grocery-sales-forecasting

September 20, 2023

1 Machine Learning Techniques for Sales Forecasting

1.1 Importing Libraries

[ ]:
```
%pip install xgboost
%pip install statsmodels
%pip install pandas numpy statsmodels
```

```
Requirement already satisfied: xgboost in c:\users\srume\anaconda3\lib\site-
packages (2.0.0)
Requirement already satisfied: numpy in
c:\users\srume\appdata\roaming\python\python311\site-packages (from xgboost)
(1.25.1)
Requirement already satisfied: scipy in
c:\users\srume\appdata\roaming\python\python311\site-packages (from xgboost)
(1.11.1)
Note: you may need to restart the kernel to use updated packages.
Requirement already satisfied: statsmodels in c:\users\srume\anaconda3\lib\site-
packages (0.14.0)
Requirement already satisfied: numpy>=1.18 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from statsmodels)
(1.25.1)
Requirement already satisfied: scipy!=1.9.2,>=1.4 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from statsmodels)
(1.11.1)
Requirement already satisfied: pandas>=1.0 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from statsmodels)
(2.0.3)
Requirement already satisfied: patsy>=0.5.2 in
c:\users\srume\anaconda3\lib\site-packages (from statsmodels) (0.5.3)
Requirement already satisfied: packaging>=21.3 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from statsmodels)
(23.1)
Requirement already satisfied: python-dateutil>=2.8.2 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from
pandas>=1.0->statsmodels) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from
```

```
pandas>=1.0->statsmodels) (2023.3)
Requirement already satisfied: tzdata>=2022.1 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from
pandas>=1.0->statsmodels) (2023.3)
Requirement already satisfied: six in
c:\users\srume\appdata\roaming\python\python311\site-packages (from
patsy>=0.5.2->statsmodels) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
Requirement already satisfied: pandas in
c:\users\srume\appdata\roaming\python\python311\site-packages (2.0.3)
Requirement already satisfied: numpy in
c:\users\srume\appdata\roaming\python\python311\site-packages (1.25.1)
Requirement already satisfied: statsmodels in c:\users\srume\anaconda3\lib\site-
packages (0.14.0)
Requirement already satisfied: python-dateutil>=2.8.2 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from pandas)
(2.8.2)
Requirement already satisfied: pytz>=2020.1 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from pandas)
(2023.3)
Requirement already satisfied: tzdata>=2022.1 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from pandas)
(2023.3)
Requirement already satisfied: scipy!=1.9.2,>=1.4 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from statsmodels)
(1.11.1)
Requirement already satisfied: patsy>=0.5.2 in
c:\users\srume\anaconda3\lib\site-packages (from statsmodels) (0.5.3)
Requirement already satisfied: packaging>=21.3 in
c:\users\srume\appdata\roaming\python\python311\site-packages (from statsmodels)
(23.1)
Requirement already satisfied: six in
c:\users\srume\appdata\roaming\python\python311\site-packages (from
patsy>=0.5.2->statsmodels) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
```

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import statsmodels.api as sm
import scipy.stats as stats
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC
from sklearn.tree import DecisionTreeClassifier
```

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.linear_model import SGDRegressor
from sklearn.ensemble import ExtraTreesRegressor
from sklearn.linear_model import Ridge
from xgboost import XGBRegressor
from sklearn.linear_model import Lasso
from statsmodels.tsa.arima.model import ARIMA
from sklearn.linear_model import BayesianRidge
from sklearn.neighbors import KNeighborsRegressor
from sklearn.ensemble import AdaBoostRegressor
from sklearn.metrics import mean_squared_error
from sklearn.metrics import mean_absolute_error
from sklearn.metrics import mean_squared_error
import panel as pn
pn.extension()
import hvplot.pandas
from statsmodels.tsa.stattools import adfuller
```

1.2 Importing Datasets & Read all csv files

files available at: https://www.kaggle.com/datasets/ndarshan2797/english-converted-datasets

1. item_categories.csv - item_category_name, item_category_id
2. items.csv - item_name, item_id, category_id
3. sales_train.csv - date, date_block_num, shop_id, item_id, item_price, item_cnt_day
4. shops.csv - shop_name, shop_id
5. test.csv - ID, shop_id, item_id

[ ]:
```
#importing data
item_categories = pd.read_csv('./data-set/item_categories.csv')
items = pd.read_csv('./data-set/items.csv')
sales_train = pd.read_csv('./data-set/sales_train.csv')
shops = pd.read_csv('./data-set/shops.csv')
test = pd.read_csv('./data-set/test.csv')
```

[ ]:
```
#checking the shape of the data
print("Shape of item_categories:", item_categories.shape)
print("Shape of items:", items.shape)
print("Shape of sales_train:", sales_train.shape)
print("Shape of shops:", shops.shape)
print("Shape of test:", test.shape)
```

```
Shape of item_categories: (84, 2)
Shape of items: (22170, 3)
Shape of sales_train: (2935849, 6)
Shape of shops: (60, 2)
Shape of test: (214200, 3)
```

[ ]:
```
#checking the columns of the data
print("\n\nColumns of item_categories:\n")
print(item_categories.info())

print("-----------------------------------------------------")

print("\n\nColumns of items:\n")
print(items.info())

print("-----------------------------------------------------")

print("\n\nColumns of sales_train:\n")
print(sales_train.info())

print("-----------------------------------------------------")

print("\n\nColumns of shops:\n")
print(shops.info())

print("-----------------------------------------------------")

print("\n\nColumns of test:\n")
print(test.info())
```

```
Columns of item_categories:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 84 entries, 0 to 83
Data columns (total 2 columns):
 #   Column              Non-Null Count  Dtype 
---  ------              --------------  ----- 
 0   item_category_name  84 non-null     object
 1   item_category_id    84 non-null     int64 
dtypes: int64(1), object(1)
memory usage: 1.4+ KB
None
-----------------------------------------------------


Columns of items:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 22170 entries, 0 to 22169
Data columns (total 3 columns):
 #   Column       Non-Null Count  Dtype 
---  ------       --------------  ----- 
```

```
 0   item_name    22170 non-null  object
 1   item_id      22170 non-null  int64
 2   category_id  22170 non-null  int64
dtypes: int64(2), object(1)
memory usage: 519.7+ KB
None
-------------------------------------------------------


Columns of sales_train:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2935849 entries, 0 to 2935848
Data columns (total 6 columns):
 #   Column          Dtype
---  ------          -----
 0   date            object
 1   date_block_num  int64
 2   shop_id         int64
 3   item_id         int64
 4   item_price      float64
 5   item_cnt_day    float64
dtypes: float64(2), int64(3), object(1)
memory usage: 134.4+ MB
None
-------------------------------------------------------


Columns of shops:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 60 entries, 0 to 59
Data columns (total 2 columns):
 #   Column     Non-Null Count  Dtype
---  ------     --------------  -----
 0   shop_name  60 non-null     object
 1   shop_id    60 non-null     int64
dtypes: int64(1), object(1)
memory usage: 1.1+ KB
None
-------------------------------------------------------


Columns of test:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 214200 entries, 0 to 214199
Data columns (total 3 columns):
```

```
 #   Column   Non-Null Count   Dtype
---  ------   --------------   -----
 0   ID       214200 non-null  int64
 1   shop_id  214200 non-null  int64
 2   item_id  214200 non-null  int64
dtypes: int64(3)
memory usage: 4.9 MB
None
```

[ ]:
```
#checking the head and tail of the data

print("\n\nHead of item_categories:\n")
print(item_categories.head())

print("\n\nTail of item_categories:\n")
print(item_categories.tail())

print("-------------------------------------------------------")

print("\n\nHead of items:\n")
print(items.head())

print("\n\nTail of items:\n")
print(items.tail())

print("-------------------------------------------------------")

print("\n\nHead of sales_train:\n")
print(sales_train.head())

print("\n\nTail of sales_train:\n")
print(sales_train.tail())

print("-------------------------------------------------------")

print("\n\nHead of shops:\n")
print(shops.head())

print("\n\nTail of shops:\n")
print(shops.tail())

print("-------------------------------------------------------")

print("\n\nHead of test:\n")
print(test.head())

print("\n\nTail of test:\n")
```

```
print(test.tail())
```

```
Head of item_categories:

           item_category_name  item_category_id
0  PC - Headsets / Headphones                 0
1           Accessories - PS2                 1
2           Accessories - PS3                 2
3           Accessories - PS4                 3
4           Accessories - PSP                 4


Tail of item_categories:

       item_category_name  item_category_id
79                Service                79
80      Service - Tickets                80
81    Blank media (spire)                81
82   Blank media (piece)                 82
83              Batteries                83
--------------------------------------------------


Head of items:

                                          item_name  item_id  category_id
0             !! IN THE POWER OF HAPPINESS (PLAST) D        0           40
1  ! ABBYY FineReader 12 Professional Edition Ful…        1           76
2              *** IN THE GLORY OF THE GLORY (UNV) D        2           40
3                             *** BLUE WAVE (Univ) D        3           40
4                                  *** BOX (GLASS) D        4           40


Tail of items:

                                             item_name  item_id  category_id
22165            Nuclear Titbit 2 [PC, Digital Version]    22165           31
22166    Query language 1C: Enterprise [Digital version]    22166           54
22167  The query language is 1C: Enterprise 8 (+ CD)…    22167           49
22168                                Egg for Little Inu    22168           62
22169               Egg of the Dragon (Game of Thrones)    22169           69
--------------------------------------------------


Head of sales_train:
```

```
         date  date_block_num  shop_id  item_id  item_price  item_cnt_day
0  02.01.2013               0       59    22154      999.00           1.0
1  03.01.2013               0       25     2552      899.00           1.0
2  05.01.2013               0       25     2552      899.00          -1.0
3  06.01.2013               0       25     2554     1709.05           1.0
4  15.01.2013               0       25     2555     1099.00           1.0


Tail of sales_train:

               date  date_block_num  shop_id  item_id  item_price  \
2935844  10.10.2015              33       25     7409       299.0
2935845  09.10.2015              33       25     7460       299.0
2935846  14.10.2015              33       25     7459       349.0
2935847  22.10.2015              33       25     7440       299.0
2935848  03.10.2015              33       25     7460       299.0

         item_cnt_day
2935844           1.0
2935845           1.0
2935846           1.0
2935847           1.0
2935848           1.0
--------------------------------------------------


Head of shops:

                           shop_name  shop_id
0  ! Yakutsk Ordzhonikidze, 56 francs        0
1         ! Yakutsk TC "Central" fran        1
2                     Adygea TC "Mega"        2
3     Balashikha TC "Oktyabr-Kinomir"        3
4               Volga TC "Volga Mall"        4


Tail of shops:

                      shop_name  shop_id
55   Digital warehouse 1C-Online       55
56        Chekhov TC" Karnaval "       56
57     Yakutsk Ordzhonikidze, 56       57
58         Yakutsk TC" Central "       58
59        Yaroslavl TC" Altair "       59
--------------------------------------------------


Head of test:
```

```
   ID  shop_id  item_id
0   0        5     5037
1   1        5     5320
2   2        5     5233
3   3        5     5232
4   4        5     5268
```

```
Tail of test:
```

```
            ID  shop_id  item_id
214195  214195       45    18454
214196  214196       45    16188
214197  214197       45    15757
214198  214198       45    19648
214199  214199       45      969
```

1.3 Data Preprocessing & Feature Engineering

[ ]:
```
#merging the data for better understand the data
```

[ ]:
```
#Merge sales_train.csv with items.csv on the "item_id" column
sales_with_items = sales_train.merge(items, on='item_id', how='left')
print("\n\nHead of sales_with_items:\n")
print(sales_with_items.head(20))
print(sales_with_items.shape)
```

```
Head of sales_with_items:
```

```
          date  date_block_num  shop_id  item_id  item_price  item_cnt_day  \
0   02.01.2013               0       59    22154      999.00           1.0
1   03.01.2013               0       25     2552      899.00           1.0
2   05.01.2013               0       25     2552      899.00          -1.0
3   06.01.2013               0       25     2554     1709.05           1.0
4   15.01.2013               0       25     2555     1099.00           1.0
5   10.01.2013               0       25     2564      349.00           1.0
6   02.01.2013               0       25     2565      549.00           1.0
7   04.01.2013               0       25     2572      239.00           1.0
8   11.01.2013               0       25     2572      299.00           1.0
9   03.01.2013               0       25     2573      299.00           3.0
10  03.01.2013               0       25     2574      399.00           2.0
11  05.01.2013               0       25     2574      399.00           1.0
12  07.01.2013               0       25     2574      399.00           1.0
13  08.01.2013               0       25     2574      399.00           2.0
14  10.01.2013               0       25     2574      399.00           1.0
```

```
15  11.01.2013              0       25     2574      399.00           2.0
16  13.01.2013              0       25     2574      399.00           1.0
17  16.01.2013              0       25     2574      399.00           1.0
18  26.01.2013              0       25     2574      399.00           1.0
19  27.01.2013              0       25     2574      399.00           1.0

                                                 item_name  category_id
0                                        SCENE 2012 (BD)           37
1           DEEP PURPLE  The House Of Blue Light  LP           58
2           DEEP PURPLE  The House Of Blue Light  LP           58
3           DEEP PURPLE  Who Do You Think We Are  LP           58
4       DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                   DEEP PURPLE Stormbringer (firms).           56
7                              DEFTONES Koi No Yokan           55
8                              DEFTONES Koi No Yokan           55
9                           DEL REY LANA  Born To Die           55
10  DEL REY LANA  Born To Die  The Paradise Editio…           55
11  DEL REY LANA  Born To Die  The Paradise Editio…           55
12  DEL REY LANA  Born To Die  The Paradise Editio…           55
13  DEL REY LANA  Born To Die  The Paradise Editio…           55
14  DEL REY LANA  Born To Die  The Paradise Editio…           55
15  DEL REY LANA  Born To Die  The Paradise Editio…           55
16  DEL REY LANA  Born To Die  The Paradise Editio…           55
17  DEL REY LANA  Born To Die  The Paradise Editio…           55
18  DEL REY LANA  Born To Die  The Paradise Editio…           55
19  DEL REY LANA  Born To Die  The Paradise Editio…           55
(2935849, 8)
```

[ ]:
```
#Merge the result with item_categories.csv on the "category_id"
sales_with_items_and_categories = sales_with_items.merge(item_categories,␣
 ↪right_on='item_category_id', left_on='category_id', how='left')
print("\n\nHead of sales_with_items_and_categories:\n")
print(sales_with_items_and_categories.head(20))
print(sales_with_items_and_categories.shape)
```

```
Head of sales_with_items_and_categories:

         date  date_block_num  shop_id  item_id  item_price  item_cnt_day  \
0  02.01.2013              0       59    22154      999.00           1.0
1  03.01.2013              0       25     2552      899.00           1.0
2  05.01.2013              0       25     2552      899.00          -1.0
3  06.01.2013              0       25     2554     1709.05           1.0
4  15.01.2013              0       25     2555     1099.00           1.0
5  10.01.2013              0       25     2564      349.00           1.0
6  02.01.2013              0       25     2565      549.00           1.0
```

7	04.01.2013	0	25	2572	239.00	1.0
8	11.01.2013	0	25	2572	299.00	1.0
9	03.01.2013	0	25	2573	299.00	3.0
10	03.01.2013	0	25	2574	399.00	2.0
11	05.01.2013	0	25	2574	399.00	1.0
12	07.01.2013	0	25	2574	399.00	1.0
13	08.01.2013	0	25	2574	399.00	2.0
14	10.01.2013	0	25	2574	399.00	1.0
15	11.01.2013	0	25	2574	399.00	2.0
16	13.01.2013	0	25	2574	399.00	1.0
17	16.01.2013	0	25	2574	399.00	1.0
18	26.01.2013	0	25	2574	399.00	1.0
19	27.01.2013	0	25	2574	399.00	1.0

	item_name	category_id	\
0	SCENE 2012 (BD)	37	
1	DEEP PURPLE The House Of Blue Light LP	58	
2	DEEP PURPLE The House Of Blue Light LP	58	
3	DEEP PURPLE Who Do You Think We Are LP	58	
4	DEEP PURPLE 30 Very Best Of 2CD (Businesses).	56	
5	DEEP PURPLE Perihelion: Live In Concert DVD (C…	59	
6	DEEP PURPLE Stormbringer (firms).	56	
7	DEFTONES Koi No Yokan	55	
8	DEFTONES Koi No Yokan	55	
9	DEL REY LANA Born To Die	55	
10	DEL REY LANA Born To Die The Paradise Editio…	55	
11	DEL REY LANA Born To Die The Paradise Editio…	55	
12	DEL REY LANA Born To Die The Paradise Editio…	55	
13	DEL REY LANA Born To Die The Paradise Editio…	55	
14	DEL REY LANA Born To Die The Paradise Editio…	55	
15	DEL REY LANA Born To Die The Paradise Editio…	55	
16	DEL REY LANA Born To Die The Paradise Editio…	55	
17	DEL REY LANA Born To Die The Paradise Editio…	55	
18	DEL REY LANA Born To Die The Paradise Editio…	55	
19	DEL REY LANA Born To Die The Paradise Editio…	55	

	item_category_name	item_category_id
0	Cinema - Blu-Ray	37
1	Music - Vinyl	58
2	Music - Vinyl	58
3	Music - Vinyl	58
4	Music - CD of corporate production	56
5	Music - Music video	59
6	Music - CD of corporate production	56
7	Music - CD of local production	55
8	Music - CD of local production	55
9	Music - CD of local production	55
10	Music - CD of local production	55

```
11       Music - CD of local production                55
12       Music - CD of local production                55
13       Music - CD of local production                55
14       Music - CD of local production                55
15       Music - CD of local production                55
16       Music - CD of local production                55
17       Music - CD of local production                55
18       Music - CD of local production                55
19       Music - CD of local production                55
(2935849, 10)
```

[ ]:
```
# Check if the two columns are the same
if sales_with_items_and_categories['item_category_id'].
 ↪equals(sales_with_items_and_categories['category_id']):
    # If they are the same, drop one of the columns
    sales_with_items_and_categories.drop(columns=['item_category_id'],␣
 ↪inplace=True)
```

[ ]:
```
print("\n\nHead of sales_with_items_and_categories:\n")
print(sales_with_items_and_categories.head(20))
print(sales_with_items_and_categories.shape)
```

```
Head of sales_with_items_and_categories:

          date  date_block_num  shop_id  item_id  item_price  item_cnt_day  \
0   02.01.2013               0       59    22154      999.00           1.0
1   03.01.2013               0       25     2552      899.00           1.0
2   05.01.2013               0       25     2552      899.00          -1.0
3   06.01.2013               0       25     2554     1709.05           1.0
4   15.01.2013               0       25     2555     1099.00           1.0
5   10.01.2013               0       25     2564      349.00           1.0
6   02.01.2013               0       25     2565      549.00           1.0
7   04.01.2013               0       25     2572      239.00           1.0
8   11.01.2013               0       25     2572      299.00           1.0
9   03.01.2013               0       25     2573      299.00           3.0
10  03.01.2013               0       25     2574      399.00           2.0
11  05.01.2013               0       25     2574      399.00           1.0
12  07.01.2013               0       25     2574      399.00           1.0
13  08.01.2013               0       25     2574      399.00           2.0
14  10.01.2013               0       25     2574      399.00           1.0
15  11.01.2013               0       25     2574      399.00           2.0
16  13.01.2013               0       25     2574      399.00           1.0
17  16.01.2013               0       25     2574      399.00           1.0
18  26.01.2013               0       25     2574      399.00           1.0
19  27.01.2013               0       25     2574      399.00           1.0
```

```
                                          item_name  category_id  \
0                                  SCENE 2012 (BD)           37
1           DEEP PURPLE  The House Of Blue Light  LP           58
2           DEEP PURPLE  The House Of Blue Light  LP           58
3           DEEP PURPLE  Who Do You Think We Are  LP           58
4      DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                  DEEP PURPLE Stormbringer (firms).           56
7                            DEFTONES Koi No Yokan           55
8                            DEFTONES Koi No Yokan           55
9                        DEL REY LANA  Born To Die           55
10  DEL REY LANA  Born To Die  The Paradise Editio…           55
11  DEL REY LANA  Born To Die  The Paradise Editio…           55
12  DEL REY LANA  Born To Die  The Paradise Editio…           55
13  DEL REY LANA  Born To Die  The Paradise Editio…           55
14  DEL REY LANA  Born To Die  The Paradise Editio…           55
15  DEL REY LANA  Born To Die  The Paradise Editio…           55
16  DEL REY LANA  Born To Die  The Paradise Editio…           55
17  DEL REY LANA  Born To Die  The Paradise Editio…           55
18  DEL REY LANA  Born To Die  The Paradise Editio…           55
19  DEL REY LANA  Born To Die  The Paradise Editio…           55

                     item_category_name
0                      Cinema - Blu-Ray
1                         Music - Vinyl
2                         Music - Vinyl
3                         Music - Vinyl
4    Music - CD of corporate production
5                   Music - Music video
6    Music - CD of corporate production
7         Music - CD of local production
8         Music - CD of local production
9         Music - CD of local production
10        Music - CD of local production
11        Music - CD of local production
12        Music - CD of local production
13        Music - CD of local production
14        Music - CD of local production
15        Music - CD of local production
16        Music - CD of local production
17        Music - CD of local production
18        Music - CD of local production
19        Music - CD of local production
(2935849, 9)
```

[ ]:
```
#Merge the result with shops.csv on the "shop_id"
```

```
final_dataset = sales_with_items_and_categories.merge(shops, on='shop_id',␣
 ↪how='left')
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

         date  date_block_num  shop_id  item_id  item_price  item_cnt_day  \
0  02.01.2013               0       59    22154      999.00           1.0
1  03.01.2013               0       25     2552      899.00           1.0
2  05.01.2013               0       25     2552      899.00          -1.0
3  06.01.2013               0       25     2554     1709.05           1.0
4  15.01.2013               0       25     2555     1099.00           1.0
5  10.01.2013               0       25     2564      349.00           1.0
6  02.01.2013               0       25     2565      549.00           1.0
7  04.01.2013               0       25     2572      239.00           1.0
8  11.01.2013               0       25     2572      299.00           1.0
9  03.01.2013               0       25     2573      299.00           3.0
10 03.01.2013               0       25     2574      399.00           2.0
11 05.01.2013               0       25     2574      399.00           1.0
12 07.01.2013               0       25     2574      399.00           1.0
13 08.01.2013               0       25     2574      399.00           2.0
14 10.01.2013               0       25     2574      399.00           1.0
15 11.01.2013               0       25     2574      399.00           2.0
16 13.01.2013               0       25     2574      399.00           1.0
17 16.01.2013               0       25     2574      399.00           1.0
18 26.01.2013               0       25     2574      399.00           1.0
19 27.01.2013               0       25     2574      399.00           1.0

                                                item_name  category_id  \
0                                          SCENE 2012 (BD)           37
1              DEEP PURPLE  The House Of Blue Light  LP           58
2              DEEP PURPLE  The House Of Blue Light  LP           58
3              DEEP PURPLE  Who Do You Think We Are  LP           58
4         DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                    DEEP PURPLE Stormbringer (firms).           56
7                               DEFTONES Koi No Yokan           55
8                               DEFTONES Koi No Yokan           55
9                            DEL REY LANA  Born To Die           55
10 DEL REY LANA  Born To Die  The Paradise Editio…           55
11 DEL REY LANA  Born To Die  The Paradise Editio…           55
12 DEL REY LANA  Born To Die  The Paradise Editio…           55
13 DEL REY LANA  Born To Die  The Paradise Editio…           55
14 DEL REY LANA  Born To Die  The Paradise Editio…           55
```

```
15  DEL REY LANA  Born To Die  The Paradise Editio…          55
16  DEL REY LANA  Born To Die  The Paradise Editio…          55
17  DEL REY LANA  Born To Die  The Paradise Editio…          55
18  DEL REY LANA  Born To Die  The Paradise Editio…          55
19  DEL REY LANA  Born To Die  The Paradise Editio…          55

                    item_category_name               shop_name
0                     Cinema - Blu-Ray   Yaroslavl TC" Altair "
1                        Music - Vinyl     Moscow TEC" Atrium "
2                        Music - Vinyl     Moscow TEC" Atrium "
3                        Music - Vinyl     Moscow TEC" Atrium "
4    Music - CD of corporate production     Moscow TEC" Atrium "
5                   Music - Music video     Moscow TEC" Atrium "
6    Music - CD of corporate production     Moscow TEC" Atrium "
7        Music - CD of local production     Moscow TEC" Atrium "
8        Music - CD of local production     Moscow TEC" Atrium "
9        Music - CD of local production     Moscow TEC" Atrium "
10       Music - CD of local production     Moscow TEC" Atrium "
11       Music - CD of local production     Moscow TEC" Atrium "
12       Music - CD of local production     Moscow TEC" Atrium "
13       Music - CD of local production     Moscow TEC" Atrium "
14       Music - CD of local production     Moscow TEC" Atrium "
15       Music - CD of local production     Moscow TEC" Atrium "
16       Music - CD of local production     Moscow TEC" Atrium "
17       Music - CD of local production     Moscow TEC" Atrium "
18       Music - CD of local production     Moscow TEC" Atrium "
19       Music - CD of local production     Moscow TEC" Atrium "
(2935849, 10)
```

[ ]:
```
#checks the columns of the final dataset
print("\n\nColumns of final_dataset:\n")
print(final_dataset.info())
```

```
Columns of final_dataset:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2935849 entries, 0 to 2935848
Data columns (total 10 columns):
 #   Column              Dtype
---  ------              -----
 0   date                object
 1   date_block_num      int64
 2   shop_id             int64
 3   item_id             int64
 4   item_price          float64
 5   item_cnt_day        float64
```

```
 6   item_name           object
 7   category_id         int64
 8   item_category_name  object
 9   shop_name           object
dtypes: float64(2), int64(4), object(4)
memory usage: 224.0+ MB
None
```

