] < 0])

# Calculate the total amount in each category
amount_overcharged = abs(df_new[df_new['Difference (Rs.)'] > 0]['Difference (Rs.)']
amount_undercharged = df_new[df_new['Difference (Rs.)'] < 0]['Difference (Rs.)'].su
amount_correctly_charged = df_new[df_new['Difference (Rs.)'] == 0]['Expected Charge

# Create a new DataFrame for the summary
summary_data = {'Description': ['Total Orders where ABC has been correctly charged'
                                'Total Orders where ABC has been overcharged',
                                'Total Orders where ABC has been undercharged'],
                'Count': [total_correctly_charged, total_overcharged, total_underch
                'Amount (Rs.)': [amount_correctly_charged, amount_overcharged, amou

df_summary = pd.DataFrame(summary_data)

print(df_summary)
```

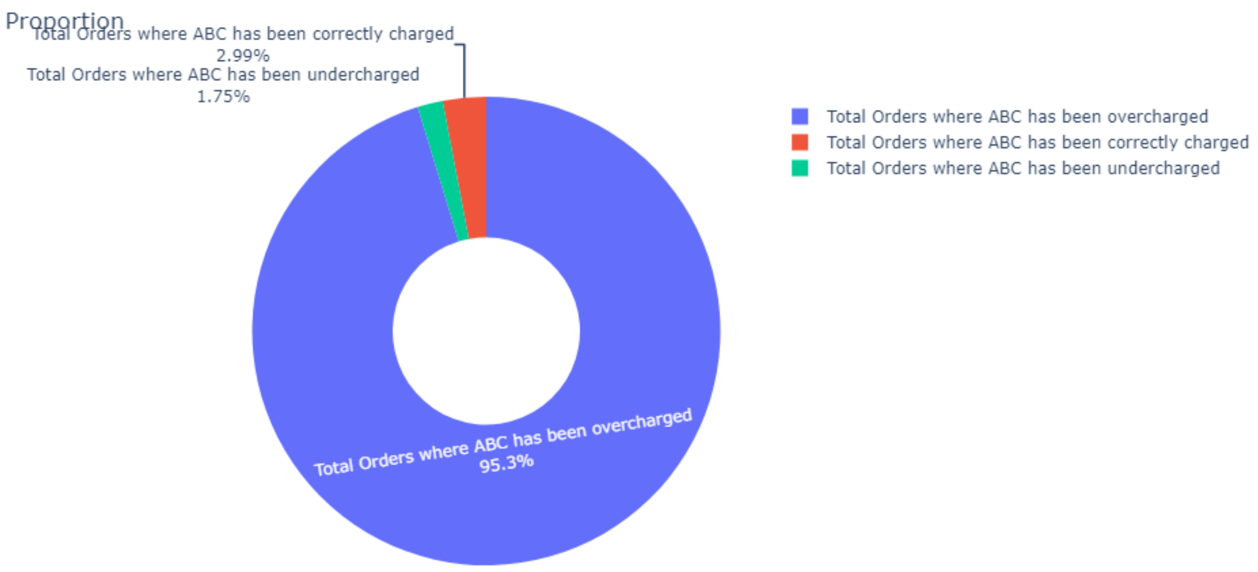
```
                                         Description  Count  Amount (Rs.)
0  Total Orders where ABC has been correctly charged     12         507.6
1        Total Orders where ABC has been overcharged    382       33750.5
2       Total Orders where ABC has been undercharged      7        -165.2
```

In [116]:

```
import plotly.graph_objects as go
fig = go.Figure(data=go.Pie(labels=df_summary['Description'],
                            values=df_summary['Count'],
                            textinfo='label+percent',
                            hole=0.4))
fig.update_layout(title='Proportion')

fig.show()
```

...


Proportion
Total Orders where ABC has been correctly charged
2.99%
Total Orders where ABC has been undercharged
1.75%
Total Orders where ABC has been overcharged
95.3%
🟦 Total Orders where ABC has been overcharged
🟥 Total Orders where ABC has been correctly charged
🟩 Total Orders where ABC has been undercharged