[ ]:
```
#prints the date and date_block_num column to check whether they are related
columns_to_print = ['date', 'date_block_num']
print(final_dataset[columns_to_print])
```

```
               date  date_block_num
0        02.01.2013               0
1        03.01.2013               0
2        05.01.2013               0
3        06.01.2013               0
4        15.01.2013               0
…               …               …
2935844  10.10.2015              33
2935845  09.10.2015              33
2935846  14.10.2015              33
2935847  22.10.2015              33
2935848  03.10.2015              33

[2935849 rows x 2 columns]
```

[ ]:
```
# Rename the column
final_dataset.rename(columns={'date_block_num': 'month_num'}, inplace=True)
```

[ ]:
```
#Rename the column
final_dataset.rename(columns={'item_cnt_day': 'item_cnt_month'}, inplace=True)
```

[ ]:
```
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```


Head of final_dataset:

         date  month_num  shop_id  item_id  item_price  item_cnt_month  \
0  02.01.2013          0       59    22154      999.00             1.0
1  03.01.2013          0       25     2552      899.00             1.0
2  05.01.2013          0       25     2552      899.00            -1.0
3  06.01.2013          0       25     2554     1709.05             1.0
4  15.01.2013          0       25     2555     1099.00             1.0
5  10.01.2013          0       25     2564      349.00             1.0
6  02.01.2013          0       25     2565      549.00             1.0
```

```
7   04.01.2013          0       25     2572      239.00            1.0
8   11.01.2013          0       25     2572      299.00            1.0
9   03.01.2013          0       25     2573      299.00            3.0
10  03.01.2013          0       25     2574      399.00            2.0
11  05.01.2013          0       25     2574      399.00            1.0
12  07.01.2013          0       25     2574      399.00            1.0
13  08.01.2013          0       25     2574      399.00            2.0
14  10.01.2013          0       25     2574      399.00            1.0
15  11.01.2013          0       25     2574      399.00            2.0
16  13.01.2013          0       25     2574      399.00            1.0
17  16.01.2013          0       25     2574      399.00            1.0
18  26.01.2013          0       25     2574      399.00            1.0
19  27.01.2013          0       25     2574      399.00            1.0

                                          item_name  category_id  \
0                                    SCENE 2012 (BD)           37
1           DEEP PURPLE  The House Of Blue Light  LP           58
2           DEEP PURPLE  The House Of Blue Light  LP           58
3           DEEP PURPLE  Who Do You Think We Are  LP           58
4      DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                  DEEP PURPLE Stormbringer (firms).           56
7                            DEFTONES Koi No Yokan           55
8                            DEFTONES Koi No Yokan           55
9                        DEL REY LANA  Born To Die           55
10  DEL REY LANA  Born To Die  The Paradise Editio…           55
11  DEL REY LANA  Born To Die  The Paradise Editio…           55
12  DEL REY LANA  Born To Die  The Paradise Editio…           55
13  DEL REY LANA  Born To Die  The Paradise Editio…           55
14  DEL REY LANA  Born To Die  The Paradise Editio…           55
15  DEL REY LANA  Born To Die  The Paradise Editio…           55
16  DEL REY LANA  Born To Die  The Paradise Editio…           55
17  DEL REY LANA  Born To Die  The Paradise Editio…           55
18  DEL REY LANA  Born To Die  The Paradise Editio…           55
19  DEL REY LANA  Born To Die  The Paradise Editio…           55

                    item_category_name                shop_name
0                     Cinema - Blu-Ray   Yaroslavl TC" Altair "
1                        Music - Vinyl     Moscow TEC" Atrium "
2                        Music - Vinyl     Moscow TEC" Atrium "
3                        Music - Vinyl     Moscow TEC" Atrium "
4    Music - CD of corporate production     Moscow TEC" Atrium "
5                   Music - Music video     Moscow TEC" Atrium "
6    Music - CD of corporate production     Moscow TEC" Atrium "
7        Music - CD of local production     Moscow TEC" Atrium "
8        Music - CD of local production     Moscow TEC" Atrium "
9        Music - CD of local production     Moscow TEC" Atrium "
10       Music - CD of local production     Moscow TEC" Atrium "
```

```
11       Music - CD of local production     Moscow TEC" Atrium "
12       Music - CD of local production     Moscow TEC" Atrium "
13       Music - CD of local production     Moscow TEC" Atrium "
14       Music - CD of local production     Moscow TEC" Atrium "
15       Music - CD of local production     Moscow TEC" Atrium "
16       Music - CD of local production     Moscow TEC" Atrium "
17       Music - CD of local production     Moscow TEC" Atrium "
18       Music - CD of local production     Moscow TEC" Atrium "
19       Music - CD of local production     Moscow TEC" Atrium "
(2935849, 10)
```

[ ]:
```
#checks the columns of the final dataset
print("\n\nColumns of final_dataset:\n")
print(final_dataset.info())
```

```
Columns of final_dataset:

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 2935849 entries, 0 to 2935848
Data columns (total 10 columns):
 #   Column              Dtype
---  ------              -----
 0   date                object
 1   month_num           int64
 2   shop_id             int64
 3   item_id             int64
 4   item_price          float64
 5   item_cnt_month      float64
 6   item_name           object
 7   category_id         int64
 8   item_category_name  object
 9   shop_name           object
dtypes: float64(2), int64(4), object(4)
memory usage: 224.0+ MB
None
```

[ ]:
```
#export the final dataset to csv file
final_dataset.to_csv('./data-set/output/final_dataset_without_cleaning.csv',␣
 ↪index=False)
```

[ ]:
```
#Data Cleaning

#checking for missing values
print("\n\nMissing values in final_dataset:\n")
print(final_dataset.isnull().sum())
```

```
Missing values in final_dataset:

date                 0
month_num            0
shop_id              0
item_id              0
item_price           0
item_cnt_month       0
item_name            0
category_id          0
item_category_name   0
shop_name            0
dtype: int64
```

[ ]:
```
#checking for null values
print("\n\nNull values in final_dataset:\n")
print(final_dataset.isnull().sum())
```

```
Null values in final_dataset:

date                 0
month_num            0
shop_id              0
item_id              0
item_price           0
item_cnt_month       0
item_name            0
category_id          0
item_category_name   0
shop_name            0
dtype: int64
```

[ ]:
```
print(final_dataset.shape)
```

```
(2935849, 10)
```

[ ]:
```
#handles the missing values in final_dataset
final_dataset['item_name'].fillna('Unknown', inplace=True)
final_dataset['item_category_name'].fillna('Unknown', inplace=True)
```

[ ]:
```
print(final_dataset.shape)
```

```
(2935849, 10)
```

[ ]:
```
#removes duplicates rows in final_dataset
final_dataset.drop_duplicates(inplace=True)
```

[ ]:
```
print(final_dataset.shape)
```

```
(2935843, 10)
```

[ ]:
```
#checks and solves the data type of the columns
print("\n\nData types of final_dataset:\n")
print(final_dataset.dtypes)
```

```
Data types of final_dataset:

date                  object
month_num              int64
shop_id                int64
item_id                int64
item_price           float64
item_cnt_month       float64
item_name             object
category_id            int64
item_category_name    object
shop_name             object
dtype: object
```

[ ]:
```
# #seems like item_cnt_month should be int64
final_dataset['item_cnt_month'] = final_dataset['item_cnt_month'].
 ↪astype('int64')
```

[ ]:
```
print(final_dataset.dtypes)
```

```
date                  object
month_num              int64
shop_id                int64
item_id                int64
item_price           float64
item_cnt_month         int64
item_name             object
category_id            int64
item_category_name    object
shop_name             object
dtype: object
```

[ ]:
```
#prints item_cnt_month column to check whether it is int64
print(final_dataset['item_cnt_month'].head(30))
```

```
0     1
1     1
2    -1
3     1
```

```
4     1
5     1
6     1
7     1
8     1
9     3
10    2
11    1
12    1
13    2
14    1
15    2
16    1
17    1
18    1
19    1
20    1
21    1
22    1
23    1
24    1
25    1
26    1
27    1
28    1
29    1
Name: item_cnt_month, dtype: int64
```

[ ]:
```
print(final_dataset.shape)
```

```
(2935843, 10)
```

[ ]:
```
#removes -1 and 307980 from item_cnt_month column because it is an outlier
#it is not possible to sell -1 and 307980 items in a day because 307980 is the␣
 ↪total number of items sold in a day
#which means that the data is incorrect
#and -1 is not possible

final_dataset = final_dataset[(final_dataset['item_cnt_month'] > 0) &␣
 ↪(final_dataset['item_cnt_month'] < 307980)]

print(final_dataset.shape)
```

```
(2928487, 10)
```

[ ]:
```
#outlier treatment

#checks for outliers in the item_cnt_month column
```

```
print("\n\nOutliers in item_cnt_month column:\n")
print(final_dataset[final_dataset['item_cnt_month'] > 1000])

#removes the outliers in the item_cnt_month column
final_dataset = final_dataset[final_dataset['item_cnt_month'] < 1000]

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Outliers in item_cnt_month column:

               date  month_num  shop_id  item_id  item_price  item_cnt_month  \
2909818  28.10.2015         33       12    11373    0.908714            2169

                                      item_name  category_id  \
2909818  Delivery to the point of issue (Boxberry)            9

         item_category_name                                shop_name
2909818   Delivery of goods   Internet-shop of emergency situations


Head of final_dataset:

          date  month_num  shop_id  item_id  item_price  item_cnt_month  \
0   02.01.2013          0       59    22154      999.00               1
1   03.01.2013          0       25     2552      899.00               1
3   06.01.2013          0       25     2554     1709.05               1
4   15.01.2013          0       25     2555     1099.00               1
5   10.01.2013          0       25     2564      349.00               1
6   02.01.2013          0       25     2565      549.00               1
7   04.01.2013          0       25     2572      239.00               1
8   11.01.2013          0       25     2572      299.00               1
9   03.01.2013          0       25     2573      299.00               3
10  03.01.2013          0       25     2574      399.00               2
11  05.01.2013          0       25     2574      399.00               1
12  07.01.2013          0       25     2574      399.00               1
13  08.01.2013          0       25     2574      399.00               2
14  10.01.2013          0       25     2574      399.00               1
15  11.01.2013          0       25     2574      399.00               2
16  13.01.2013          0       25     2574      399.00               1
17  16.01.2013          0       25     2574      399.00               1
18  26.01.2013          0       25     2574      399.00               1
19  27.01.2013          0       25     2574      399.00               1
20  09.01.2013          0       25     2593      279.00               1
```

```
                                        item_name  category_id  \
0                                  SCENE 2012 (BD)           37
1          DEEP PURPLE  The House Of Blue Light  LP           58
3          DEEP PURPLE  Who Do You Think We Are  LP           58
4     DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5  DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                DEEP PURPLE Stormbringer (firms).           56
7                           DEFTONES Koi No Yokan            55
8                           DEFTONES Koi No Yokan            55
9                        DEL REY LANA  Born To Die           55
10 DEL REY LANA  Born To Die  The Paradise Editio…           55
11 DEL REY LANA  Born To Die  The Paradise Editio…           55
12 DEL REY LANA  Born To Die  The Paradise Editio…           55
13 DEL REY LANA  Born To Die  The Paradise Editio…           55
14 DEL REY LANA  Born To Die  The Paradise Editio…           55
15 DEL REY LANA  Born To Die  The Paradise Editio…           55
16 DEL REY LANA  Born To Die  The Paradise Editio…           55
17 DEL REY LANA  Born To Die  The Paradise Editio…           55
18 DEL REY LANA  Born To Die  The Paradise Editio…           55
19 DEL REY LANA  Born To Die  The Paradise Editio…           55
20               DEPECHE MODE  Music For The Masses           55

                    item_category_name                shop_name
0                     Cinema - Blu-Ray   Yaroslavl TC" Altair "
1                        Music - Vinyl     Moscow TEC" Atrium "
3                        Music - Vinyl     Moscow TEC" Atrium "
4    Music - CD of corporate production     Moscow TEC" Atrium "
5                   Music - Music video     Moscow TEC" Atrium "
6    Music - CD of corporate production     Moscow TEC" Atrium "
7        Music - CD of local production     Moscow TEC" Atrium "
8        Music - CD of local production     Moscow TEC" Atrium "
9        Music - CD of local production     Moscow TEC" Atrium "
10       Music - CD of local production     Moscow TEC" Atrium "
11       Music - CD of local production     Moscow TEC" Atrium "
12       Music - CD of local production     Moscow TEC" Atrium "
13       Music - CD of local production     Moscow TEC" Atrium "
14       Music - CD of local production     Moscow TEC" Atrium "
15       Music - CD of local production     Moscow TEC" Atrium "
16       Music - CD of local production     Moscow TEC" Atrium "
17       Music - CD of local production     Moscow TEC" Atrium "
18       Music - CD of local production     Moscow TEC" Atrium "
19       Music - CD of local production     Moscow TEC" Atrium "
20       Music - CD of local production     Moscow TEC" Atrium "
(2928485, 10)
```

[ ]:
```
#deal with the incorrect data in the item_price column
#the item_price should not be negative
```

```
#the item_price should not be zero
#the item_price should not be greater than 100000

final_dataset = final_dataset[(final_dataset['item_price'] > 0) &␣
 ↪(final_dataset['item_price'] < 100000)]
```

[ ]:
```
print(final_dataset.shape)
```

```
(2928483, 10)
```

[ ]:
```
#handles special characters and formatting in the data set
final_dataset['item_name'] = final_dataset['item_name'].str.
 ↪replace('[^A-Za-z0-9 - -]+', ' ')
```

[ ]:
```
print(final_dataset.shape)
```

```
(2928483, 10)
```

[ ]:
```
#removes the noise in the item_name column
final_dataset['item_name'] = final_dataset['item_name'].str.replace('  ', ' ')
```

[ ]:
```
print(final_dataset.head())
```

```
         date  month_num  shop_id  item_id  item_price  item_cnt_month  \
0  02.01.2013          0       59    22154      999.00               1
1  03.01.2013          0       25     2552      899.00               1
3  06.01.2013          0       25     2554     1709.05               1
4  15.01.2013          0       25     2555     1099.00               1
5  10.01.2013          0       25     2564      349.00               1

                                        item_name  category_id  \
0                                SCENE 2012 (BD)           37
1            DEEP PURPLE The House Of Blue Light LP           58
3            DEEP PURPLE Who Do You Think We Are LP           58
4     DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5  DEEP PURPLE Perihelion: Live In Concert DVD (C…           59

                  item_category_name                shop_name
0                    Cinema - Blu-Ray   Yaroslavl TC" Altair "
1                       Music - Vinyl     Moscow TEC" Atrium "
3                       Music - Vinyl     Moscow TEC" Atrium "
4   Music - CD of corporate production     Moscow TEC" Atrium "
5                  Music - Music video     Moscow TEC" Atrium "
```

[ ]:
```
#creates a new column called revenue
final_dataset['revenue'] = final_dataset['item_cnt_month'] *␣
 ↪final_dataset['item_price']
```

```
[ ]: print("\n\nHead of final_dataset:\n")
     print(final_dataset.head(20))
     print(final_dataset.shape)
```

```
Head of final_dataset:

          date  month_num  shop_id  item_id  item_price  item_cnt_month  \
0   02.01.2013          0       59    22154      999.00               1
1   03.01.2013          0       25     2552      899.00               1
3   06.01.2013          0       25     2554     1709.05               1
4   15.01.2013          0       25     2555     1099.00               1
5   10.01.2013          0       25     2564      349.00               1
6   02.01.2013          0       25     2565      549.00               1
7   04.01.2013          0       25     2572      239.00               1
8   11.01.2013          0       25     2572      299.00               1
9   03.01.2013          0       25     2573      299.00               3
10  03.01.2013          0       25     2574      399.00               2
11  05.01.2013          0       25     2574      399.00               1
12  07.01.2013          0       25     2574      399.00               1
13  08.01.2013          0       25     2574      399.00               2
14  10.01.2013          0       25     2574      399.00               1
15  11.01.2013          0       25     2574      399.00               2
16  13.01.2013          0       25     2574      399.00               1
17  16.01.2013          0       25     2574      399.00               1
18  26.01.2013          0       25     2574      399.00               1
19  27.01.2013          0       25     2574      399.00               1
20  09.01.2013          0       25     2593      279.00               1

                                                item_name  category_id  \
0                                        SCENE 2012 (BD)           37
1                    DEEP PURPLE The House Of Blue Light LP           58
3                    DEEP PURPLE Who Do You Think We Are LP           58
4               DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6                           DEEP PURPLE Stormbringer (firms).           56
7                                    DEFTONES Koi No Yokan           55
8                                    DEFTONES Koi No Yokan           55
9                                 DEL REY LANA Born To Die           55
10  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17  DEL REY LANA Born To Die The Paradise Edition 2CD           55
```

```
18  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20                  DEPECHE MODE Music For The Masses           55

                    item_category_name                shop_name  revenue
0                     Cinema - Blu-Ray   Yaroslavl TC" Altair "   999.00
1                        Music - Vinyl     Moscow TEC" Atrium "   899.00
3                        Music - Vinyl     Moscow TEC" Atrium "  1709.05
4    Music - CD of corporate production     Moscow TEC" Atrium "  1099.00
5                   Music - Music video     Moscow TEC" Atrium "   349.00
6    Music - CD of corporate production     Moscow TEC" Atrium "   549.00
7        Music - CD of local production     Moscow TEC" Atrium "   239.00
8        Music - CD of local production     Moscow TEC" Atrium "   299.00
9        Music - CD of local production     Moscow TEC" Atrium "   897.00
10       Music - CD of local production     Moscow TEC" Atrium "   798.00
11       Music - CD of local production     Moscow TEC" Atrium "   399.00
12       Music - CD of local production     Moscow TEC" Atrium "   399.00
13       Music - CD of local production     Moscow TEC" Atrium "   798.00
14       Music - CD of local production     Moscow TEC" Atrium "   399.00
15       Music - CD of local production     Moscow TEC" Atrium "   798.00
16       Music - CD of local production     Moscow TEC" Atrium "   399.00
17       Music - CD of local production     Moscow TEC" Atrium "   399.00
18       Music - CD of local production     Moscow TEC" Atrium "   399.00
19       Music - CD of local production     Moscow TEC" Atrium "   399.00
20       Music - CD of local production     Moscow TEC" Atrium "   279.00
(2928483, 11)
```

[ ]:
```
#creates a new column called revenue_per_item
final_dataset['revenue_per_item'] = final_dataset['revenue'] /␣
 ↪final_dataset['item_cnt_month']


print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

         date  month_num  shop_id  item_id  item_price  item_cnt_month  \
0  02.01.2013          0       59    22154      999.00               1
1  03.01.2013          0       25     2552      899.00               1
3  06.01.2013          0       25     2554     1709.05               1
4  15.01.2013          0       25     2555     1099.00               1
5  10.01.2013          0       25     2564      349.00               1
6  02.01.2013          0       25     2565      549.00               1
7  04.01.2013          0       25     2572      239.00               1
```

8	11.01.2013	0	25	2572	299.00	1
9	03.01.2013	0	25	2573	299.00	3
10	03.01.2013	0	25	2574	399.00	2
11	05.01.2013	0	25	2574	399.00	1
12	07.01.2013	0	25	2574	399.00	1
13	08.01.2013	0	25	2574	399.00	2
14	10.01.2013	0	25	2574	399.00	1
15	11.01.2013	0	25	2574	399.00	2
16	13.01.2013	0	25	2574	399.00	1
17	16.01.2013	0	25	2574	399.00	1
18	26.01.2013	0	25	2574	399.00	1
19	27.01.2013	0	25	2574	399.00	1
20	09.01.2013	0	25	2593	279.00	1

	item_name	category_id	\
0	SCENE 2012 (BD)	37	
1	DEEP PURPLE The House Of Blue Light LP	58	
3	DEEP PURPLE Who Do You Think We Are LP	58	
4	DEEP PURPLE 30 Very Best Of 2CD (Businesses).	56	
5	DEEP PURPLE Perihelion: Live In Concert DVD (C…	59	
6	DEEP PURPLE Stormbringer (firms).	56	
7	DEFTONES Koi No Yokan	55	
8	DEFTONES Koi No Yokan	55	
9	DEL REY LANA Born To Die	55	
10	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
11	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
12	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
13	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
14	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
15	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
16	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
17	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
18	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
19	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
20	DEPECHE MODE Music For The Masses	55	

	item_category_name	shop_name	revenue	\
0	Cinema - Blu-Ray	Yaroslavl TC" Altair "	999.00	
1	Music - Vinyl	Moscow TEC" Atrium "	899.00	
3	Music - Vinyl	Moscow TEC" Atrium "	1709.05	
4	Music - CD of corporate production	Moscow TEC" Atrium "	1099.00	
5	Music - Music video	Moscow TEC" Atrium "	349.00	
6	Music - CD of corporate production	Moscow TEC" Atrium "	549.00	
7	Music - CD of local production	Moscow TEC" Atrium "	239.00	
8	Music - CD of local production	Moscow TEC" Atrium "	299.00	
9	Music - CD of local production	Moscow TEC" Atrium "	897.00	
10	Music - CD of local production	Moscow TEC" Atrium "	798.00	
11	Music - CD of local production	Moscow TEC" Atrium "	399.00	

```
12       Music - CD of local production     Moscow TEC" Atrium "   399.00
13       Music - CD of local production     Moscow TEC" Atrium "   798.00
14       Music - CD of local production     Moscow TEC" Atrium "   399.00
15       Music - CD of local production     Moscow TEC" Atrium "   798.00
16       Music - CD of local production     Moscow TEC" Atrium "   399.00
17       Music - CD of local production     Moscow TEC" Atrium "   399.00
18       Music - CD of local production     Moscow TEC" Atrium "   399.00
19       Music - CD of local production     Moscow TEC" Atrium "   399.00
20       Music - CD of local production     Moscow TEC" Atrium "   279.00

    revenue_per_item
0             999.00
1             899.00
3            1709.05
4            1099.00
5             349.00
6             549.00
7             239.00
8             299.00
9             299.00
10            399.00
11            399.00
12            399.00
13            399.00
14            399.00
15            399.00
16            399.00
17            399.00
18            399.00
19            399.00
20            279.00
(2928483, 12)
```

[ ]:
```python
#checks whether the revenue_per_item column and revenue column are the same

if final_dataset['revenue_per_item'].equals(final_dataset['revenue']):
    # If they are the same, drop one of the columns
    final_dataset.drop(columns=['revenue_per_item'], inplace=True)

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

         date  month_num  shop_id  item_id  item_price  item_cnt_month  \
```

0	02.01.2013	0	59	22154	999.00	1
1	03.01.2013	0	25	2552	899.00	1
3	06.01.2013	0	25	2554	1709.05	1
4	15.01.2013	0	25	2555	1099.00	1
5	10.01.2013	0	25	2564	349.00	1
6	02.01.2013	0	25	2565	549.00	1
7	04.01.2013	0	25	2572	239.00	1
8	11.01.2013	0	25	2572	299.00	1
9	03.01.2013	0	25	2573	299.00	3
10	03.01.2013	0	25	2574	399.00	2
11	05.01.2013	0	25	2574	399.00	1
12	07.01.2013	0	25	2574	399.00	1
13	08.01.2013	0	25	2574	399.00	2
14	10.01.2013	0	25	2574	399.00	1
15	11.01.2013	0	25	2574	399.00	2
16	13.01.2013	0	25	2574	399.00	1
17	16.01.2013	0	25	2574	399.00	1
18	26.01.2013	0	25	2574	399.00	1
19	27.01.2013	0	25	2574	399.00	1
20	09.01.2013	0	25	2593	279.00	1

	item_name	category_id	\
0	SCENE 2012 (BD)	37	
1	DEEP PURPLE The House Of Blue Light LP	58	
3	DEEP PURPLE Who Do You Think We Are LP	58	
4	DEEP PURPLE 30 Very Best Of 2CD (Businesses).	56	
5	DEEP PURPLE Perihelion: Live In Concert DVD (C…	59	
6	DEEP PURPLE Stormbringer (firms).	56	
7	DEFTONES Koi No Yokan	55	
8	DEFTONES Koi No Yokan	55	
9	DEL REY LANA Born To Die	55	
10	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
11	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
12	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
13	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
14	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
15	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
16	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
17	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
18	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
19	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
20	DEPECHE MODE Music For The Masses	55	

	item_category_name	shop_name	revenue	\
0	Cinema - Blu-Ray	Yaroslavl TC" Altair "	999.00	
1	Music - Vinyl	Moscow TEC" Atrium "	899.00	
3	Music - Vinyl	Moscow TEC" Atrium "	1709.05	
4	Music - CD of corporate production	Moscow TEC" Atrium "	1099.00	

```
5                   Music - Music video     Moscow TEC" Atrium "   349.00
6    Music - CD of corporate production     Moscow TEC" Atrium "   549.00
7        Music - CD of local production     Moscow TEC" Atrium "   239.00
8        Music - CD of local production     Moscow TEC" Atrium "   299.00
9        Music - CD of local production     Moscow TEC" Atrium "   897.00
10       Music - CD of local production     Moscow TEC" Atrium "   798.00
11       Music - CD of local production     Moscow TEC" Atrium "   399.00
12       Music - CD of local production     Moscow TEC" Atrium "   399.00
13       Music - CD of local production     Moscow TEC" Atrium "   798.00
14       Music - CD of local production     Moscow TEC" Atrium "   399.00
15       Music - CD of local production     Moscow TEC" Atrium "   798.00
16       Music - CD of local production     Moscow TEC" Atrium "   399.00
17       Music - CD of local production     Moscow TEC" Atrium "   399.00
18       Music - CD of local production     Moscow TEC" Atrium "   399.00
19       Music - CD of local production     Moscow TEC" Atrium "   399.00
20       Music - CD of local production     Moscow TEC" Atrium "   279.00

    revenue_per_item
0             999.00
1             899.00
3            1709.05
4            1099.00
5             349.00
6             549.00
7             239.00
8             299.00
9             299.00
10            399.00
11            399.00
12            399.00
13            399.00
14            399.00
15            399.00
16            399.00
17            399.00
18            399.00
19            399.00
20            279.00
(2928483, 12)
```

[ ]:
```
#creates a new column called date num
final_dataset['date_num'] = final_dataset['date'].str[:2]
```

[ ]:
```
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

Head of final_dataset:

	date	month_num	shop_id	item_id	item_price	item_cnt_month	\
0	02.01.2013	0	59	22154	999.00	1	
1	03.01.2013	0	25	2552	899.00	1	
3	06.01.2013	0	25	2554	1709.05	1	
4	15.01.2013	0	25	2555	1099.00	1	
5	10.01.2013	0	25	2564	349.00	1	
6	02.01.2013	0	25	2565	549.00	1	
7	04.01.2013	0	25	2572	239.00	1	
8	11.01.2013	0	25	2572	299.00	1	
9	03.01.2013	0	25	2573	299.00	3	
10	03.01.2013	0	25	2574	399.00	2	
11	05.01.2013	0	25	2574	399.00	1	
12	07.01.2013	0	25	2574	399.00	1	
13	08.01.2013	0	25	2574	399.00	2	
14	10.01.2013	0	25	2574	399.00	1	
15	11.01.2013	0	25	2574	399.00	2	
16	13.01.2013	0	25	2574	399.00	1	
17	16.01.2013	0	25	2574	399.00	1	
18	26.01.2013	0	25	2574	399.00	1	
19	27.01.2013	0	25	2574	399.00	1	
20	09.01.2013	0	25	2593	279.00	1	

	item_name	category_id	\
0	SCENE 2012 (BD)	37	
1	DEEP PURPLE The House Of Blue Light LP	58	
3	DEEP PURPLE Who Do You Think We Are LP	58	
4	DEEP PURPLE 30 Very Best Of 2CD (Businesses).	56	
5	DEEP PURPLE Perihelion: Live In Concert DVD (C…	59	
6	DEEP PURPLE Stormbringer (firms).	56	
7	DEFTONES Koi No Yokan	55	
8	DEFTONES Koi No Yokan	55	
9	DEL REY LANA Born To Die	55	
10	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
11	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
12	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
13	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
14	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
15	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
16	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
17	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
18	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
19	DEL REY LANA Born To Die The Paradise Edition 2CD	55	
20	DEPECHE MODE Music For The Masses	55	

	item_category_name	shop_name	revenue	\

```
0                     Cinema - Blu-Ray   Yaroslavl TC" Altair "   999.00
1                        Music - Vinyl     Moscow TEC" Atrium "   899.00
3                        Music - Vinyl     Moscow TEC" Atrium "  1709.05
4    Music - CD of corporate production     Moscow TEC" Atrium "  1099.00
5                    Music - Music video     Moscow TEC" Atrium "   349.00
6    Music - CD of corporate production     Moscow TEC" Atrium "   549.00
7        Music - CD of local production     Moscow TEC" Atrium "   239.00
8        Music - CD of local production     Moscow TEC" Atrium "   299.00
9        Music - CD of local production     Moscow TEC" Atrium "   897.00
10       Music - CD of local production     Moscow TEC" Atrium "   798.00
11       Music - CD of local production     Moscow TEC" Atrium "   399.00
12       Music - CD of local production     Moscow TEC" Atrium "   399.00
13       Music - CD of local production     Moscow TEC" Atrium "   798.00
14       Music - CD of local production     Moscow TEC" Atrium "   399.00
15       Music - CD of local production     Moscow TEC" Atrium "   798.00
16       Music - CD of local production     Moscow TEC" Atrium "   399.00
17       Music - CD of local production     Moscow TEC" Atrium "   399.00
18       Music - CD of local production     Moscow TEC" Atrium "   399.00
19       Music - CD of local production     Moscow TEC" Atrium "   399.00
20       Music - CD of local production     Moscow TEC" Atrium "   279.00

    revenue_per_item date_num
0             999.00       02
1             899.00       03
3            1709.05       06
4            1099.00       15
5             349.00       10
6             549.00       02
7             239.00       04
8             299.00       11
9             299.00       03
10            399.00       03
11            399.00       05
12            399.00       07
13            399.00       08
14            399.00       10
15            399.00       11
16            399.00       13
17            399.00       16
18            399.00       26
19            399.00       27
20            279.00       09
(2928483, 13)
```

[ ]:
```
#creates a new column called year num
final_dataset['year_num'] = final_dataset['date'].str[6:]
```

[ ]:
```
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date  month_num  shop_id  item_id  item_price  item_cnt_month  \
0   02.01.2013          0       59    22154      999.00               1
1   03.01.2013          0       25     2552      899.00               1
3   06.01.2013          0       25     2554     1709.05               1
4   15.01.2013          0       25     2555     1099.00               1
5   10.01.2013          0       25     2564      349.00               1
6   02.01.2013          0       25     2565      549.00               1
7   04.01.2013          0       25     2572      239.00               1
8   11.01.2013          0       25     2572      299.00               1
9   03.01.2013          0       25     2573      299.00               3
10  03.01.2013          0       25     2574      399.00               2
11  05.01.2013          0       25     2574      399.00               1
12  07.01.2013          0       25     2574      399.00               1
13  08.01.2013          0       25     2574      399.00               2
14  10.01.2013          0       25     2574      399.00               1
15  11.01.2013          0       25     2574      399.00               2
16  13.01.2013          0       25     2574      399.00               1
17  16.01.2013          0       25     2574      399.00               1
18  26.01.2013          0       25     2574      399.00               1
19  27.01.2013          0       25     2574      399.00               1
20  09.01.2013          0       25     2593      279.00               1

                                                item_name  category_id  \
0                                        SCENE 2012 (BD)           37
1                    DEEP PURPLE The House Of Blue Light LP           58
3                    DEEP PURPLE Who Do You Think We Are LP           58
4               DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6                           DEEP PURPLE Stormbringer (firms).           56
7                                    DEFTONES Koi No Yokan           55
8                                    DEFTONES Koi No Yokan           55
9                                 DEL REY LANA Born To Die           55
10  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17  DEL REY LANA Born To Die The Paradise Edition 2CD           55
```

```
18  DEL REY LANA Born To Die The Paradise Edition 2CD          55
19  DEL REY LANA Born To Die The Paradise Edition 2CD          55
20                 DEPECHE MODE Music For The Masses          55

                    item_category_name               shop_name  revenue  \
0                     Cinema - Blu-Ray   Yaroslavl TC" Altair "   999.00
1                        Music - Vinyl     Moscow TEC" Atrium "   899.00
3                        Music - Vinyl     Moscow TEC" Atrium "  1709.05
4    Music - CD of corporate production     Moscow TEC" Atrium "  1099.00
5                   Music - Music video     Moscow TEC" Atrium "   349.00
6    Music - CD of corporate production     Moscow TEC" Atrium "   549.00
7        Music - CD of local production     Moscow TEC" Atrium "   239.00
8        Music - CD of local production     Moscow TEC" Atrium "   299.00
9        Music - CD of local production     Moscow TEC" Atrium "   897.00
10       Music - CD of local production     Moscow TEC" Atrium "   798.00
11       Music - CD of local production     Moscow TEC" Atrium "   399.00
12       Music - CD of local production     Moscow TEC" Atrium "   399.00
13       Music - CD of local production     Moscow TEC" Atrium "   798.00
14       Music - CD of local production     Moscow TEC" Atrium "   399.00
15       Music - CD of local production     Moscow TEC" Atrium "   798.00
16       Music - CD of local production     Moscow TEC" Atrium "   399.00
17       Music - CD of local production     Moscow TEC" Atrium "   399.00
18       Music - CD of local production     Moscow TEC" Atrium "   399.00
19       Music - CD of local production     Moscow TEC" Atrium "   399.00
20       Music - CD of local production     Moscow TEC" Atrium "   279.00

    revenue_per_item date_num year_num
0             999.00       02     2013
1             899.00       03     2013
3            1709.05       06     2013
4            1099.00       15     2013
5             349.00       10     2013
6             549.00       02     2013
7             239.00       04     2013
8             299.00       11     2013
9             299.00       03     2013
10            399.00       03     2013
11            399.00       05     2013
12            399.00       07     2013
13            399.00       08     2013
14            399.00       10     2013
15            399.00       11     2013
16            399.00       13     2013
17            399.00       16     2013
18            399.00       26     2013
19            399.00       27     2013
20            279.00       09     2013
(2928483, 14)
```

[ ]:
```
print(final_dataset.shape)
print(final_dataset.info())
```

```
(2928483, 14)
<class 'pandas.core.frame.DataFrame'>
Index: 2928483 entries, 0 to 2935848
Data columns (total 14 columns):
 #   Column              Dtype
---  ------              -----
 0   date                object
 1   month_num           int64
 2   shop_id             int64
 3   item_id             int64
 4   item_price          float64
 5   item_cnt_month      int64
 6   item_name           object
 7   category_id         int64
 8   item_category_name  object
 9   shop_name           object
 10  revenue             float64
 11  revenue_per_item    float64
 12  date_num            object
 13  year_num            object
dtypes: float64(3), int64(5), object(6)
memory usage: 335.1+ MB
None
```

[ ]:
```
# rearrange the columns
final_dataset = final_dataset[['date', 'date_num', 'year_num', 'month_num',␣
 ↪'shop_id', 'shop_name', 'item_id', 'item_name', 'category_id',␣
 ↪'item_category_name', 'item_price', 'item_cnt_month', 'revenue']]

print(final_dataset.shape)
print(final_dataset.info())
```

```
(2928483, 13)
<class 'pandas.core.frame.DataFrame'>
Index: 2928483 entries, 0 to 2935848
Data columns (total 13 columns):
 #   Column              Dtype
---  ------              -----
 0   date                object
 1   date_num            object
 2   year_num            object
 3   month_num           int64
 4   shop_id             int64
 5   shop_name           object
 6   item_id             int64
```

```
 7   item_name           object
 8   category_id         int64
 9   item_category_name  object
 10  item_price          float64
 11  item_cnt_month      int64
 12  revenue             float64
dtypes: float64(2), int64(5), object(6)
memory usage: 312.8+ MB
None
```

[ ]:
```
#data profiling

#descriptive statistics
print("\n\nDescriptive statistics of final_dataset:\n")
print(final_dataset.describe())
```

```
Descriptive statistics of final_dataset:

          month_num       shop_id       item_id   category_id    item_price  \
count  2.928483e+06  2.928483e+06  2.928483e+06  2.928483e+06  2.928483e+06
mean   1.456976e+01  3.300296e+01  1.020028e+04  4.001637e+01  8.893627e+02
std    9.422952e+00  1.622543e+01  6.324391e+03  1.709809e+01  1.718155e+03
min    0.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00  7.000000e-02
25%    7.000000e+00  2.200000e+01  4.477000e+03  2.800000e+01  2.490000e+02
50%    1.400000e+01  3.100000e+01  9.355000e+03  4.000000e+01  3.990000e+02
75%    2.300000e+01  4.700000e+01  1.569100e+04  5.500000e+01  9.990000e+02
max    3.300000e+01  5.900000e+01  2.216900e+04  8.300000e+01  5.920000e+04

       item_cnt_month       revenue
count    2.928483e+06  2.928483e+06
mean     1.247257e+00  1.164267e+03
std      2.217429e+00  5.684853e+03
min      1.000000e+00  7.000000e-02
25%      1.000000e+00  2.490000e+02
50%      1.000000e+00  4.490000e+02
75%      1.000000e+00  1.090000e+03
max      6.690000e+02  1.829990e+06
```

[ ]:
```
#data enrichment

#creates a new column called month name
```

```
final_dataset['month_name'] = final_dataset['month_num'].replace({0: 'January',␣
 ↪1: 'February', 2: 'March', 3: 'April', 4: 'May', 5: 'June', 6: 'July', 7:␣
 ↪'August', 8: 'September', 9: 'October', 10: 'November', 11: 'December', 12:␣
 ↪'January', 13: 'February', 14: 'March', 15: 'April', 16: 'May', 17: 'June',␣
 ↪18: 'July', 19: 'August', 20: 'September', 21: 'October', 22: 'November', 23:
 ↪ 'December', 24: 'January', 25: 'February', 26: 'March', 27: 'April', 28:␣
 ↪'May', 29: 'June', 30: 'July', 31: 'August', 32: 'September', 33: 'October'})

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num year_num  month_num  shop_id                shop_name  \
0   02.01.2013       02     2013          0       59   Yaroslavl TC" Altair "
1   03.01.2013       03     2013          0       25     Moscow TEC" Atrium "
3   06.01.2013       06     2013          0       25     Moscow TEC" Atrium "
4   15.01.2013       15     2013          0       25     Moscow TEC" Atrium "
5   10.01.2013       10     2013          0       25     Moscow TEC" Atrium "
6   02.01.2013       02     2013          0       25     Moscow TEC" Atrium "
7   04.01.2013       04     2013          0       25     Moscow TEC" Atrium "
8   11.01.2013       11     2013          0       25     Moscow TEC" Atrium "
9   03.01.2013       03     2013          0       25     Moscow TEC" Atrium "
10  03.01.2013       03     2013          0       25     Moscow TEC" Atrium "
11  05.01.2013       05     2013          0       25     Moscow TEC" Atrium "
12  07.01.2013       07     2013          0       25     Moscow TEC" Atrium "
13  08.01.2013       08     2013          0       25     Moscow TEC" Atrium "
14  10.01.2013       10     2013          0       25     Moscow TEC" Atrium "
15  11.01.2013       11     2013          0       25     Moscow TEC" Atrium "
16  13.01.2013       13     2013          0       25     Moscow TEC" Atrium "
17  16.01.2013       16     2013          0       25     Moscow TEC" Atrium "
18  26.01.2013       26     2013          0       25     Moscow TEC" Atrium "
19  27.01.2013       27     2013          0       25     Moscow TEC" Atrium "
20  09.01.2013       09     2013          0       25     Moscow TEC" Atrium "

    item_id                                          item_name  category_id  \
0     22154                                SCENE 2012 (BD)           37
1      2552            DEEP PURPLE The House Of Blue Light LP           58
3      2554            DEEP PURPLE Who Do You Think We Are LP           58
4      2555     DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5      2564  DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6      2565                  DEEP PURPLE Stormbringer (firms).           56
7      2572                          DEFTONES Koi No Yokan           55
8      2572                          DEFTONES Koi No Yokan           55
9      2573                       DEL REY LANA Born To Die           55
```

```
10     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
11     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
12     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
13     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
14     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
15     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
16     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
17     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
18     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
19     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55
20     2593                 DEPECHE MODE Music For The Masses          55

                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   month_name
0     January
1     January
3     January
4     January
5     January
6     January
7     January
8     January
9     January
10    January
11    January
12    January
13    January
```

```
14    January
15    January
16    January
17    January
18    January
19    January
20    January
(2928483, 14)
```

[ ]:
```python
#removes month_num column

final_dataset.drop(columns=['month_num'], inplace=True)

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num year_num  shop_id                shop_name  item_id  \
0   02.01.2013       02     2013       59   Yaroslavl TC" Altair "    22154
1   03.01.2013       03     2013       25     Moscow TEC" Atrium "     2552
3   06.01.2013       06     2013       25     Moscow TEC" Atrium "     2554
4   15.01.2013       15     2013       25     Moscow TEC" Atrium "     2555
5   10.01.2013       10     2013       25     Moscow TEC" Atrium "     2564
6   02.01.2013       02     2013       25     Moscow TEC" Atrium "     2565
7   04.01.2013       04     2013       25     Moscow TEC" Atrium "     2572
8   11.01.2013       11     2013       25     Moscow TEC" Atrium "     2572
9   03.01.2013       03     2013       25     Moscow TEC" Atrium "     2573
10  03.01.2013       03     2013       25     Moscow TEC" Atrium "     2574
11  05.01.2013       05     2013       25     Moscow TEC" Atrium "     2574
12  07.01.2013       07     2013       25     Moscow TEC" Atrium "     2574
13  08.01.2013       08     2013       25     Moscow TEC" Atrium "     2574
14  10.01.2013       10     2013       25     Moscow TEC" Atrium "     2574
15  11.01.2013       11     2013       25     Moscow TEC" Atrium "     2574
16  13.01.2013       13     2013       25     Moscow TEC" Atrium "     2574
17  16.01.2013       16     2013       25     Moscow TEC" Atrium "     2574
18  26.01.2013       26     2013       25     Moscow TEC" Atrium "     2574
19  27.01.2013       27     2013       25     Moscow TEC" Atrium "     2574
20  09.01.2013       09     2013       25     Moscow TEC" Atrium "     2593

                                        item_name  category_id  \
0                                SCENE 2012 (BD)           37
1          DEEP PURPLE The House Of Blue Light LP           58
3          DEEP PURPLE Who Do You Think We Are LP           58
4   DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
```

```
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6                   DEEP PURPLE Stormbringer (firms).          56
7                              DEFTONES Koi No Yokan           55
8                              DEFTONES Koi No Yokan           55
9                            DEL REY LANA Born To Die          55
10  DEL REY LANA Born To Die The Paradise Edition 2CD          55
11  DEL REY LANA Born To Die The Paradise Edition 2CD          55
12  DEL REY LANA Born To Die The Paradise Edition 2CD          55
13  DEL REY LANA Born To Die The Paradise Edition 2CD          55
14  DEL REY LANA Born To Die The Paradise Edition 2CD          55
15  DEL REY LANA Born To Die The Paradise Edition 2CD          55
16  DEL REY LANA Born To Die The Paradise Edition 2CD          55
17  DEL REY LANA Born To Die The Paradise Edition 2CD          55
18  DEL REY LANA Born To Die The Paradise Edition 2CD          55
19  DEL REY LANA Born To Die The Paradise Edition 2CD          55
20                  DEPECHE MODE Music For The Masses          55

                     item_category_name  item_price  item_cnt_month  revenue  \
0                      Cinema - Blu-Ray      999.00               1   999.00
1                         Music - Vinyl      899.00               1   899.00
3                         Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   month_name
0     January
1     January
3     January
4     January
5     January
6     January
7     January
8     January
```

```
9     January
10    January
11    January
12    January
13    January
14    January
15    January
16    January
17    January
18    January
19    January
20    January
(2928483, 13)
```

[ ]:
```
#rearange the columns

final_dataset = final_dataset[['date', 'date_num', 'month_name', 'year_num',␣
 ↪'shop_id', 'shop_name', 'item_id', 'item_name', 'category_id',␣
 ↪'item_category_name', 'item_price', 'item_cnt_month', 'revenue']]

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num month_name year_num  shop_id                shop_name  \
0   02.01.2013       02    January     2013       59   Yaroslavl TC" Altair "
1   03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
3   06.01.2013       06    January     2013       25     Moscow TEC" Atrium "
4   15.01.2013       15    January     2013       25     Moscow TEC" Atrium "
5   10.01.2013       10    January     2013       25     Moscow TEC" Atrium "
6   02.01.2013       02    January     2013       25     Moscow TEC" Atrium "
7   04.01.2013       04    January     2013       25     Moscow TEC" Atrium "
8   11.01.2013       11    January     2013       25     Moscow TEC" Atrium "
9   03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
10  03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
11  05.01.2013       05    January     2013       25     Moscow TEC" Atrium "
12  07.01.2013       07    January     2013       25     Moscow TEC" Atrium "
13  08.01.2013       08    January     2013       25     Moscow TEC" Atrium "
14  10.01.2013       10    January     2013       25     Moscow TEC" Atrium "
15  11.01.2013       11    January     2013       25     Moscow TEC" Atrium "
16  13.01.2013       13    January     2013       25     Moscow TEC" Atrium "
17  16.01.2013       16    January     2013       25     Moscow TEC" Atrium "
18  26.01.2013       26    January     2013       25     Moscow TEC" Atrium "
19  27.01.2013       27    January     2013       25     Moscow TEC" Atrium "
```

```
20  09.01.2013       09    January     2013       25     Moscow TEC" Atrium "

    item_id                                          item_name  category_id  \
0     22154                                SCENE 2012 (BD)           37
1      2552            DEEP PURPLE The House Of Blue Light LP           58
3      2554            DEEP PURPLE Who Do You Think We Are LP           58
4      2555     DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5      2564  DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6      2565                 DEEP PURPLE Stormbringer (firms).           56
7      2572                           DEFTONES Koi No Yokan           55
8      2572                           DEFTONES Koi No Yokan           55
9      2573                        DEL REY LANA Born To Die           55
10     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
18     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20     2593                 DEPECHE MODE Music For The Masses           55

                    item_category_name  item_price  item_cnt_month  revenue
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                  Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00
(2928483, 13)
```

[ ]:
```
#data binning

#found the bins using the following code
print(final_dataset['item_price'].max())
print(final_dataset['item_price'].min())

#creates a new column called price range
final_dataset['price_range'] = pd.cut(final_dataset['item_price'], bins=[-1,␣
 ↪100, 200, 300, 400, 500, 600, 700, 800, 900, 100000], labels=['0-100',␣
 ↪'100-200', '200-300', '300-400', '400-500', '500-600', '600-700', '700-800',␣
 ↪'800-900', '900-100000'])
```

```
59200.0
0.07
```

[ ]:
```
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num month_name year_num  shop_id                shop_name  \
0   02.01.2013       02    January     2013       59   Yaroslavl TC" Altair "
1   03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
3   06.01.2013       06    January     2013       25     Moscow TEC" Atrium "
4   15.01.2013       15    January     2013       25     Moscow TEC" Atrium "
5   10.01.2013       10    January     2013       25     Moscow TEC" Atrium "
6   02.01.2013       02    January     2013       25     Moscow TEC" Atrium "
7   04.01.2013       04    January     2013       25     Moscow TEC" Atrium "
8   11.01.2013       11    January     2013       25     Moscow TEC" Atrium "
9   03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
10  03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
11  05.01.2013       05    January     2013       25     Moscow TEC" Atrium "
12  07.01.2013       07    January     2013       25     Moscow TEC" Atrium "
13  08.01.2013       08    January     2013       25     Moscow TEC" Atrium "
14  10.01.2013       10    January     2013       25     Moscow TEC" Atrium "
15  11.01.2013       11    January     2013       25     Moscow TEC" Atrium "
16  13.01.2013       13    January     2013       25     Moscow TEC" Atrium "
17  16.01.2013       16    January     2013       25     Moscow TEC" Atrium "
18  26.01.2013       26    January     2013       25     Moscow TEC" Atrium "
19  27.01.2013       27    January     2013       25     Moscow TEC" Atrium "
20  09.01.2013       09    January     2013       25     Moscow TEC" Atrium "

    item_id                                          item_name  category_id  \
0     22154                                SCENE 2012 (BD)           37
1      2552            DEEP PURPLE The House Of Blue Light LP           58
```

```
3      2554             DEEP PURPLE Who Do You Think We Are LP           58
4      2555      DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5      2564  DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6      2565                  DEEP PURPLE Stormbringer (firms).           56
7      2572                               DEFTONES Koi No Yokan           55
8      2572                               DEFTONES Koi No Yokan           55
9      2573                            DEL REY LANA Born To Die           55
10     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
18     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20     2593                  DEPECHE MODE Music For The Masses           55

                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   price_range
0   900-100000
1      800-900
3   900-100000
4   900-100000
5      300-400
6      500-600
```

```
7      200-300
8      200-300
9      200-300
10     300-400
11     300-400
12     300-400
13     300-400
14     300-400
15     300-400
16     300-400
17     300-400
18     300-400
19     300-400
20     200-300
(2928483, 14)
```

[ ]:
```
#log transformation

#creates a new column called log_revenue
final_dataset['log_revenue'] = np.log(final_dataset['revenue'])
```

[ ]:
```
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num month_name year_num  shop_id                shop_name  \
0   02.01.2013       02    January     2013       59   Yaroslavl TC" Altair "
1   03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
3   06.01.2013       06    January     2013       25     Moscow TEC" Atrium "
4   15.01.2013       15    January     2013       25     Moscow TEC" Atrium "
5   10.01.2013       10    January     2013       25     Moscow TEC" Atrium "
6   02.01.2013       02    January     2013       25     Moscow TEC" Atrium "
7   04.01.2013       04    January     2013       25     Moscow TEC" Atrium "
8   11.01.2013       11    January     2013       25     Moscow TEC" Atrium "
9   03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
10  03.01.2013       03    January     2013       25     Moscow TEC" Atrium "
11  05.01.2013       05    January     2013       25     Moscow TEC" Atrium "
12  07.01.2013       07    January     2013       25     Moscow TEC" Atrium "
13  08.01.2013       08    January     2013       25     Moscow TEC" Atrium "
14  10.01.2013       10    January     2013       25     Moscow TEC" Atrium "
15  11.01.2013       11    January     2013       25     Moscow TEC" Atrium "
16  13.01.2013       13    January     2013       25     Moscow TEC" Atrium "
17  16.01.2013       16    January     2013       25     Moscow TEC" Atrium "
18  26.01.2013       26    January     2013       25     Moscow TEC" Atrium "
```

```
19  27.01.2013       27    January     2013       25     Moscow TEC" Atrium "
20  09.01.2013       09    January     2013       25     Moscow TEC" Atrium "

    item_id                                          item_name  category_id  \
0     22154                                SCENE 2012 (BD)           37
1      2552            DEEP PURPLE The House Of Blue Light LP           58
3      2554            DEEP PURPLE Who Do You Think We Are LP           58
4      2555     DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5      2564  DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6      2565                 DEEP PURPLE Stormbringer (firms).           56
7      2572                              DEFTONES Koi No Yokan           55
8      2572                              DEFTONES Koi No Yokan           55
9      2573                           DEL REY LANA Born To Die           55
10     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
18     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19     2574  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20     2593                 DEPECHE MODE Music For The Masses           55

                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                  Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   price_range  log_revenue
```

```
0    900-100000     6.906755
1       800-900     6.801283
3    900-100000     7.443693
4    900-100000     7.002156
5       300-400     5.855072
6       500-600     6.308098
7       200-300     5.476464
8       200-300     5.700444
9       200-300     6.799056
10      300-400     6.682109
11      300-400     5.988961
12      300-400     5.988961
13      300-400     6.682109
14      300-400     5.988961
15      300-400     6.682109
16      300-400     5.988961
17      300-400     5.988961
18      300-400     5.988961
19      300-400     5.988961
20      200-300     5.631212
(2928483, 15)
```

[ ]:
```
#encoding

#encodes the year_num column to 0, 1, 2

final_dataset['year_num'] = final_dataset['year_num'].replace({'2013': 0,␣
 ↪'2014': 1, '2015': 2})


print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num month_name  year_num  shop_id  \
0   02.01.2013       02    January         0       59
1   03.01.2013       03    January         0       25
3   06.01.2013       06    January         0       25
4   15.01.2013       15    January         0       25
5   10.01.2013       10    January         0       25
6   02.01.2013       02    January         0       25
7   04.01.2013       04    January         0       25
8   11.01.2013       11    January         0       25
9   03.01.2013       03    January         0       25
```

```
10  03.01.2013       03    January         0       25
11  05.01.2013       05    January         0       25
12  07.01.2013       07    January         0       25
13  08.01.2013       08    January         0       25
14  10.01.2013       10    January         0       25
15  11.01.2013       11    January         0       25
16  13.01.2013       13    January         0       25
17  16.01.2013       16    January         0       25
18  26.01.2013       26    January         0       25
19  27.01.2013       27    January         0       25
20  09.01.2013       09    January         0       25

                  shop_name  item_id  \
0    Yaroslavl TC" Altair "    22154
1      Moscow TEC" Atrium "     2552
3      Moscow TEC" Atrium "     2554
4      Moscow TEC" Atrium "     2555
5      Moscow TEC" Atrium "     2564
6      Moscow TEC" Atrium "     2565
7      Moscow TEC" Atrium "     2572
8      Moscow TEC" Atrium "     2572
9      Moscow TEC" Atrium "     2573
10     Moscow TEC" Atrium "     2574
11     Moscow TEC" Atrium "     2574
12     Moscow TEC" Atrium "     2574
13     Moscow TEC" Atrium "     2574
14     Moscow TEC" Atrium "     2574
15     Moscow TEC" Atrium "     2574
16     Moscow TEC" Atrium "     2574
17     Moscow TEC" Atrium "     2574
18     Moscow TEC" Atrium "     2574
19     Moscow TEC" Atrium "     2574
20     Moscow TEC" Atrium "     2593

                                          item_name  category_id  \
0                                   SCENE 2012 (BD)           37
1             DEEP PURPLE The House Of Blue Light LP           58
3             DEEP PURPLE Who Do You Think We Are LP           58
4       DEEP PURPLE 30 Very Best Of 2CD (Businesses).          56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6                  DEEP PURPLE Stormbringer (firms).           56
7                              DEFTONES Koi No Yokan           55
8                              DEFTONES Koi No Yokan           55
9                           DEL REY LANA Born To Die           55
10  DEL REY LANA Born To Die The Paradise Edition 2CD          55
11  DEL REY LANA Born To Die The Paradise Edition 2CD          55
12  DEL REY LANA Born To Die The Paradise Edition 2CD          55
13  DEL REY LANA Born To Die The Paradise Edition 2CD          55
```

```
14  DEL REY LANA Born To Die The Paradise Edition 2CD          55
15  DEL REY LANA Born To Die The Paradise Edition 2CD          55
16  DEL REY LANA Born To Die The Paradise Edition 2CD          55
17  DEL REY LANA Born To Die The Paradise Edition 2CD          55
18  DEL REY LANA Born To Die The Paradise Edition 2CD          55
19  DEL REY LANA Born To Die The Paradise Edition 2CD          55
20                 DEPECHE MODE Music For The Masses          55

                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   price_range  log_revenue
0   900-100000     6.906755
1      800-900     6.801283
3   900-100000     7.443693
4   900-100000     7.002156
5      300-400     5.855072
6      500-600     6.308098
7      200-300     5.476464
8      200-300     5.700444
9      200-300     6.799056
10     300-400     6.682109
11     300-400     5.988961
12     300-400     5.988961
13     300-400     6.682109
14     300-400     5.988961
15     300-400     6.682109
16     300-400     5.988961
17     300-400     5.988961
```

```
18      300-400     5.988961
19      300-400     5.988961
20      200-300     5.631212
(2928483, 15)
```

[ ]:
```
#grouping and aggregation

#grouping the data set by shop_id and year_num and aggregating the␣
 ↪item_cnt_month column using sum

grouped_by_shop_id_and_year_num = final_dataset.groupby(['shop_id',␣
 ↪'year_num']).agg({'item_cnt_month': 'sum'})

print("\n\nHead of grouped_by_shop_id_and_year_num:\n")
print(grouped_by_shop_id_and_year_num.head(60))
print(grouped_by_shop_id_and_year_num.shape)
```

```
Head of grouped_by_shop_id_and_year_num:

                  item_cnt_month
shop_id year_num
0       0                 11705
1       0                  6311
2       0                  9989
        1                 12247
        2                  8470
3       0                 10242
        1                 11039
        2                  7194
4       0                 19054
        1                 15909
        2                  9106
5       0                 14717
        1                 17041
        2                 11089
6       0                 46707
        1                 35496
        2                 18554
7       0                 28218
        1                 24530
        2                 14411
8       0                  3602
9       0                  6531
        1                  6155
        2                  3188
10      0                 11132
```

```
        1                   8859
        2                   4532
11      2                    572
12      0                  19494
        1                  26379
        2                  24947
13      0                  13529
        1                   6234
14      0                  20114
        1                  16003
        2                  10397
15      0                  32339
        1                  24854
        2                  14138
16      0                  30250
        1                  19569
        2                  11953
17      0                   9913
        1                  15308
        2                    697
18      0                  33632
        1                  18815
        2                  13174
19      0                  32860
        1                  25353
        2                  15455
20      1                   3262
        2                   2611
21      0                  25258
        1                  25167
        2                  18259
22      0                  26943
        1                  20341
        2                  13050
23      0                   7722
(159, 1)
```

[ ]:
```
#creates a new column called scaled_revenue
final_dataset['scaled_revenue'] = (final_dataset['revenue'] -␣
 ↪final_dataset['revenue'].min()) / (final_dataset['revenue'].max() -␣
 ↪final_dataset['revenue'].min())

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

Head of final_dataset:

	date	date_num	month_name	year_num	shop_id	\
0	02.01.2013	02	January	0	59	
1	03.01.2013	03	January	0	25	
3	06.01.2013	06	January	0	25	
4	15.01.2013	15	January	0	25	
5	10.01.2013	10	January	0	25	
6	02.01.2013	02	January	0	25	
7	04.01.2013	04	January	0	25	
8	11.01.2013	11	January	0	25	
9	03.01.2013	03	January	0	25	
10	03.01.2013	03	January	0	25	
11	05.01.2013	05	January	0	25	
12	07.01.2013	07	January	0	25	
13	08.01.2013	08	January	0	25	
14	10.01.2013	10	January	0	25	
15	11.01.2013	11	January	0	25	
16	13.01.2013	13	January	0	25	
17	16.01.2013	16	January	0	25	
18	26.01.2013	26	January	0	25	
19	27.01.2013	27	January	0	25	
20	09.01.2013	09	January	0	25	

	shop_name	item_id	\
0	Yaroslavl TC" Altair "	22154	
1	Moscow TEC" Atrium "	2552	
3	Moscow TEC" Atrium "	2554	
4	Moscow TEC" Atrium "	2555	
5	Moscow TEC" Atrium "	2564	
6	Moscow TEC" Atrium "	2565	
7	Moscow TEC" Atrium "	2572	
8	Moscow TEC" Atrium "	2572	
9	Moscow TEC" Atrium "	2573	
10	Moscow TEC" Atrium "	2574	
11	Moscow TEC" Atrium "	2574	
12	Moscow TEC" Atrium "	2574	
13	Moscow TEC" Atrium "	2574	
14	Moscow TEC" Atrium "	2574	
15	Moscow TEC" Atrium "	2574	
16	Moscow TEC" Atrium "	2574	
17	Moscow TEC" Atrium "	2574	
18	Moscow TEC" Atrium "	2574	
19	Moscow TEC" Atrium "	2574	
20	Moscow TEC" Atrium "	2593	

	item_name	category_id	\
0	SCENE 2012 (BD)	37	

```
1              DEEP PURPLE The House Of Blue Light LP           58
3              DEEP PURPLE Who Do You Think We Are LP           58
4       DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6                    DEEP PURPLE Stormbringer (firms).          56
7                               DEFTONES Koi No Yokan           55
8                               DEFTONES Koi No Yokan           55
9                             DEL REY LANA Born To Die          55
10  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17  DEL REY LANA Born To Die The Paradise Edition 2CD           55
18  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20                   DEPECHE MODE Music For The Masses          55

                     item_category_name  item_price  item_cnt_month  revenue  \
0                       Cinema - Blu-Ray      999.00               1   999.00
1                          Music - Vinyl      899.00               1   899.00
3                          Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                    Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7         Music - CD of local production      239.00               1   239.00
8         Music - CD of local production      299.00               1   299.00
9         Music - CD of local production      299.00               3   897.00
10        Music - CD of local production      399.00               2   798.00
11        Music - CD of local production      399.00               1   399.00
12        Music - CD of local production      399.00               1   399.00
13        Music - CD of local production      399.00               2   798.00
14        Music - CD of local production      399.00               1   399.00
15        Music - CD of local production      399.00               2   798.00
16        Music - CD of local production      399.00               1   399.00
17        Music - CD of local production      399.00               1   399.00
18        Music - CD of local production      399.00               1   399.00
19        Music - CD of local production      399.00               1   399.00
20        Music - CD of local production      279.00               1   279.00

   price_range  log_revenue  scaled_revenue
0   900-100000     6.906755        0.000546
1      800-900     6.801283        0.000491
3   900-100000     7.443693        0.000934
4   900-100000     7.002156        0.000601
5      300-400     5.855072        0.000191
```

```
6      500-600     6.308098        0.000300
7      200-300     5.476464        0.000131
8      200-300     5.700444        0.000163
9      200-300     6.799056        0.000490
10     300-400     6.682109        0.000436
11     300-400     5.988961        0.000218
12     300-400     5.988961        0.000218
13     300-400     6.682109        0.000436
14     300-400     5.988961        0.000218
15     300-400     6.682109        0.000436
16     300-400     5.988961        0.000218
17     300-400     5.988961        0.000218
18     300-400     5.988961        0.000218
19     300-400     5.988961        0.000218
20     200-300     5.631212        0.000152
(2928483, 16)
```

[ ]:
```
#change month_name column to numeric

final_dataset['month_name'] = final_dataset['month_name'].replace({'January':␣
 ↪1, 'February': 2, 'March': 3, 'April': 4, 'May': 5, 'June':6, 'July': 7,␣
 ↪'August': 8, 'September': 9, 'October': 10, 'November':11, 'December': 12})

print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
```

```
Head of final_dataset:

          date date_num  month_name  year_num  shop_id  \
0   02.01.2013       02           1         0       59
1   03.01.2013       03           1         0       25
3   06.01.2013       06           1         0       25
4   15.01.2013       15           1         0       25
5   10.01.2013       10           1         0       25
6   02.01.2013       02           1         0       25
7   04.01.2013       04           1         0       25
8   11.01.2013       11           1         0       25
9   03.01.2013       03           1         0       25
10  03.01.2013       03           1         0       25
11  05.01.2013       05           1         0       25
12  07.01.2013       07           1         0       25
13  08.01.2013       08           1         0       25
14  10.01.2013       10           1         0       25
15  11.01.2013       11           1         0       25
16  13.01.2013       13           1         0       25
```

```
17  16.01.2013       16           1         0       25
18  26.01.2013       26           1         0       25
19  27.01.2013       27           1         0       25
20  09.01.2013       09           1         0       25

                 shop_name  item_id  \
0    Yaroslavl TC" Altair "    22154
1      Moscow TEC" Atrium "     2552
3      Moscow TEC" Atrium "     2554
4      Moscow TEC" Atrium "     2555
5      Moscow TEC" Atrium "     2564
6      Moscow TEC" Atrium "     2565
7      Moscow TEC" Atrium "     2572
8      Moscow TEC" Atrium "     2572
9      Moscow TEC" Atrium "     2573
10     Moscow TEC" Atrium "     2574
11     Moscow TEC" Atrium "     2574
12     Moscow TEC" Atrium "     2574
13     Moscow TEC" Atrium "     2574
14     Moscow TEC" Atrium "     2574
15     Moscow TEC" Atrium "     2574
16     Moscow TEC" Atrium "     2574
17     Moscow TEC" Atrium "     2574
18     Moscow TEC" Atrium "     2574
19     Moscow TEC" Atrium "     2574
20     Moscow TEC" Atrium "     2593

                                          item_name  category_id  \
0                                    SCENE 2012 (BD)           37
1              DEEP PURPLE The House Of Blue Light LP           58
3              DEEP PURPLE Who Do You Think We Are LP           58
4       DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6                   DEEP PURPLE Stormbringer (firms).           56
7                              DEFTONES Koi No Yokan            55
8                              DEFTONES Koi No Yokan            55
9                            DEL REY LANA Born To Die           55
10  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14  DEL REY LANA Born To Die The Paradise Edition 2CD           55
15  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17  DEL REY LANA Born To Die The Paradise Edition 2CD           55
18  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20                  DEPECHE MODE Music For The Masses           55
```

```
                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                  Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   price_range  log_revenue  scaled_revenue
0   900-100000     6.906755        0.000546
1      800-900     6.801283        0.000491
3   900-100000     7.443693        0.000934
4   900-100000     7.002156        0.000601
5      300-400     5.855072        0.000191
6      500-600     6.308098        0.000300
7      200-300     5.476464        0.000131
8      200-300     5.700444        0.000163
9      200-300     6.799056        0.000490
10     300-400     6.682109        0.000436
11     300-400     5.988961        0.000218
12     300-400     5.988961        0.000218
13     300-400     6.682109        0.000436
14     300-400     5.988961        0.000218
15     300-400     6.682109        0.000436
16     300-400     5.988961        0.000218
17     300-400     5.988961        0.000218
18     300-400     5.988961        0.000218
19     300-400     5.988961        0.000218
20     200-300     5.631212        0.000152
(2928483, 16)
```

1.4 Data Exploration & Analysis

[ ]:
```
#correlation

numeric_columns = final_dataset.select_dtypes(include=['number'])
print("\n\nCorrelation of final_dataset:\n")
print(numeric_columns.corr())
```

```
Correlation of final_dataset:

                month_name  year_num   shop_id   item_id  category_id  \
month_name        1.000000 -0.134131  0.020646 -0.002103    -0.001055
year_num         -0.134131  1.000000  0.011835  0.010486     0.030406
shop_id           0.020646  0.011835  1.000000  0.029344     0.019339
item_id          -0.002103  0.010486  0.029344  1.000000     0.369384
category_id      -0.001055  0.030406  0.019339  0.369384     1.000000
item_price        0.044361  0.080574 -0.023966 -0.134759    -0.255033
item_cnt_month    0.021007  0.002510 -0.005660  0.018896     0.016922
revenue           0.030326  0.029541 -0.013540 -0.063423    -0.117860
log_revenue       0.057248  0.096145 -0.039415 -0.310144    -0.342896
scaled_revenue    0.030326  0.029541 -0.013540 -0.063423    -0.117860

                item_price  item_cnt_month   revenue  log_revenue  \
month_name        0.044361        0.021007  0.030326     0.057248
year_num          0.080574        0.002510  0.029541     0.096145
shop_id          -0.023966       -0.005660 -0.013540    -0.039415
item_id          -0.134759        0.018896 -0.063423    -0.310144
category_id      -0.255033        0.016922 -0.117860    -0.342896
item_price        1.000000        0.014437  0.436314     0.601371
item_cnt_month    0.014437        1.000000  0.481568     0.115253
revenue           0.436314        0.481568  1.000000     0.331392
log_revenue       0.601371        0.115253  0.331392     1.000000
scaled_revenue    0.436314        0.481568  1.000000     0.331392

                scaled_revenue
month_name            0.030326
year_num              0.029541
shop_id              -0.013540
item_id              -0.063423
category_id          -0.117860
item_price            0.436314
item_cnt_month        0.481568
revenue               1.000000
log_revenue           0.331392
scaled_revenue        1.000000
```

[ ]:
```
#checks for missing values
print("\n\nMissing values in final_dataset:\n")
print(final_dataset.isnull().sum())

#checks for null values
print("\n\nNull values in final_dataset:\n")
print(final_dataset.isnull().sum())
```

```
Missing values in final_dataset:

date                  0
date_num              0
month_name            0
year_num              0
shop_id               0
shop_name             0
item_id               0
item_name             0
category_id           0
item_category_name    0
item_price            0
item_cnt_month        0
revenue               0
price_range           0
log_revenue           0
scaled_revenue        0
dtype: int64


Null values in final_dataset:

date                  0
date_num              0
month_name            0
year_num              0
shop_id               0
shop_name             0
item_id               0
item_name             0
category_id           0
item_category_name    0
item_price            0
item_cnt_month        0
revenue               0
price_range           0
log_revenue           0
```

```
scaled_revenue        0
dtype: int64
```

[ ]:
```
#Descriptive analytics

# Summary Statistics
print("\nDescriptive statistics of final_dataset:")
print(final_dataset.describe())
```

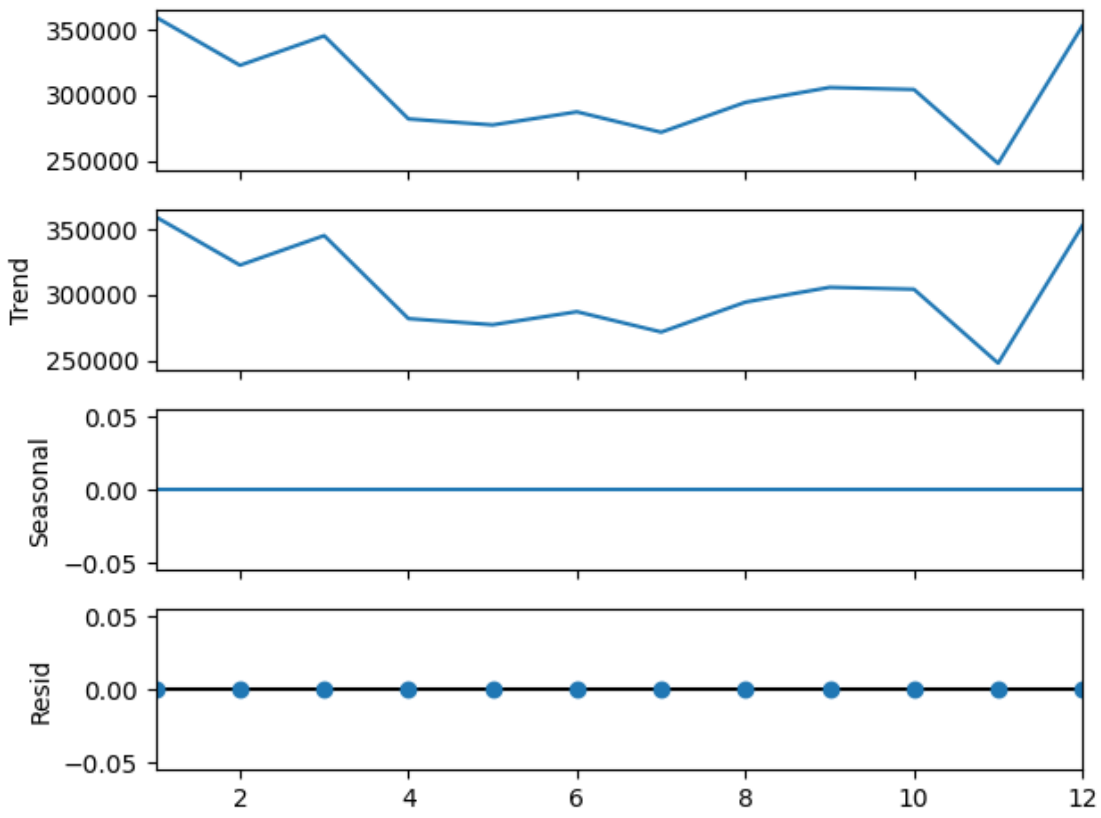
```
Descriptive statistics of final_dataset:
         month_name      year_num       shop_id       item_id   category_id  \
count  2.928483e+06  2.928483e+06  2.928483e+06  2.928483e+06  2.928483e+06
mean   6.248408e+00  7.767790e-01  3.300296e+01  1.020028e+04  4.001637e+01
std    3.535921e+00  7.684598e-01  1.622543e+01  6.324391e+03  1.709809e+01
min    1.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00
25%    3.000000e+00  0.000000e+00  2.200000e+01  4.477000e+03  2.800000e+01
50%    6.000000e+00  1.000000e+00  3.100000e+01  9.355000e+03  4.000000e+01
75%    9.000000e+00  1.000000e+00  4.700000e+01  1.569100e+04  5.500000e+01
max    1.200000e+01  2.000000e+00  5.900000e+01  2.216900e+04  8.300000e+01

          item_price  item_cnt_month       revenue   log_revenue  \
count  2.928483e+06    2.928483e+06  2.928483e+06  2.928483e+06
mean   8.893627e+02    1.247257e+00  1.164267e+03  6.254676e+00
std    1.718155e+03    2.217429e+00  5.684853e+03  1.171779e+00
min    7.000000e-02    1.000000e+00  7.000000e-02 -2.659260e+00
25%    2.490000e+02    1.000000e+00  2.490000e+02  5.517453e+00
50%    3.990000e+02    1.000000e+00  4.490000e+02  6.107023e+00
75%    9.990000e+02    1.000000e+00  1.090000e+03  6.993933e+00
max    5.920000e+04    6.690000e+02  1.829990e+06  1.441982e+01

       scaled_revenue
count    2.928483e+06
mean     6.361770e-04
std      3.106494e-03
min      0.000000e+00
25%      1.360281e-04
50%      2.453183e-04
75%      5.955934e-04
max      1.000000e+00
```

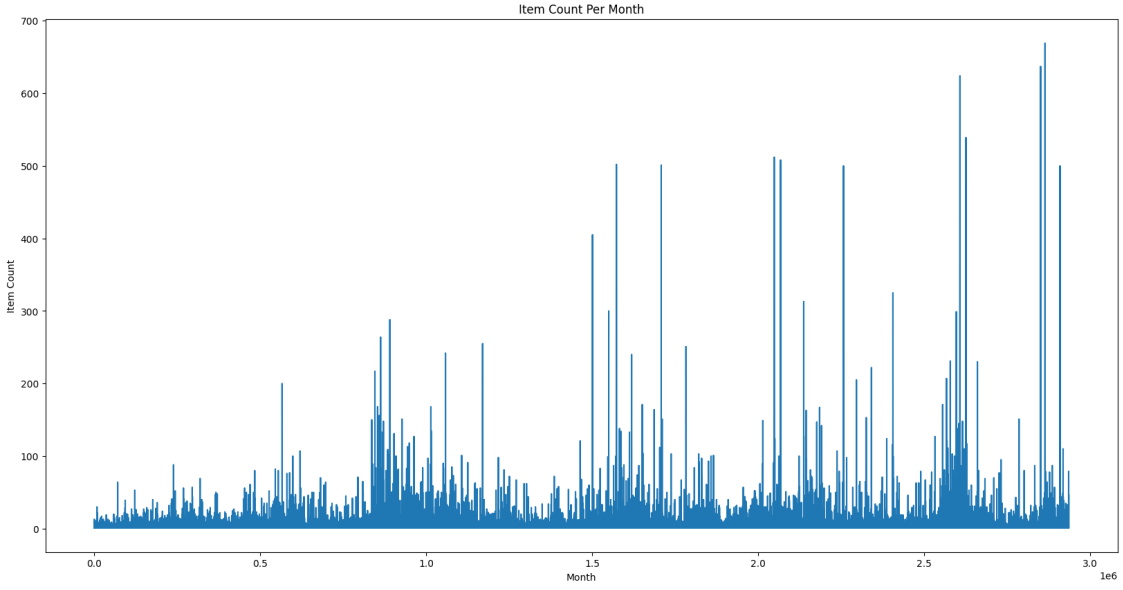
[ ]:
```
#seasonality analysis

grouped_by_month_name = final_dataset.groupby(['month_name']).
 ↪agg({'item_cnt_month': 'sum'})

print("\n\nHead of grouped_by_month_name:\n")
print(grouped_by_month_name)
```

```
print(grouped_by_month_name.shape)
```

```
Head of grouped_by_month_name:

            item_cnt_month
month_name
1                   359391
2                   322775
3                   345171
4                   282131
5                   277519
6                   287443
7                   271985
8                   294692
9                   305967
10                  304453
11                  248320
12                  352723
(12, 1)
```

[ ]:
```
#performing seasonal decomposition
decomposition = sm.tsa.seasonal_decompose(grouped_by_month_name,␣
 ↪model='additive', period=1)

#plotting the seasonal decomposition
fig = decomposition.plot()
plt.show()

#plotting the item_cnt_month column
plt.figure(figsize=(20, 10))
plt.plot(final_dataset['item_cnt_month'])
plt.title('Item Count Per Month')
plt.xlabel('Month')
plt.ylabel('Item Count')
plt.show()
```


350000
300000
250000
Trend
350000
300000
250000
Seasonal
0.05
0.00
−0.05
Resid
0.05
0.00
−0.05
2
4
6
8
10
12


Item Count Per Month
Item Count
700
600
500
400
300
200
100
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Month
1e6

[ ]:
```
#regulatory analytics

grouped_by_shop_id_and_year_num = final_dataset.groupby(['shop_id',␣
 ↪'year_num']).agg({'item_cnt_month': 'sum'})

print("\n\nHead of grouped_by_shop_id_and_year_num:\n")
print(grouped_by_shop_id_and_year_num.head(60))
```

```
Head of grouped_by_shop_id_and_year_num:

                  item_cnt_month
shop_id year_num
0       0                 11705
1       0                  6311
2       0                  9989
        1                 12247
        2                  8470
3       0                 10242
        1                 11039
        2                  7194
4       0                 19054
        1                 15909
        2                  9106
5       0                 14717
        1                 17041
        2                 11089
6       0                 46707
        1                 35496
        2                 18554
7       0                 28218
        1                 24530
        2                 14411
8       0                  3602
9       0                  6531
        1                  6155
        2                  3188
10      0                 11132
        1                  8859
        2                  4532
11      2                   572
12      0                 19494
        1                 26379
        2                 24947
13      0                 13529
        1                  6234
14      0                 20114
```

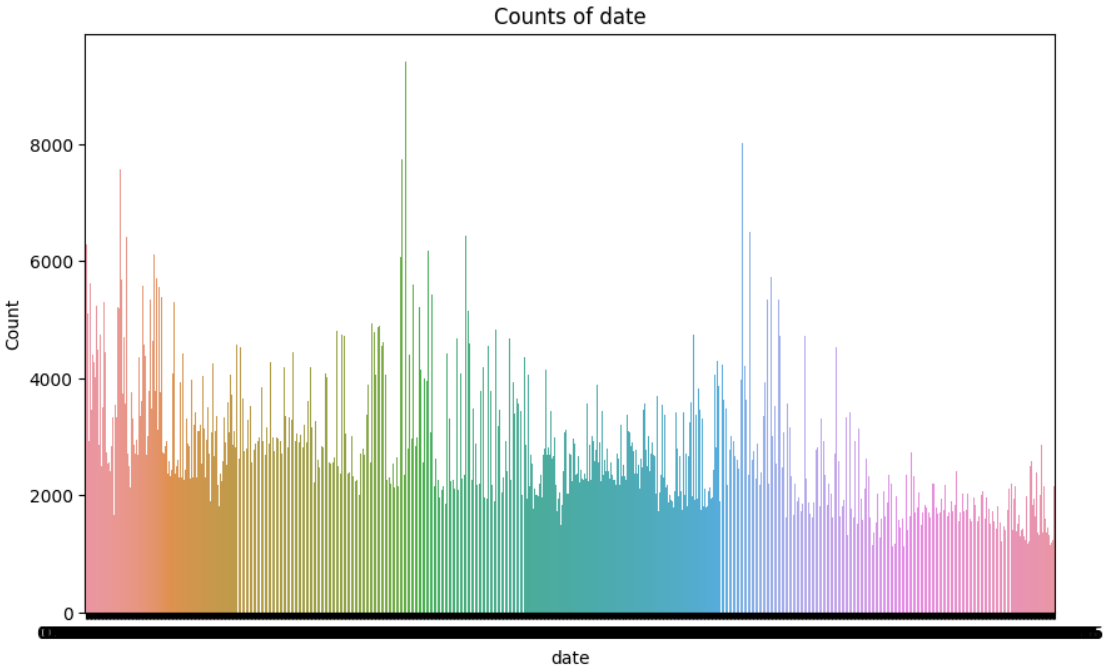
```
        1                16003
        2                10397
15      0                32339
        1                24854
        2                14138
16      0                30250
        1                19569
        2                11953
17      0                 9913
        1                15308
        2                  697
18      0                33632
        1                18815
        2                13174
19      0                32860
        1                25353
        2                15455
20      1                 3262
        2                 2611
21      0                25258
        1                25167
        2                18259
22      0                26943
        1                20341
        2                13050
23      0                 7722
```

[ ]:
```
#Variable Identification

# Identify numerical and categorical variables
numerical_vars = final_dataset.select_dtypes(include=['int64', 'float64']).
 ↪columns
categorical_vars = final_dataset.select_dtypes(include=['object', 'category']).
 ↪columns

# Print the list of numerical and categorical variables
print("Numerical Variables:")
print(numerical_vars)

print("\nCategorical Variables:")
print(categorical_vars)
```

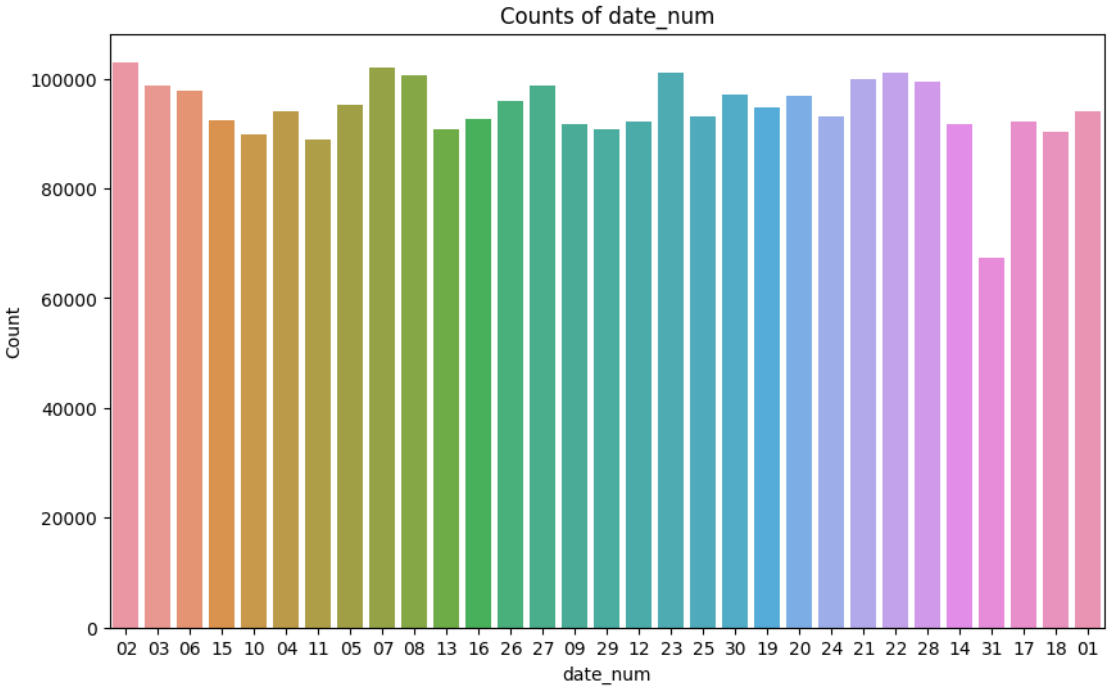
```
Numerical Variables:
Index(['month_name', 'year_num', 'shop_id', 'item_id', 'category_id',
       'item_price', 'item_cnt_month', 'revenue', 'log_revenue',
       'scaled_revenue'],
      dtype='object')
```

```
Categorical Variables:
Index(['date', 'date_num', 'shop_name', 'item_name', 'item_category_name',
       'price_range'],
      dtype='object')
```

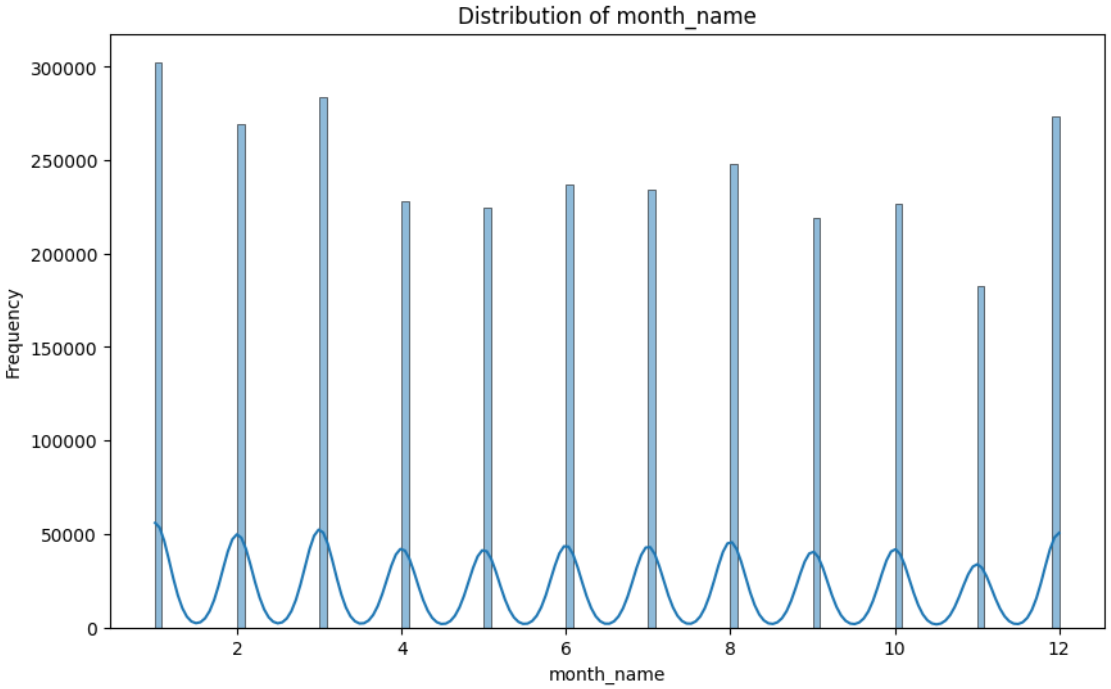
[ ]:
```python
# univariate analysis

for column in final_dataset.columns:
    variable_type = final_dataset[column].dtype

    summary_stats = final_dataset[column].describe()

    plt.figure(figsize=(10, 6))

    # For numerical variables, create a histogram
    if variable_type in ['int64', 'float64']:
        sns.histplot(data=final_dataset, x=column, kde=True)
        plt.title(f'Distribution of {column}')
        plt.xlabel(column)
        plt.ylabel('Frequency')

    # For categorical variables, create a bar plot
    else:
        sns.countplot(data=final_dataset, x=column)
        plt.title(f'Counts of {column}')
        plt.xlabel(column)
        plt.ylabel('Count')

    plt.show()

    # Print summary statistics
    print(f"Summary Statistics for {column}:")
    print(summary_stats)
```



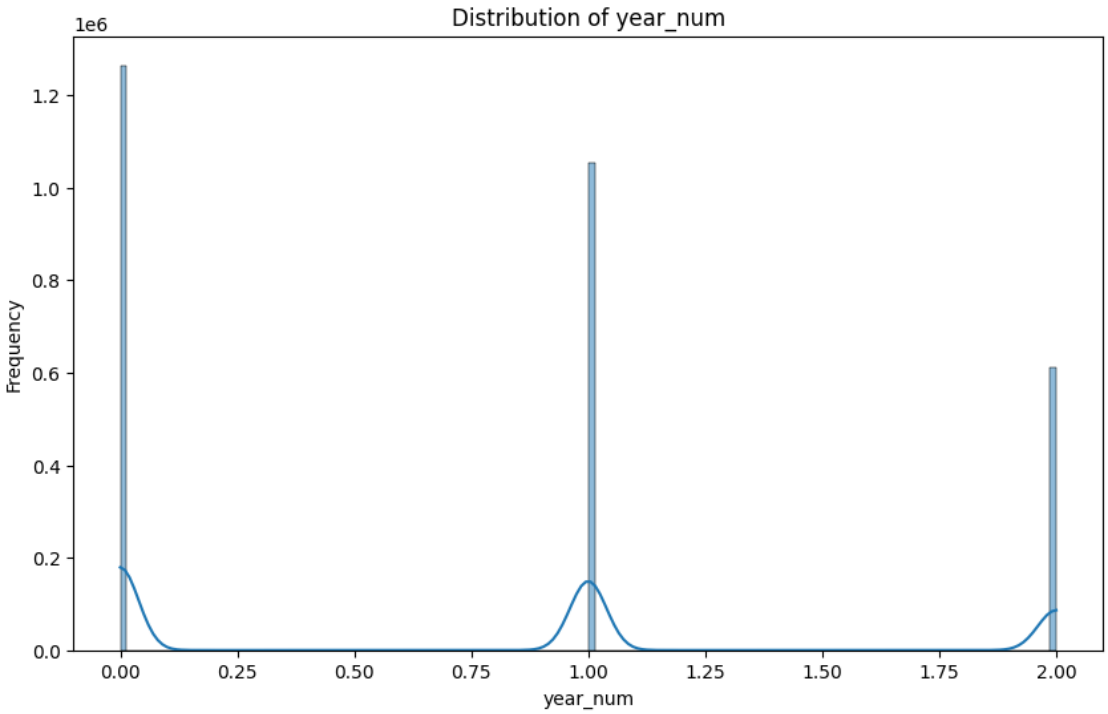

```
Summary Statistics for date:
count        2928483
unique          1034
top       28.12.2013
freq            9415
Name: date, dtype: object
```



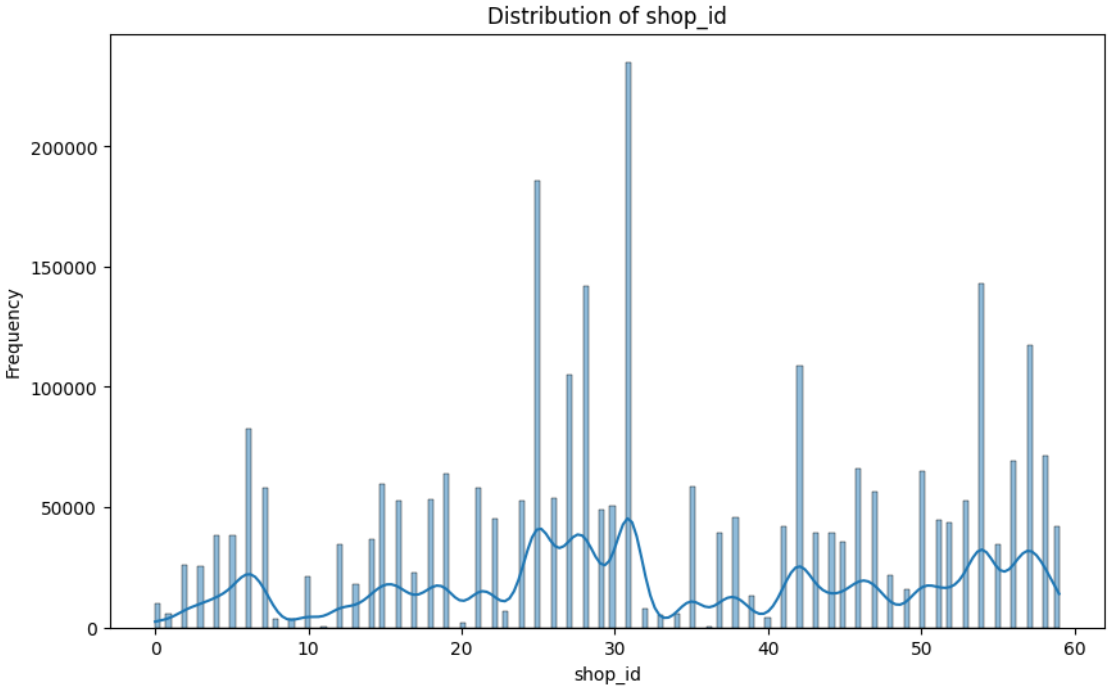

```
Summary Statistics for date_num:
count     2928483
unique         31
top            02
freq       103081
Name: date_num, dtype: object
```



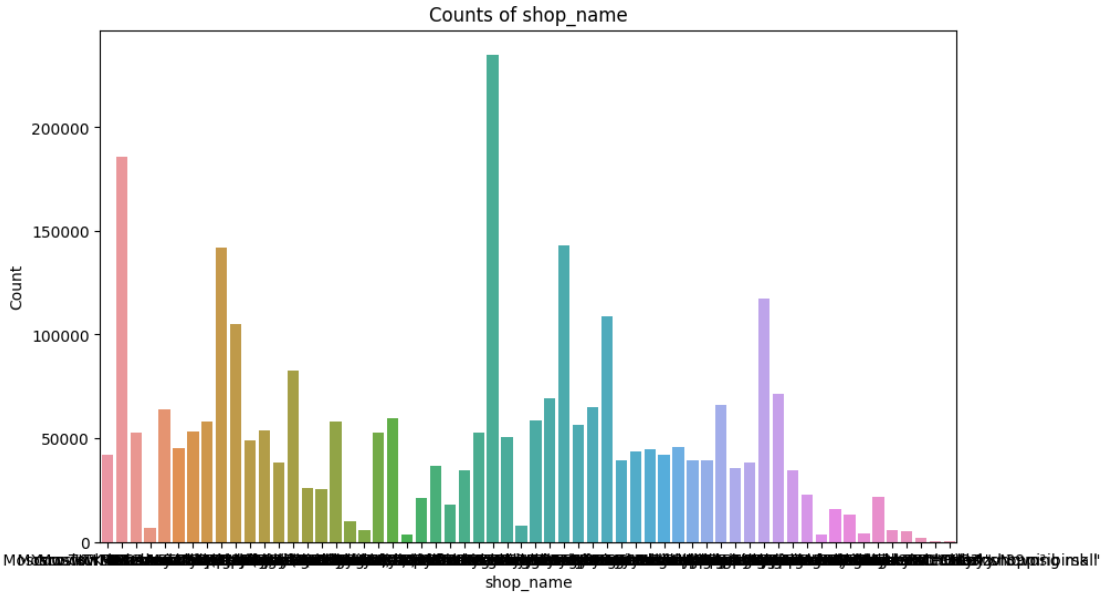

```
Summary Statistics for month_name:
count    2.928483e+06
mean     6.248408e+00
std      3.535921e+00
min      1.000000e+00
25%      3.000000e+00
50%      6.000000e+00
75%      9.000000e+00
max      1.200000e+01
Name: month_name, dtype: float64
```



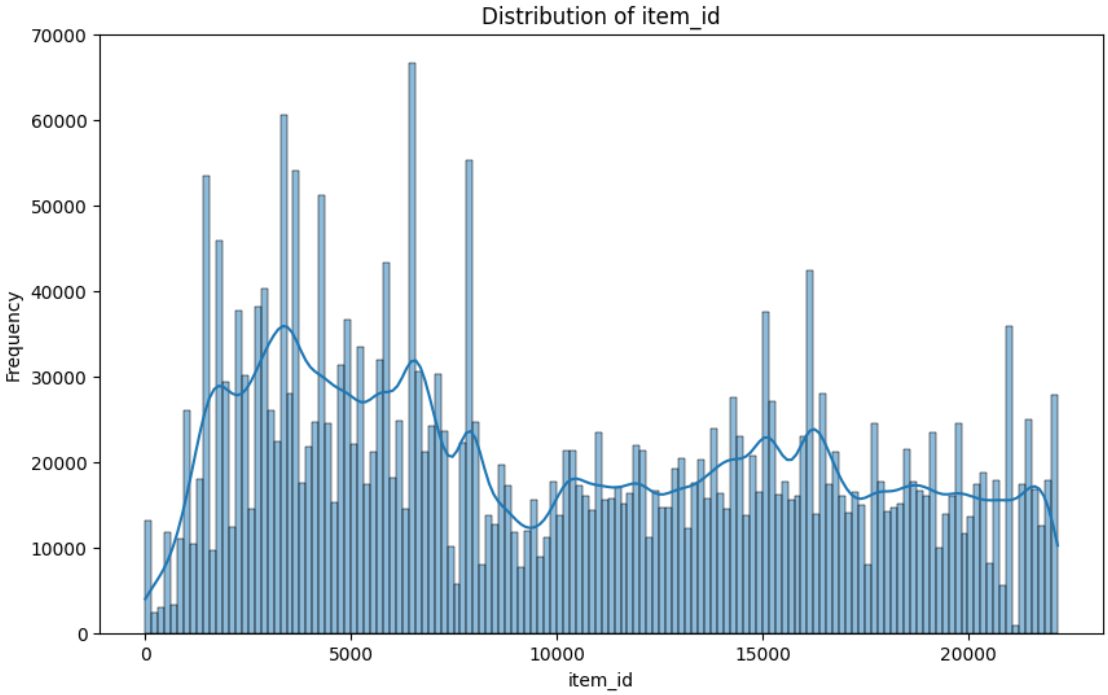

```
Summary Statistics for year_num:
count    2.928483e+06
mean     7.767790e-01
std      7.684598e-01
min      0.000000e+00
25%      0.000000e+00
50%      1.000000e+00
75%      1.000000e+00
max      2.000000e+00
Name: year_num, dtype: float64
```



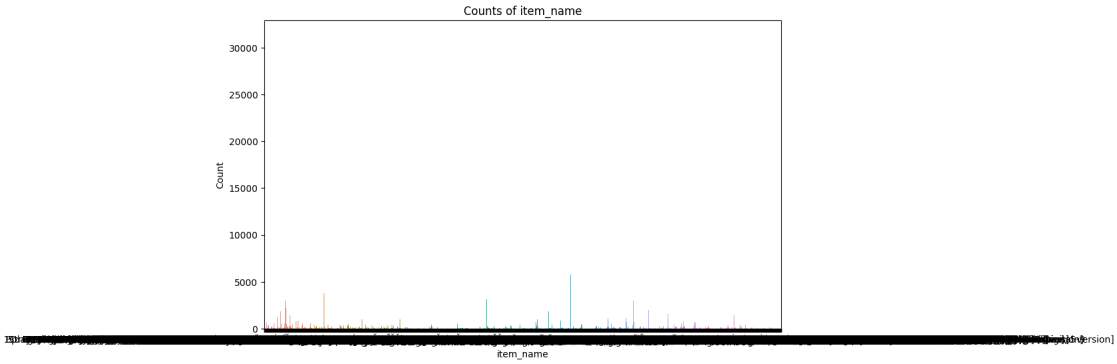

```
Summary Statistics for shop_id:
count    2.928483e+06
mean     3.300296e+01
std      1.622543e+01
min      0.000000e+00
25%      2.200000e+01
50%      3.100000e+01
75%      4.700000e+01
max      5.900000e+01
Name: shop_id, dtype: float64
```



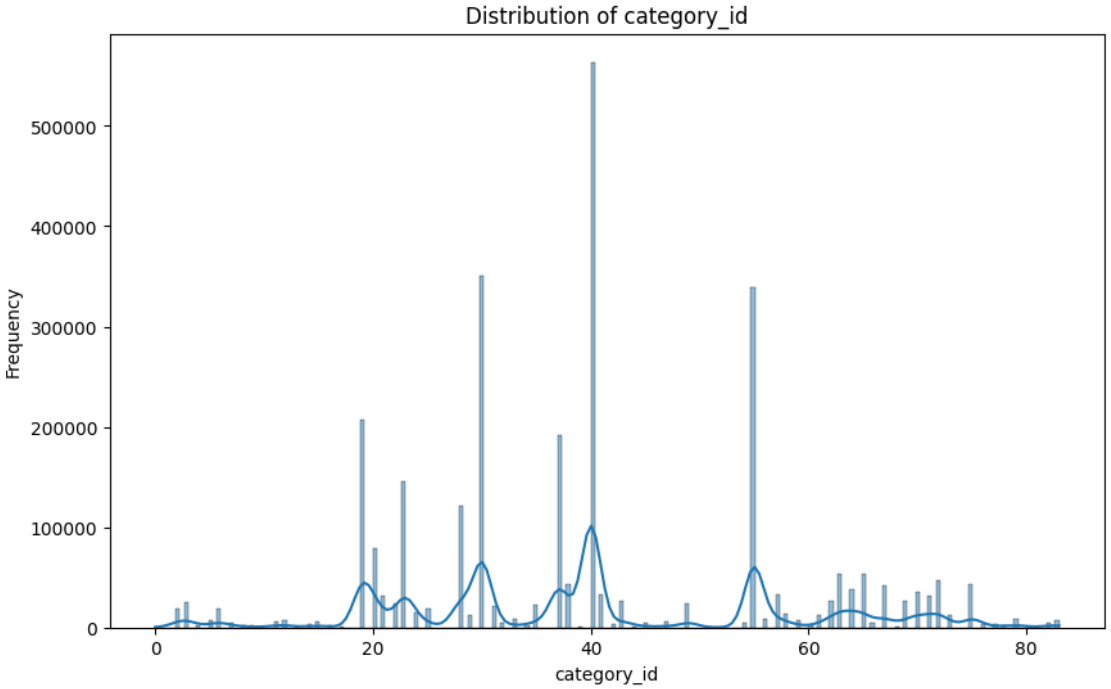

```
Summary Statistics for shop_name:
count                         2928483
unique                             60
top         Moscow TC" Semenovsky "
freq                          235185
Name: shop_name, dtype: object
```



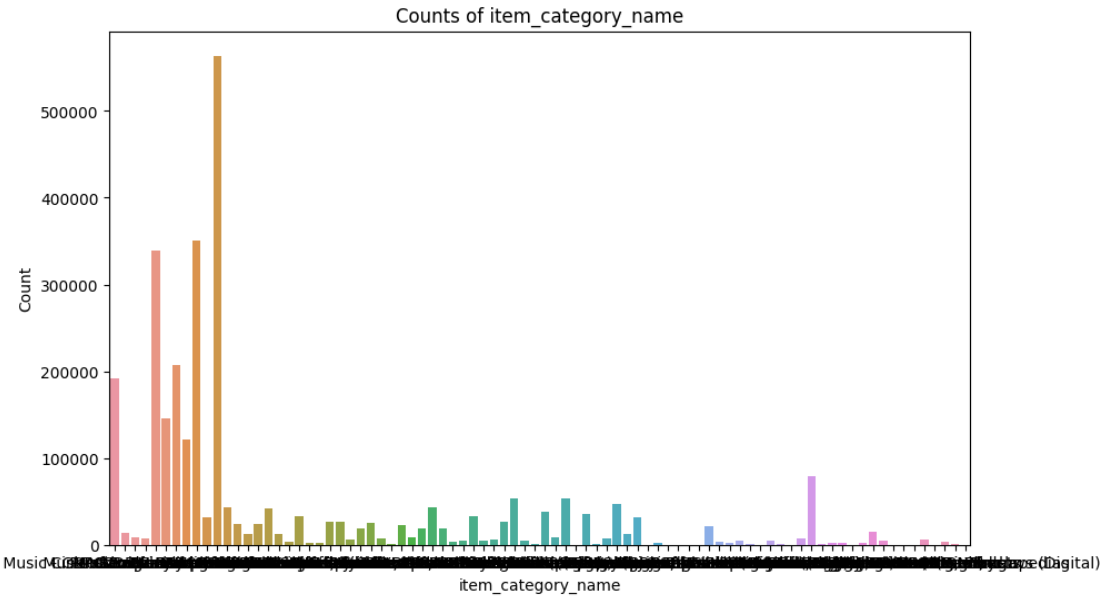
```
Summary Statistics for item_id:
count    2.928483e+06
mean     1.020028e+04
std      6.324391e+03
min      0.000000e+00
25%      4.477000e+03
50%      9.355000e+03
75%      1.569100e+04
max      2.216900e+04
Name: item_id, dtype: float64
```



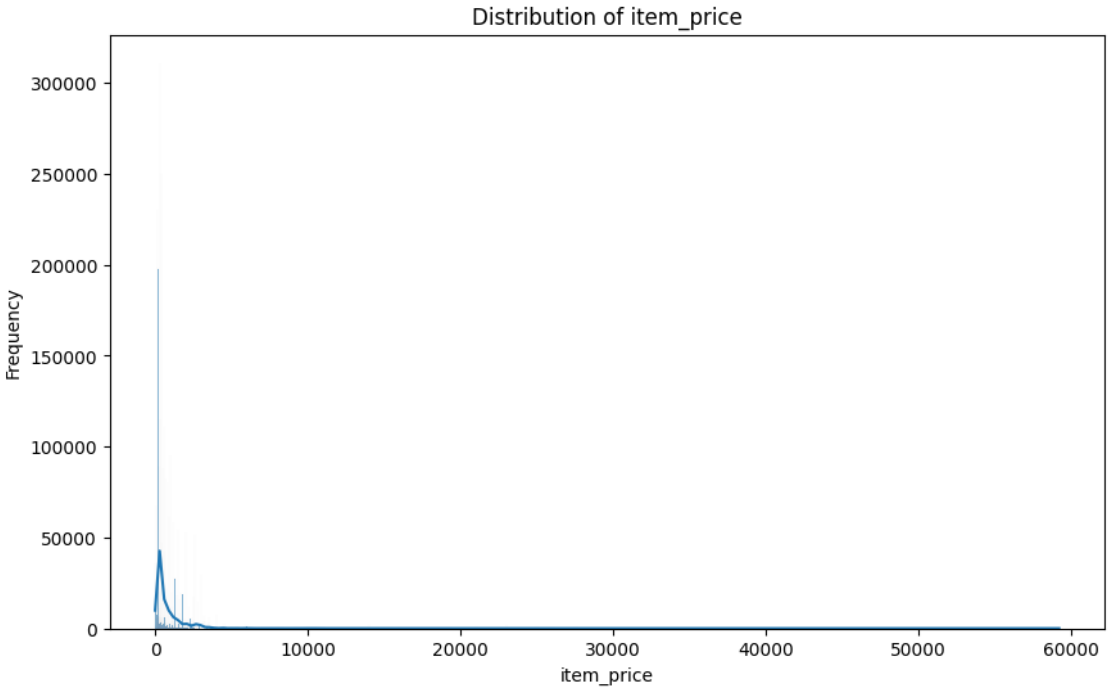

```
Summary Statistics for item_name:
count                                                2928483
unique                                                21782
top       Corporate package T-shirt 1C Interest white (3…
freq                                                 31336
Name: item_name, dtype: object
```



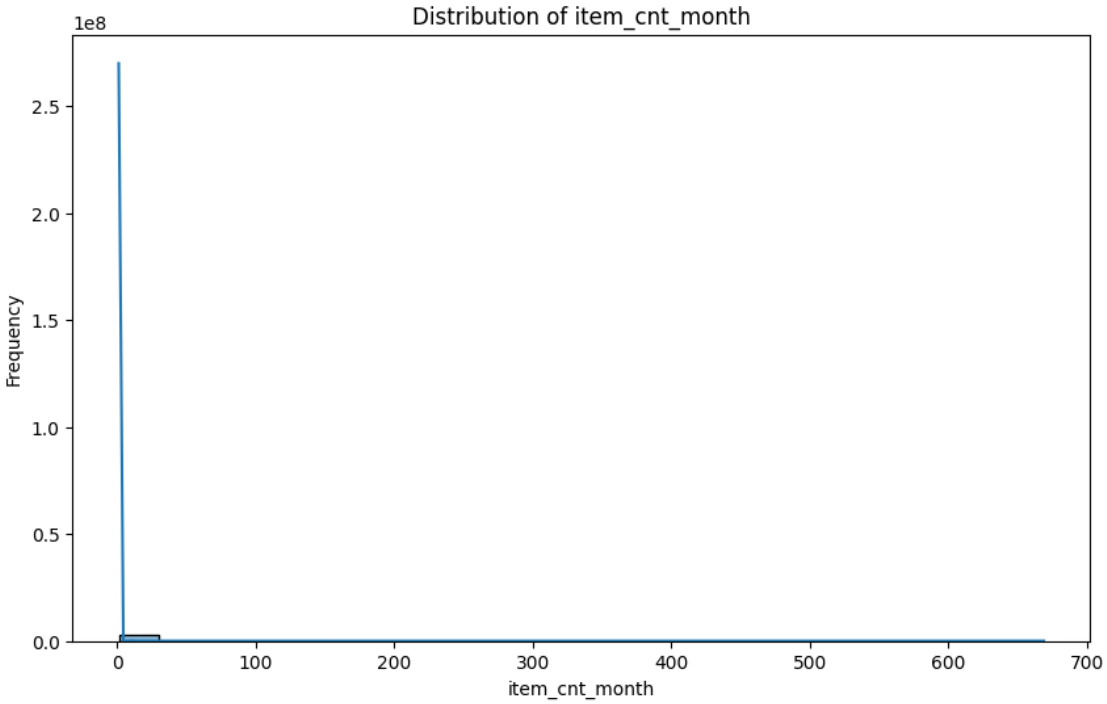

```
Summary Statistics for category_id:
count    2.928483e+06
mean     4.001637e+01
std      1.709809e+01
min      0.000000e+00
25%      2.800000e+01
50%      4.000000e+01
75%      5.500000e+01
max      8.300000e+01
Name: category_id, dtype: float64
```



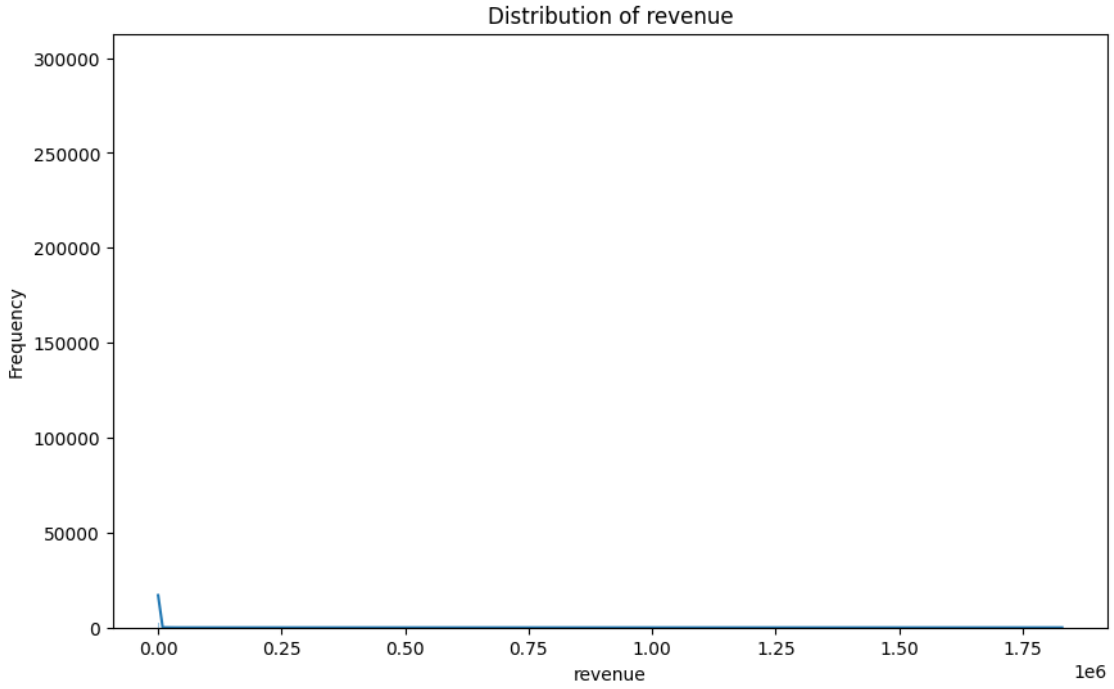

```
Summary Statistics for item_category_name:
count           2928483
unique               84
top        Cinema - DVD
freq             563937
Name: item_category_name, dtype: object
```



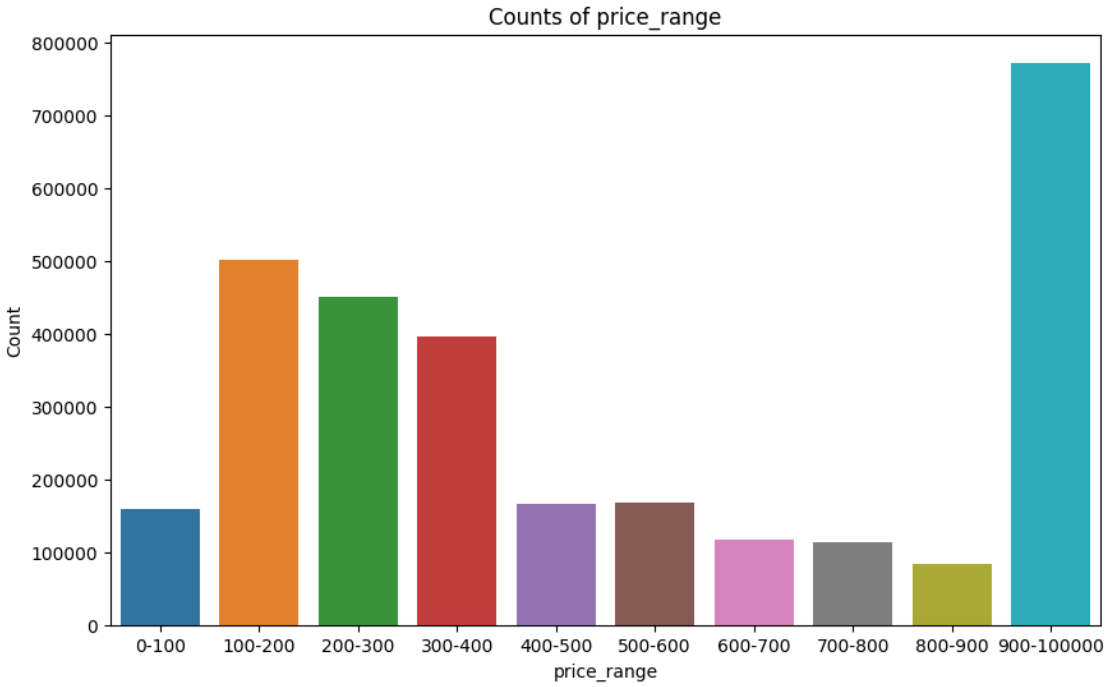
```
Summary Statistics for item_price:
count    2.928483e+06
mean     8.893627e+02
std      1.718155e+03
min      7.000000e-02
25%      2.490000e+02
50%      3.990000e+02
75%      9.990000e+02
max      5.920000e+04
Name: item_price, dtype: float64
```



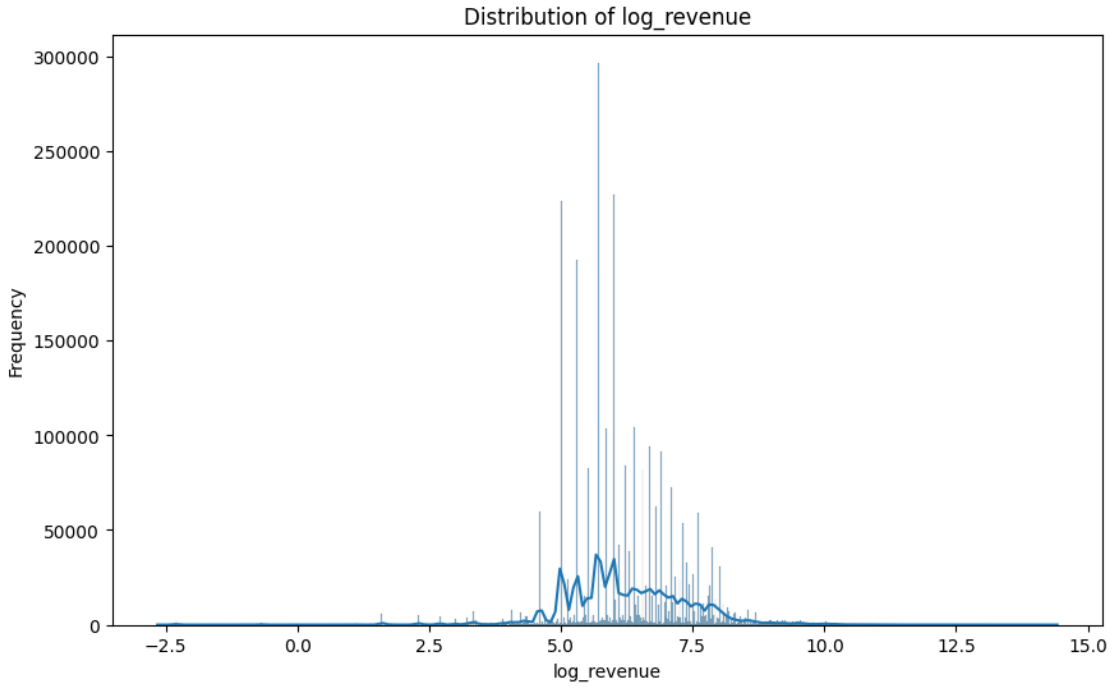

```
Summary Statistics for item_cnt_month:
count    2.928483e+06
mean     1.247257e+00
std      2.217429e+00
min      1.000000e+00
25%      1.000000e+00
50%      1.000000e+00
75%      1.000000e+00
max      6.690000e+02
Name: item_cnt_month, dtype: float64
```



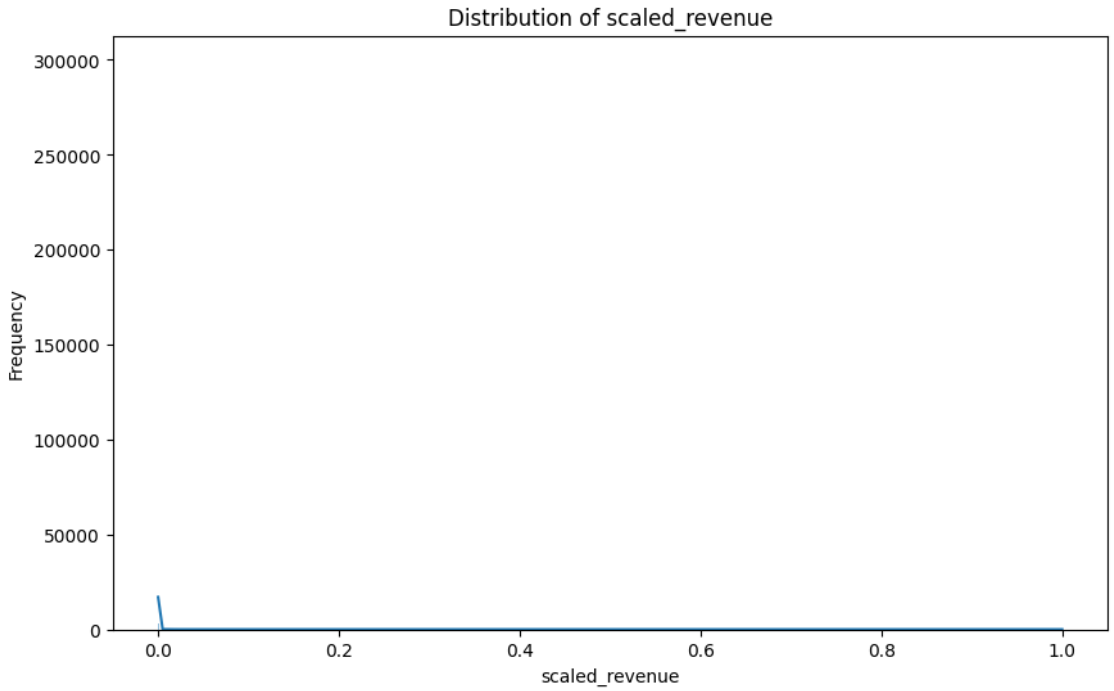

```
Summary Statistics for revenue:
count    2.928483e+06
mean     1.164267e+03
std      5.684853e+03
min      7.000000e-02
25%      2.490000e+02
50%      4.490000e+02
75%      1.090000e+03
max      1.829990e+06
Name: revenue, dtype: float64
```




```
Summary Statistics for price_range:
count        2928483
unique            10
top       900-100000
freq          772112
Name: price_range, dtype: object
```




```
Summary Statistics for log_revenue:
count    2.928483e+06
mean     6.254676e+00
std      1.171779e+00
min     -2.659260e+00
25%      5.517453e+00
50%      6.107023e+00
75%      6.993933e+00
max      1.441982e+01
Name: log_revenue, dtype: float64
```




```
Summary Statistics for scaled_revenue:
count    2.928483e+06
mean     6.361770e-04
std      3.106494e-03
min      0.000000e+00
25%      1.360281e-04
50%      2.453183e-04
75%      5.955934e-04
max      1.000000e+00
Name: scaled_revenue, dtype: float64
```

[ ]:
```python
#bivariate analysis

#can analysis by changing var1 and var2
var1 = 'item_price'
var2 = 'item_cnt_month'

var1_type = final_dataset[var1].dtype
var2_type = final_dataset[var2].dtype

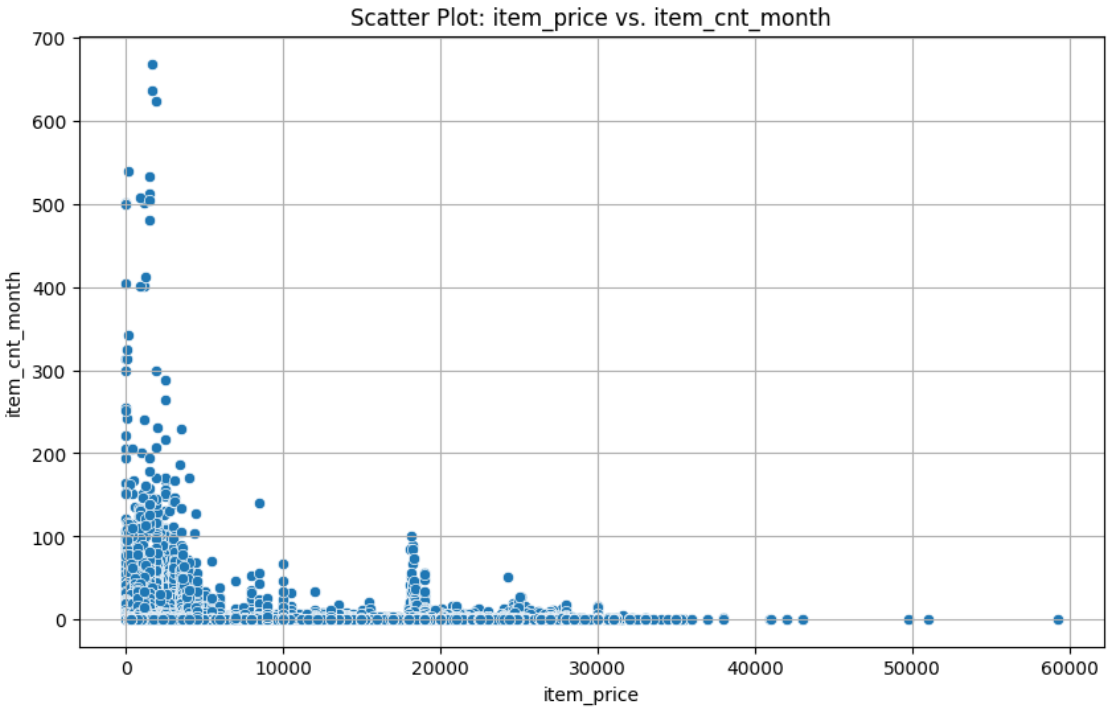
# Scatter Plot for Numerical vs. Numerical
if var1_type in ['int64', 'float64'] and var2_type in ['int64', 'float64']:
    plt.figure(figsize=(10, 6))
    sns.scatterplot(data=final_dataset, x=var1, y=var2)
    plt.title(f'Scatter Plot: {var1} vs. {var2}')
```

```
    plt.xlabel(var1)
    plt.ylabel(var2)
    plt.grid(True)
    plt.show()

# Box Plot for Categorical vs. Numerical
elif var1_type in ['object', 'category'] and var2_type in ['int64', 'float64']:
    plt.figure(figsize=(10, 6))
    sns.boxplot(data=final_dataset, x=var1, y=var2)
    plt.title(f'Box Plot: {var1} vs. {var2}')
    plt.xlabel(var1)
    plt.ylabel(var2)
    plt.grid(True)
    plt.show()

# Bar Plot for Categorical vs. Categorical
elif var1_type in ['object', 'category'] and var2_type in ['object',␣
 ↪'category']:
    crosstab = pd.crosstab(final_dataset[var1], final_dataset[var2])
    crosstab.plot(kind='bar', stacked=True, figsize=(10, 6))
    plt.title(f'Bar Plot: {var1} vs. {var2}')
    plt.xlabel(var1)
    plt.ylabel('Count')
    plt.grid(True)
    plt.show()

# Print correlation for Numerical vs. Numerical
if var1_type in ['int64', 'float64'] and var2_type in ['int64', 'float64']:
    correlation = final_dataset[[var1, var2]].corr().iloc[0, 1]
    print(f'Correlation between {var1} and {var2}: {correlation:.2f}')
```




```
Correlation between item_price and item_cnt_month: 0.01
```

[ ]:
```
#Exploratory Data Analysis (EDA)

print("Dataset Overview:")
print(final_dataset.info())

print("\nSummary Statistics for Numerical Variables:")
print(final_dataset.describe())

print("\nMissing Values:")
print(final_dataset.isnull().sum())

numerical_columns = ['month_name', 'year_num', 'shop_id', 'item_id',␣
 ↪'category_id', 'item_price', 'item_cnt_month', 'revenue', 'log_revenue',␣
 ↪'scaled_revenue']

for column in numerical_columns:
    plt.figure(figsize=(8, 4))
    sns.histplot(data=final_dataset, x=column, kde=True, bins=20)
    plt.title(f'Distribution of {column}')
    plt.xlabel(column)
    plt.ylabel('Frequency')
    plt.show()
```

```
# Visualize relationships between variables with a correlation matrix for␣
 ↪numerical variables
correlation_matrix = final_dataset[numerical_columns].corr()
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt=".2f")
plt.title("Correlation Heatmap for Numerical Variables")
plt.show()

# Explore categorical variables with bar plots
categorical_columns = ['shop_name', 'item_name', 'item_category_name',␣
 ↪'price_range']

for column in categorical_columns:
    plt.figure(figsize=(10, 6))
    sns.countplot(data=final_dataset, x=column)
    plt.title(f'Counts of {column}')
    plt.xlabel(column)
    plt.ylabel('Count')
    plt.xticks(rotation=90)
    plt.show()
```

```
Dataset Overview:
<class 'pandas.core.frame.DataFrame'>
Index: 2928483 entries, 0 to 2935848
Data columns (total 16 columns):
 #   Column              Dtype
---  ------              -----
 0   date                object
 1   date_num            object
 2   month_name          int64
 3   year_num            int64
 4   shop_id             int64
 5   shop_name           object
 6   item_id             int64
 7   item_name           object
 8   category_id         int64
 9   item_category_name  object
 10  item_price          float64
 11  item_cnt_month      int64
 12  revenue             float64
 13  price_range         category
 14  log_revenue         float64
 15  scaled_revenue      float64
dtypes: category(1), float64(4), int64(6), object(5)
memory usage: 360.3+ MB
None
```

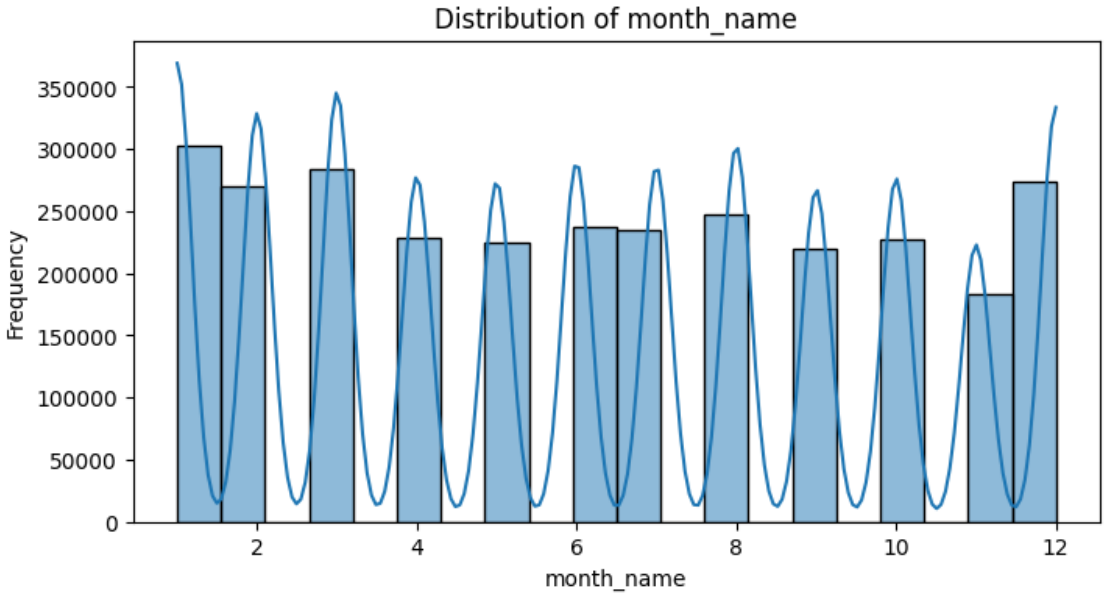
```
Summary Statistics for Numerical Variables:
         month_name      year_num       shop_id       item_id   category_id  \
count  2.928483e+06  2.928483e+06  2.928483e+06  2.928483e+06  2.928483e+06
mean   6.248408e+00  7.767790e-01  3.300296e+01  1.020028e+04  4.001637e+01
std    3.535921e+00  7.684598e-01  1.622543e+01  6.324391e+03  1.709809e+01
min    1.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00
25%    3.000000e+00  0.000000e+00  2.200000e+01  4.477000e+03  2.800000e+01
50%    6.000000e+00  1.000000e+00  3.100000e+01  9.355000e+03  4.000000e+01
75%    9.000000e+00  1.000000e+00  4.700000e+01  1.569100e+04  5.500000e+01
max    1.200000e+01  2.000000e+00  5.900000e+01  2.216900e+04  8.300000e+01

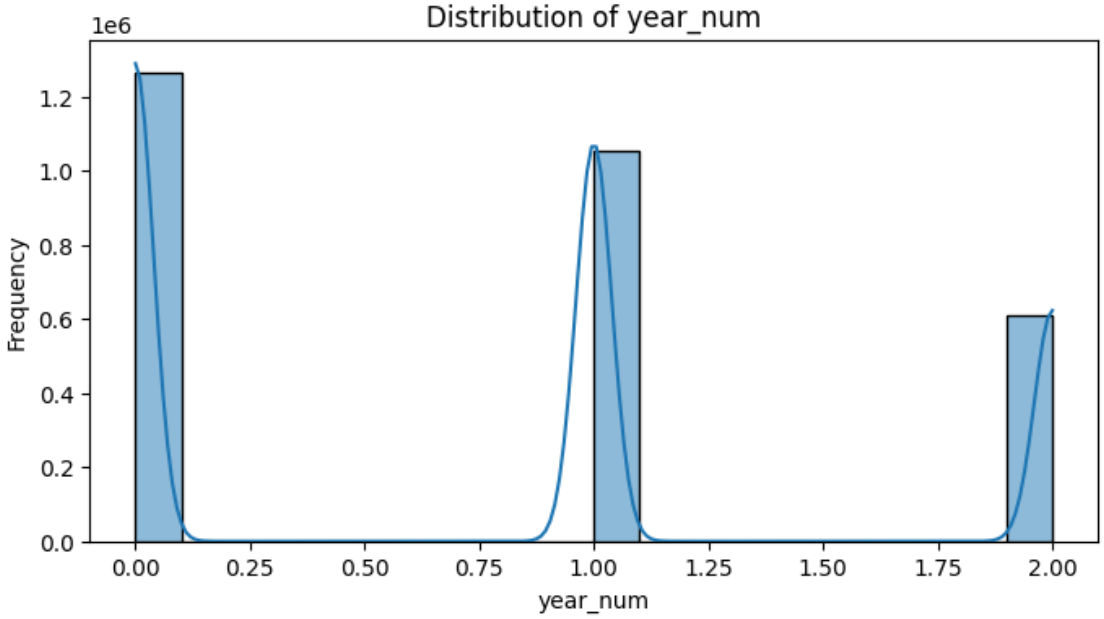
          item_price  item_cnt_month       revenue   log_revenue  \
count  2.928483e+06    2.928483e+06  2.928483e+06  2.928483e+06
mean   8.893627e+02    1.247257e+00  1.164267e+03  6.254676e+00
std    1.718155e+03    2.217429e+00  5.684853e+03  1.171779e+00
min    7.000000e-02    1.000000e+00  7.000000e-02 -2.659260e+00
25%    2.490000e+02    1.000000e+00  2.490000e+02  5.517453e+00
50%    3.990000e+02    1.000000e+00  4.490000e+02  6.107023e+00
75%    9.990000e+02    1.000000e+00  1.090000e+03  6.993933e+00
max    5.920000e+04    6.690000e+02  1.829990e+06  1.441982e+01

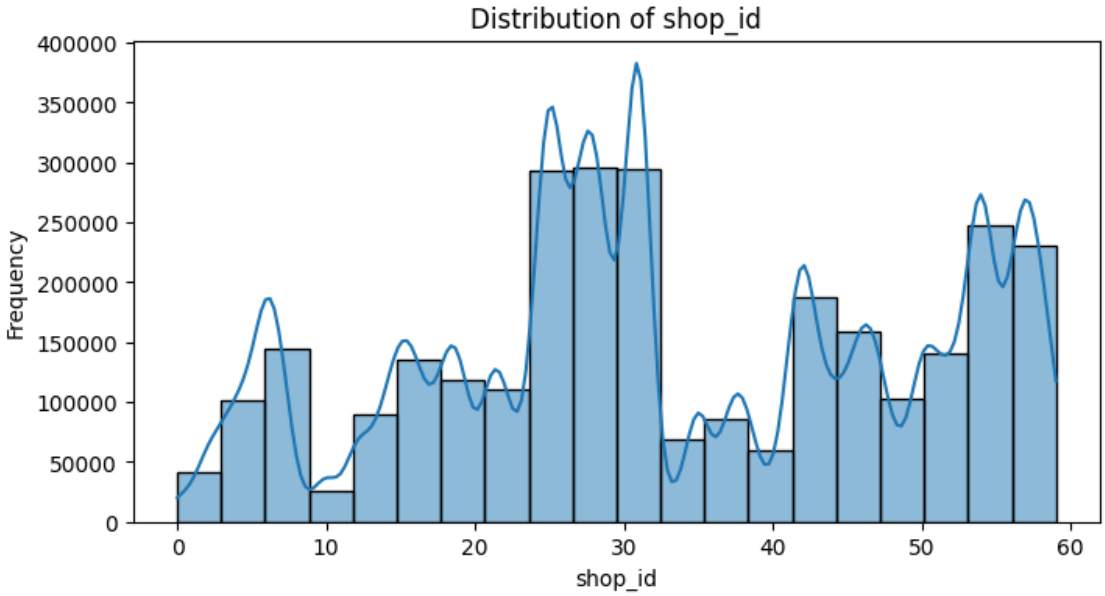
       scaled_revenue
count    2.928483e+06
mean     6.361770e-04
std      3.106494e-03
min      0.000000e+00
25%      1.360281e-04
50%      2.453183e-04
75%      5.955934e-04
max      1.000000e+00

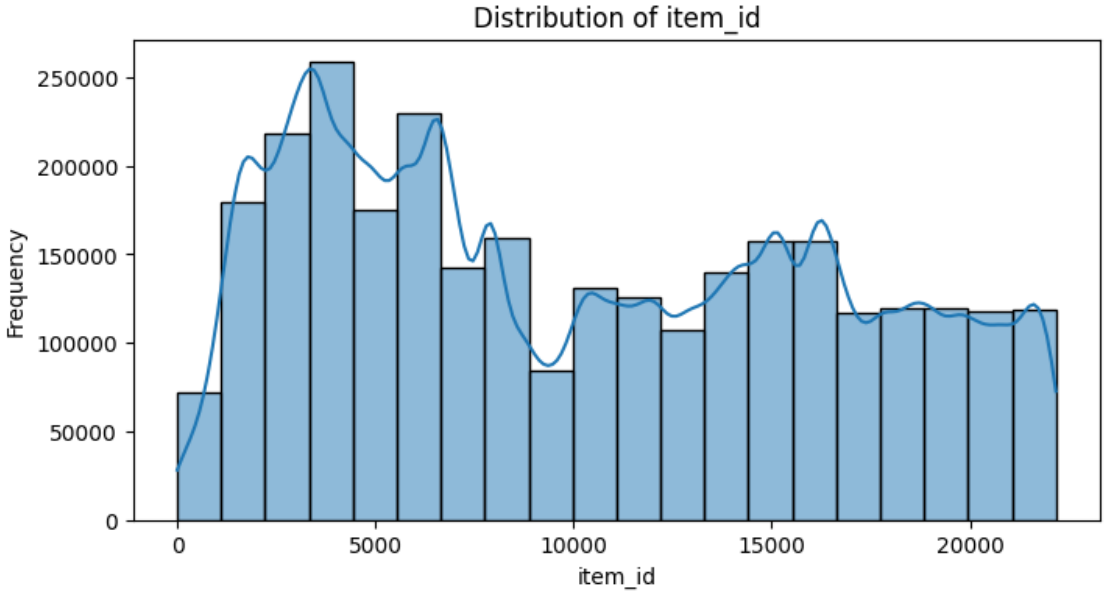
Missing Values:
date                0
date_num            0
month_name          0
year_num            0
shop_id             0
shop_name           0
item_id             0
item_name           0
category_id         0
item_category_name  0
item_price          0
item_cnt_month      0
revenue             0
price_range         0
log_revenue         0
```

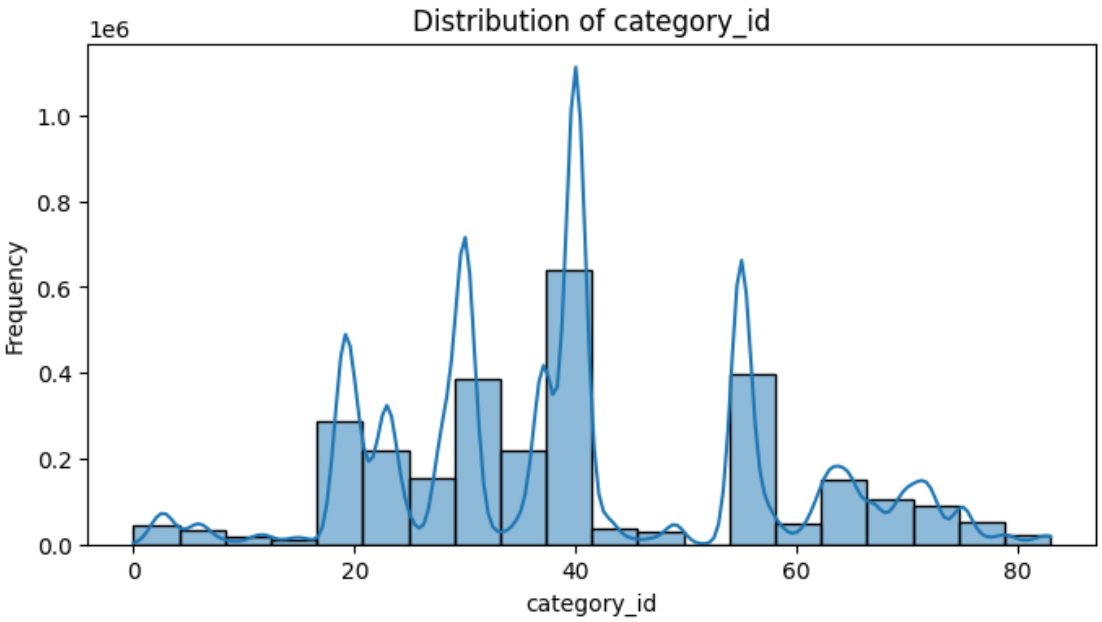
```
scaled_revenue         0
dtype: int64
```

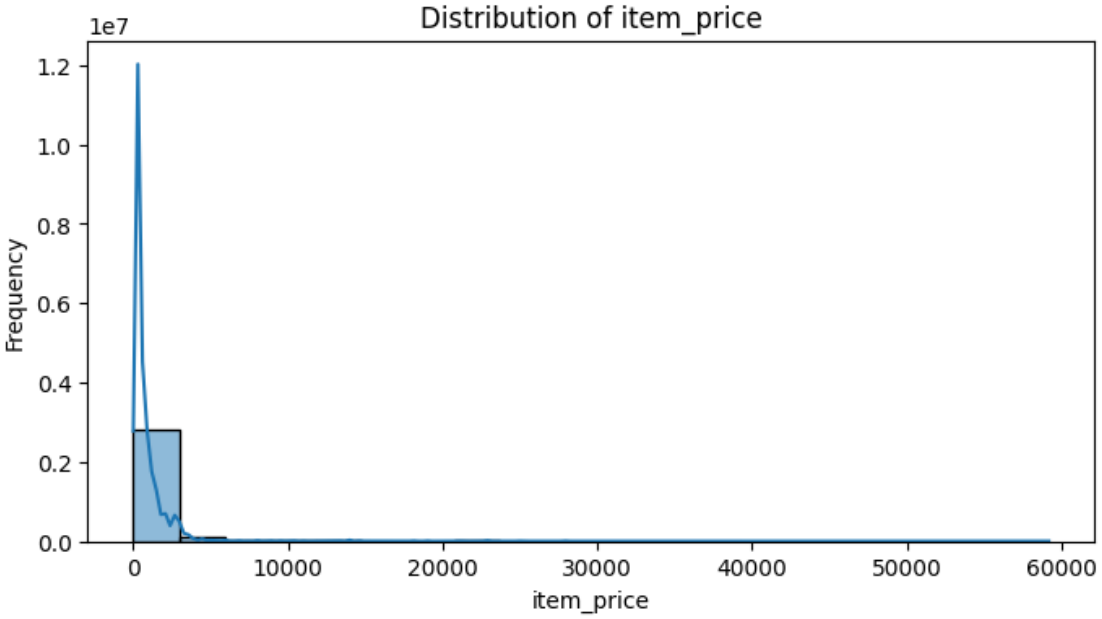


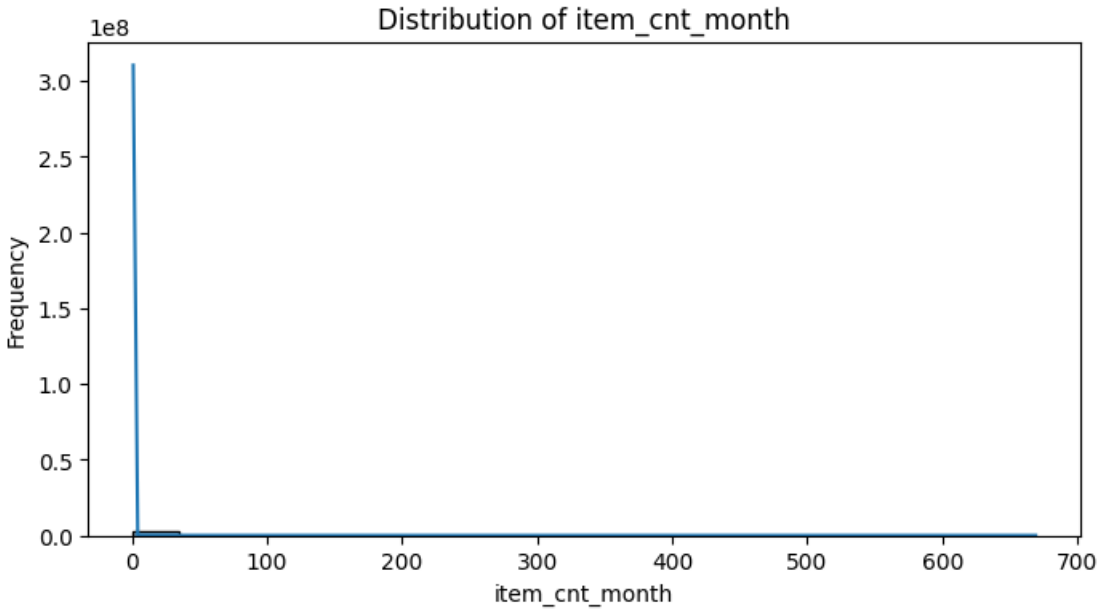


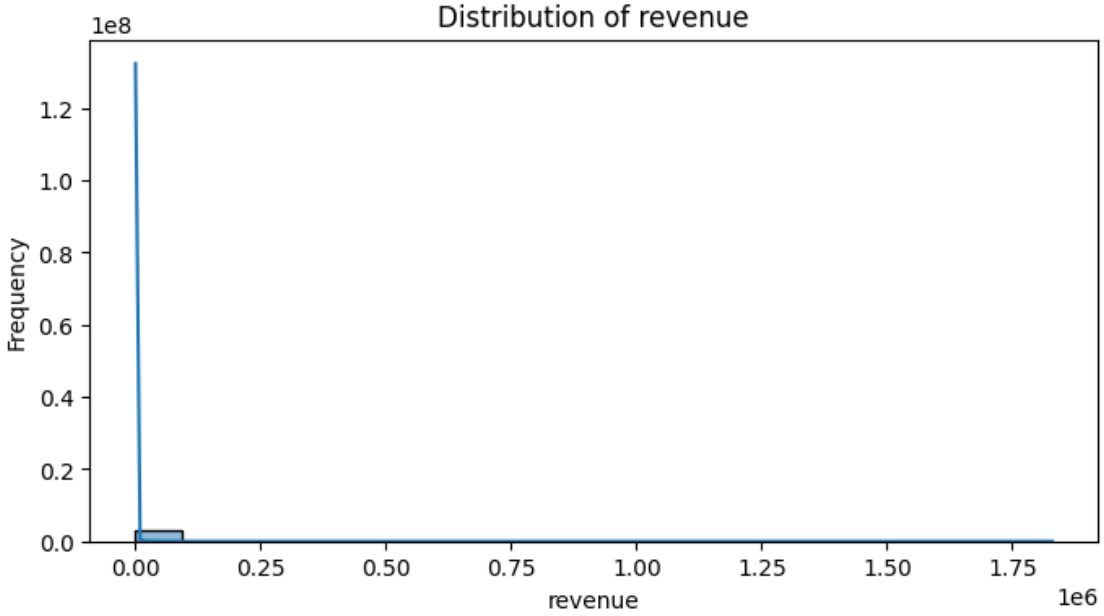

Distribution of shop_id
Frequency
shop_id
0
50000
100000
150000
200000
250000
300000
350000
400000
0
10
20
30
40
50
60

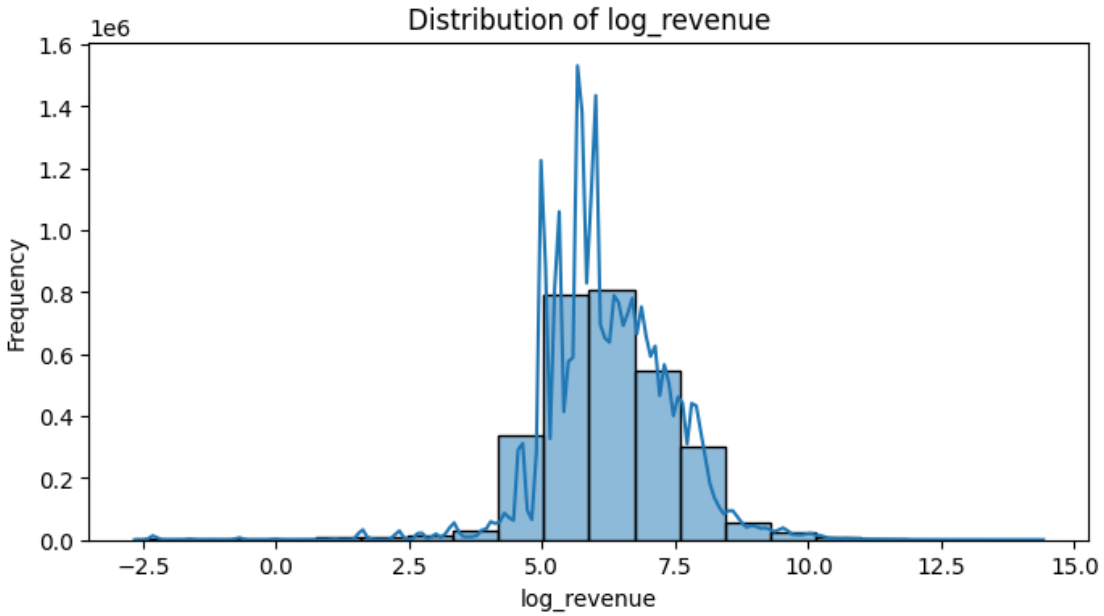

Distribution of item_id
Frequency
item_id
0
50000
100000
150000
200000
250000
0
5000
10000
15000
20000

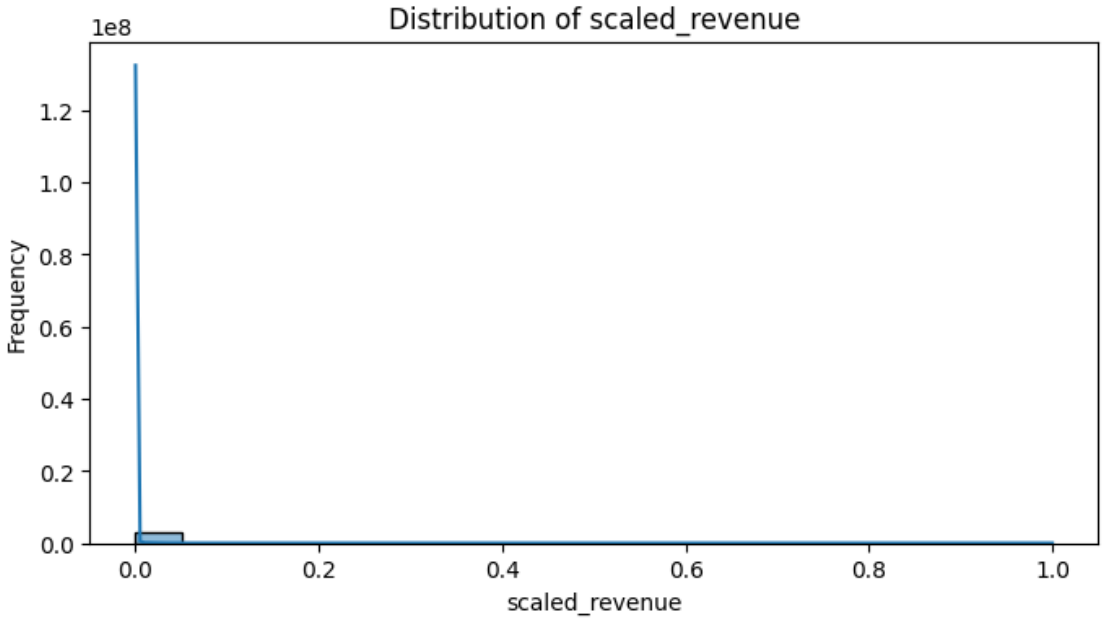

Distribution of category_id
1e6
1.0
0.8
0.6
0.4
0.2
0.0
Frequency
0
20
40
60
80
category_id

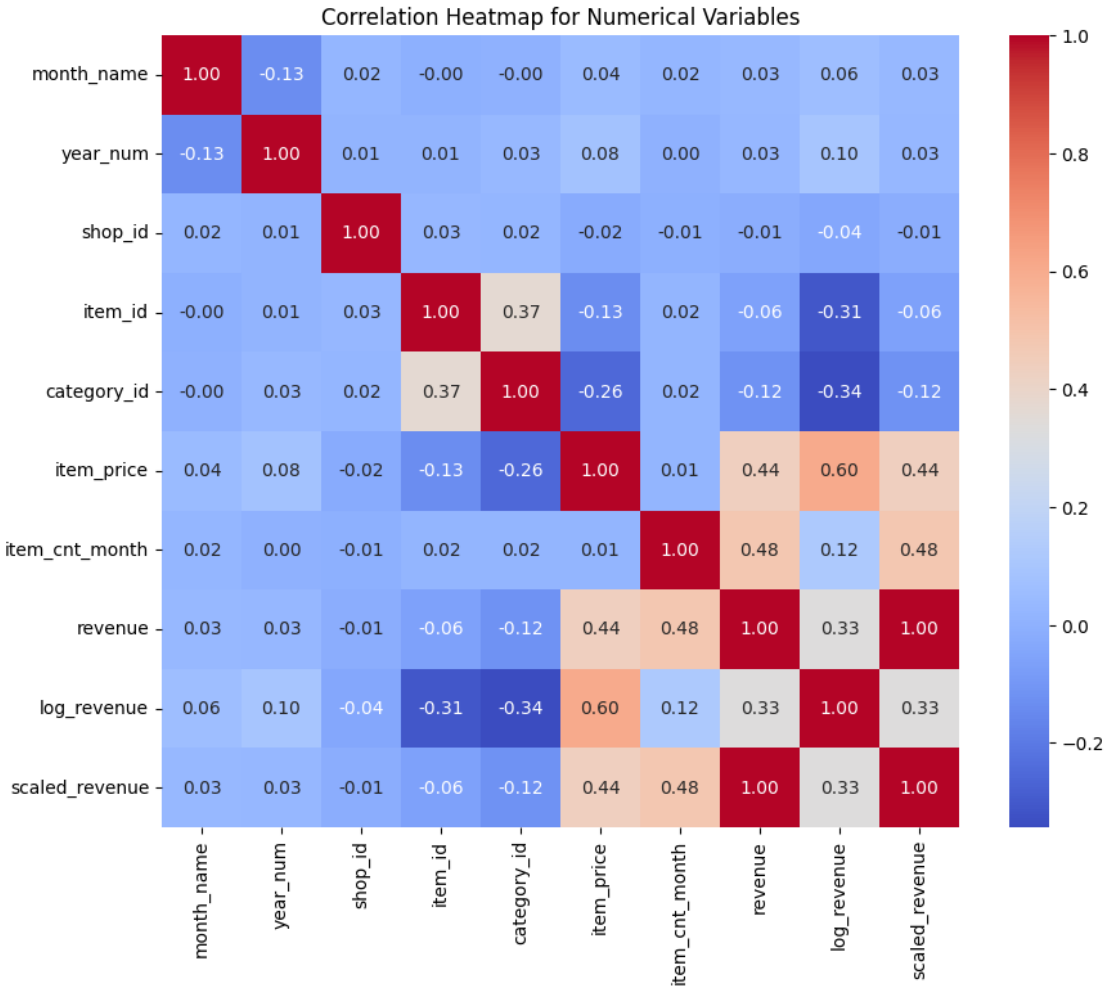

Distribution of item_price
1e7
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Frequency
0
10000
20000
30000
40000
50000
60000
item_price

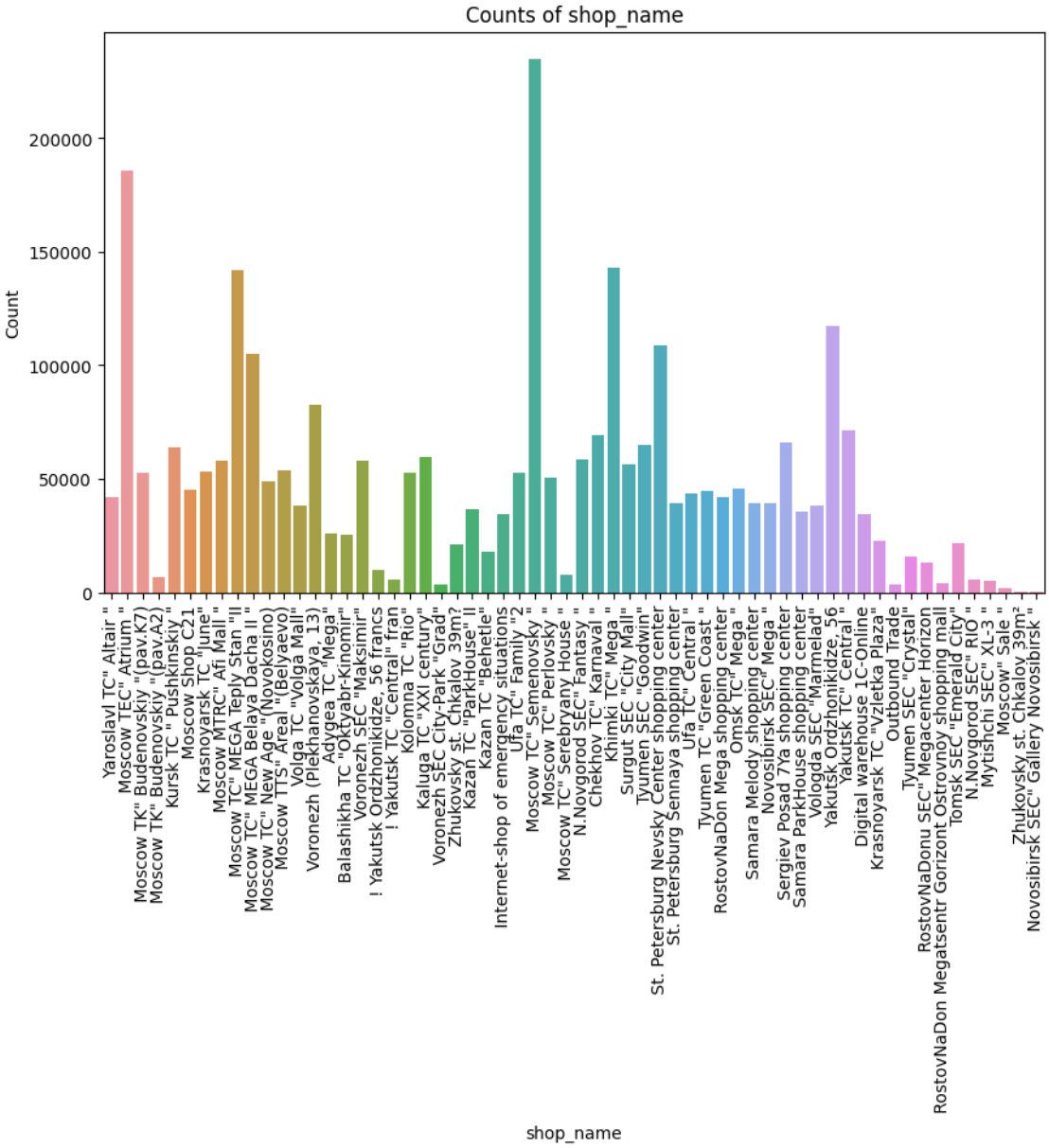

Distribution of item_cnt_month
1e8
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Frequency
0
100
200
300
400
500
600
700
item_cnt_month

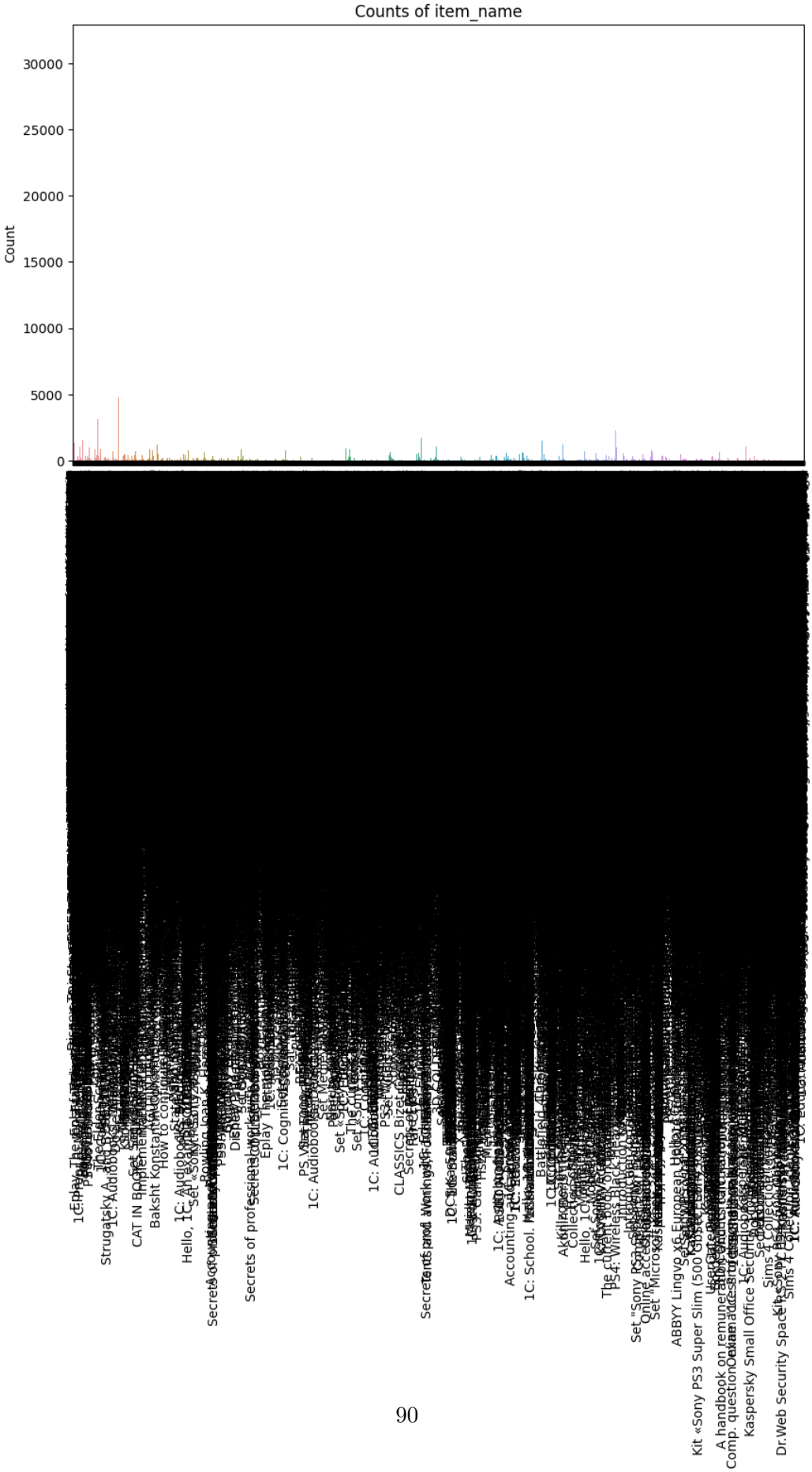

Distribution of revenue
1e8
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Frequency
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
revenue
1e6

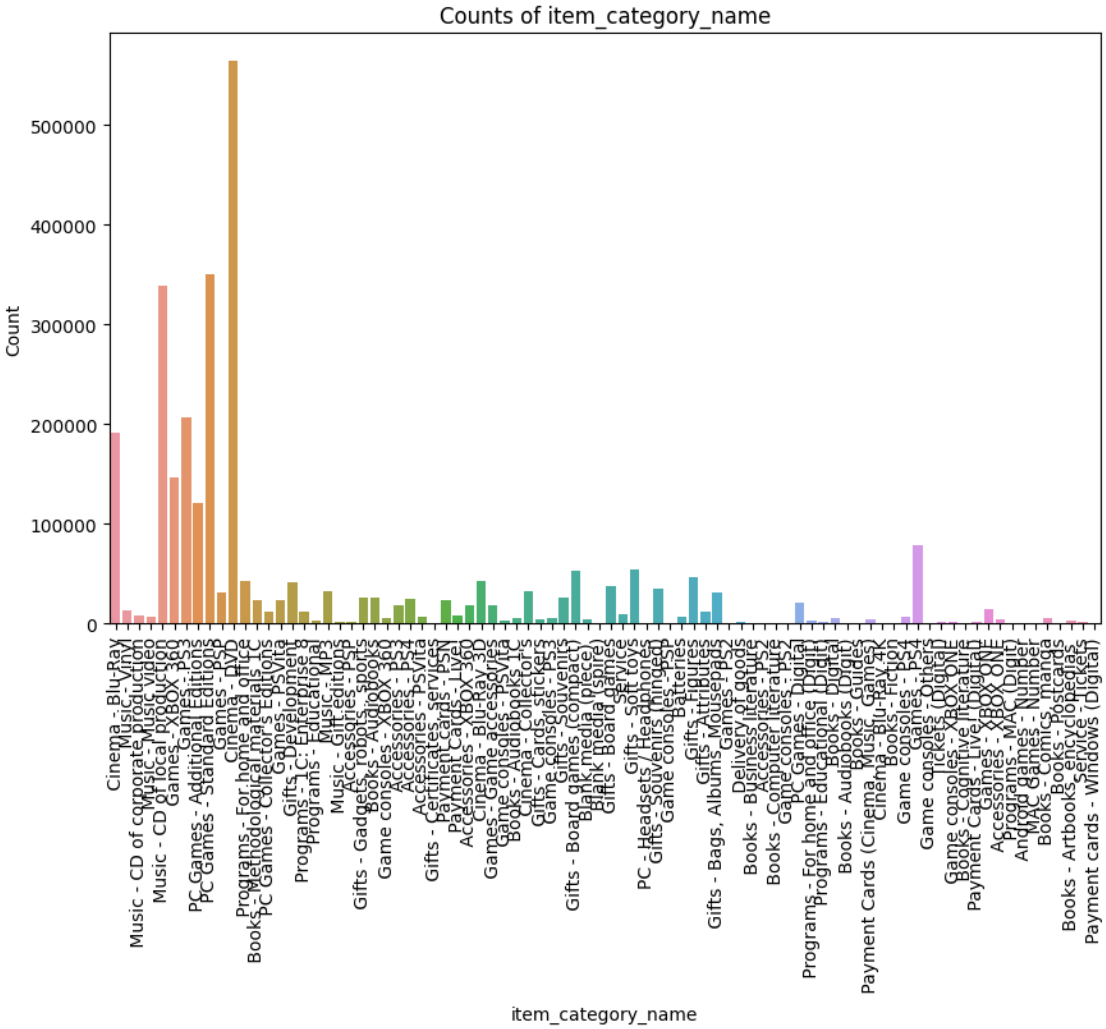

Distribution of log_revenue
1e6
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Frequency
−2.5
0.0
2.5
5.0
7.5
10.0
12.5
15.0
log_revenue

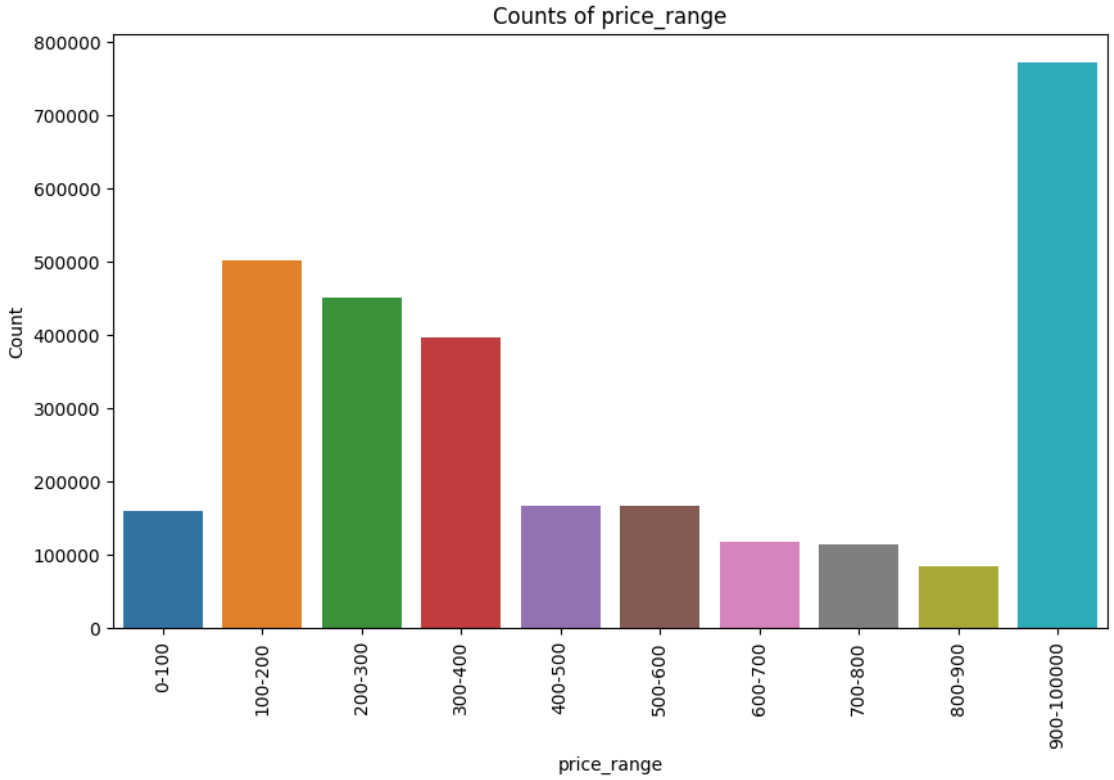

Distribution of scaled_revenue
1e8
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Frequency
0.0
0.2
0.4
0.6
0.8
1.0
scaled_revenue


Correlation Heatmap for Numerical Variables
month_name 1.00 -0.13 0.02 -0.00 -0.00 0.04 0.02 0.03 0.06 0.03
year_num -0.13 1.00 0.01 0.01 0.03 0.08 0.00 0.03 0.10 0.03
shop_id 0.02 0.01 1.00 0.03 0.02 -0.02 -0.01 -0.01 -0.04 -0.01
item_id -0.00 0.01 0.03 1.00 0.37 -0.13 0.02 -0.06 -0.31 -0.06
category_id -0.00 0.03 0.02 0.37 1.00 -0.26 0.02 -0.12 -0.34 -0.12
item_price 0.04 0.08 -0.02 -0.13 -0.26 1.00 0.01 0.44 0.60 0.44
item_cnt_month 0.02 0.00 -0.01 0.02 0.02 0.01 1.00 0.48 0.12 0.48
revenue 0.03 0.03 -0.01 -0.06 -0.12 0.44 0.48 1.00 0.33 1.00
log_revenue 0.06 0.10 -0.04 -0.31 -0.34 0.60 0.12 0.33 1.00 0.33
scaled_revenue 0.03 0.03 -0.01 -0.06 -0.12 0.44 0.48 1.00 0.33 1.00
month_name
year_num
shop_id
item_id
category_id
item_price
item_cnt_month
revenue
log_revenue
scaled_revenue
1.0
0.8
0.6
0.4
0.2
0.0
−0.2


Counts of shop_name
Count
0
50000
100000
150000
200000
shop_name
Yaroslavl TC" Altair "
Moscow TEC" Atrium"
Moscow TK" Budenovskiy "(pav.K7)
Moscow TK" Budenovskiy "(pav.A2)
Kursk TC " Pushkinskiy"
Moscow Shop C21"
Krasnoyarsk TC "June"
Moscow MTRC" Afi Mall "
Moscow TC" MEGA Teply Stan "II
Moscow TC" MEGA Belaya Dacha II "
Moscow TC" New Age "(Novokosino)
Moscow TTS" Areal "(Belyaevo)
Volga TC "Volga Mall"
Voronezh (Plekhanovskaya, 13)
Adygea TC "Mega"
Balashikha TC "Oktyabr-Kinomir"
Voronezh SEC "Maksimir"
! Yakutsk Ordzhonikidze, 56 francs
! Yakutsk TC "Central" fran
Kolomna TC "Rio"
Kaluga TC "XXI century"
Voronezh SEC City-Park "Grad"
Zhukovsky st. Chkalov 39m?
Kazan TC "ParkHouse" II
Kazan TC "Behetle"
Internet-shop of emergency situations
Ufa TC" Family "2
Moscow TC" Semenovsky "
Moscow TC" Perlovsky "
Moscow TC" Serebryany House "
N.Novgorod SEC" Fantasy "
Chekhov TC" Karnaval "
Khimki TC" Mega "
Surgut SEC "City Mall"
Tyumen SEC "Goodwin"
St. Petersburg Nevsky Center shopping center
St. Petersburg Sennaya shopping center
Ufa TC" Central "
Tyumen TC "Green Coast "
RostovNaDon Mega shopping center "
Omsk TC" Mega "
Samara Melody shopping center
Novosibirsk SEC" Mega "
Sergiev Posad 7Ya shopping center
Samara ParkHouse shopping center
Vologda SEC "Marmelad"
Yakutsk Ordzhonikidze, 56
Yakutsk TC" Central "
Digital warehouse 1C-Online
Krasnoyarsk TC "Vzletka Plaza"
Outbound Trade
Tyumen SEC "Crystal"
RostovNaDonu SEC" Megacenter Horizon
RostovNaDon Megatsentr Gorizont Ostrovnoy shopping mall
Tomsk SEC "Emerald City"
N.Novgorod SEC" RIO "
Mytishchi SEC" XL-3 "
Moscow" Sale "
Zhukovsky st. Chkalov 39m²
Novosibirsk SEC" Gallery Novosibirsk "


Counts of item_name
Count
30000
25000
20000
15000
10000
5000
0
item_name


Counts of item_category_name
Count
0
100000
200000
300000
400000
500000
item_category_name
Cinema - Blu-Ray
Music - Vinyl
Music - CD of corporate production
Music - Music video
Music - CD of local production
Games - Xbox 360
Games - PS3
PC Games - Additional Editions
PC Games - Standard Editions
Games - PSP
Cinema - DVD
Programs - For home and office
Books - Methodical literature
PC Games - Collectors Editions
Games - PSVita
Gifts - Development
Programs - 1C: Enterprise 8
Programs - Educational
Music - Gifts
Accessories - PS3
Gifts - Gadgets, robots, sports
Books - Audiobooks
Game consoles - Xbox 360
Accessories - PS4
Accessories - PSVita
Gifts - Certificates, services
Payment Cards - PSN
Payment Cards - Live!
Accessories - Xbox 360
Games - Digital
Game consoles - PSVita
Books - Audiobooks 1C
Cinema - Collectors
Gifts - Cards, stickers
Gifts - Souvenirs
Gifts - Board games (compact)
Blank media (piece)
Blank media (spire)
Gifts - Board games
Gifts - Soft toys
PC - Headsets / Headphones
Gifts - Souvenirs (magnet)
Game consoles - PSP
Batteries
Gifts - Figures
Gifts - Bags, Albums, Mousepads
Games - PS2
Delivery of goods
Books - Business literature
Accessories - PS2
Books - Computer literature
Game consoles - Digital
PC Games - Digital
Programs - For home and office (Digit)
Programs - Educational (Digit)
Books - Digital
Books - Audiobooks (Digit)
Books - Games
Payment Cards (Cinema, Music, Games)
Cinema - Blu-Ray 4K
Books - Fiction
Game consoles - PS4
Game consoles - Other
Tickets (Digital)
Game consoles - XBOX ONE
Books - Cognitive literature
Payment Cards - Live! (Digital)
Games - XBOX ONE
Accessories - XBOX ONE
Programs - MAC (Digit)
Android games - Number
MAC Games - Number
Books - Comics, manga
Books - Postcards
Books - Artbooks, encyclopedias
Payment cards - Windows (Digital)



[ ]:
```
#inferential analysis

np.random.seed(42)
data = np.random.normal(loc=70, scale=10, size=100)

# Create a DataFrame from the generated data
df = pd.DataFrame({'measurement': data})

# Calculate the sample mean and standard deviation
sample_mean = df['measurement'].mean()
sample_std = df['measurement'].std()

# Define a hypothetical population mean for comparison
population_mean = 75

# Perform a t-test to compare the sample mean with the population mean
t_statistic, p_value = stats.ttest_1samp(df['measurement'], population_mean)

# Print results
print(f"Sample Mean: {sample_mean:.2f}")
print(f"Sample Standard Deviation: {sample_std:.2f}")
print(f"Population Mean: {population_mean}")
```

```
print(f"T-Statistic: {t_statistic:.2f}")
print(f"P-Value: {p_value:.4f}")

# Determine statistical significance
alpha = 0.05  # Significance level (adjust as needed)
if p_value < alpha:
    print("Reject the null hypothesis: The sample mean is statistically␣
 ↪different from the population mean.")
else:
    print("Fail to reject the null hypothesis: There is no significant␣
 ↪difference between the sample mean and the population mean.")
```

```
Sample Mean: 68.96
Sample Standard Deviation: 9.08
Population Mean: 75
T-Statistic: -6.65
P-Value: 0.0000
Reject the null hypothesis: The sample mean is statistically different from the
population mean.
```

[ ]:
```
#dianostic analytics

# Generate a hypothetical dataset
np.random.seed(42)
X = np.random.rand(100, 1) * 10
y = 3 * X + 2 + np.random.randn(100, 1)

# Create a DataFrame from the generated data
df = pd.DataFrame({'X': X.flatten(), 'y': y.flatten()})

# Diagnostic Plots
plt.figure(figsize=(12, 6))

plt.tight_layout()
plt.show()
```

```
<Figure size 1200x600 with 0 Axes>
```

[ ]:
```
#qualitative analytics

category_counts = final_dataset['item_category_name'].value_counts()
print(category_counts)

cross_tab = pd.crosstab(final_dataset['shop_name'],␣
 ↪final_dataset['item_category_name'])
print(cross_tab)

category_frequency = (final_dataset['price_range'] == 'Low').sum()
```

```
print(f"Frequency of 'Low' price range: {category_frequency}")

average_price_per_category = final_dataset.
  ↪groupby('item_category_name')['item_price'].mean()
print(average_price_per_category)

category_counts.plot(kind='bar', figsize=(10, 6))
plt.title('Item Category Counts')
plt.xlabel('Category')
plt.ylabel('Count')
plt.xticks(rotation=90)
plt.show()
```

```
item_category_name
 Cinema - DVD                        563937
 PC Games - Standard Editions        350787
 Music - CD of local production      339127
 Games - PS3                         207371
 Cinema - Blu-Ray                    191931
                                      …
 Books - Guides                           3
 Accessories - PS2                        2
 Books - Postcards                        2
 Books - Cognitive literature             1
 Game consoles - PS2                      1
Name: count, Length: 84, dtype: int64
item_category_name                                  Accessories - PS2  \
shop_name
 Adygea TC "Mega"                                                    0
 Balashikha TC "Oktyabr-Kinomir"                                     0
 Chekhov TC" Karnaval "                                              0
 Digital warehouse 1C-Online                                         0
 Internet-shop of emergency situations                               0
 Kaluga TC "XXI century"                                             0
 Kazan TC "Behetle"                                                  0
 Kazan TC "ParkHouse" II                                             0
 Khimki TC" Mega "                                                   0
 Kolomna TC "Rio"                                                    0
 Krasnoyarsk TC "June"                                               0
 Krasnoyarsk TC "Vzletka Plaza"                                      0
 Kursk TC " Pushkinskiy "                                            0
 Moscow MTRC" Afi Mall "                                             0
 Moscow Shop C21                                                     0
 Moscow TC" MEGA Belaya Dacha II "                                   0
 Moscow TC" MEGA Teply Stan "II                                      0
 Moscow TC" New Age "(Novokosino)                                    0
 Moscow TC" Perlovsky "                                              0
 Moscow TC" Semenovsky "                                             0
```

```
 Moscow TC" Serebryany House "                                    0
 Moscow TEC" Atrium "                                             0
 Moscow TK" Budenovskiy "(pav.A2)                                 0
 Moscow TK" Budenovskiy "(pav.K7)                                 0
 Moscow TTS" Areal "(Belyaevo)                                    0
 Moscow" Sale "                                                   0
 Mytishchi SEC" XL-3 "                                            0
 N.Novgorod SEC" Fantasy "                                        0
 N.Novgorod SEC" RIO "                                            0
 Novosibirsk SEC" Gallery Novosibirsk "                           0
 Novosibirsk SEC" Mega "                                          0
 Omsk TC" Mega "                                                  0
 Outbound Trade                                                   0
 RostovNaDon Mega shopping center                                 0
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                  0
 RostovNaDonu SEC" Megacenter Horizon                             0
 Samara Melody shopping center                                    0
 Samara ParkHouse shopping center                                 1
 Sergiev Posad 7Ya shopping center                                0
 St. Petersburg Nevsky Center shopping center                     0
 St. Petersburg Sennaya shopping center                           0
 Surgut SEC "City Mall"                                           0
 Tomsk SEC "Emerald City"                                         0
 Tyumen SEC "Crystal"                                             0
 Tyumen SEC "Goodwin"                                             0
 Tyumen TC "Green Coast "                                         0
 Ufa TC" Central "                                                0
 Ufa TC" Family "2                                                0
 Volga TC "Volga Mall"                                            0
 Vologda SEC "Marmelad"                                           0
 Voronezh (Plekhanovskaya, 13)                                    0
 Voronezh SEC "Maksimir"                                          0
 Voronezh SEC City-Park "Grad"                                    0
 Yakutsk Ordzhonikidze, 56                                        0
 Yakutsk TC" Central "                                            0
 Yaroslavl TC" Altair "                                           0
 Zhukovsky st. Chkalov 39m?                                       0
 Zhukovsky st. Chkalov 39m²                                       0
! Yakutsk Ordzhonikidze, 56 francs                                 1
! Yakutsk TC "Central" fran                                       0

item_category_name                              Accessories - PS3  \
shop_name
 Adygea TC "Mega"                                              338
 Balashikha TC "Oktyabr-Kinomir"                               199
 Chekhov TC" Karnaval "                                        319
 Digital warehouse 1C-Online                                     0
 Internet-shop of emergency situations                         213
```

Kaluga TC "XXI century"	337
Kazan TC "Behetle"	0
Kazan TC "ParkHouse" II	218
Khimki TC" Mega "	814
Kolomna TC "Rio"	418
Krasnoyarsk TC "June"	689
Krasnoyarsk TC "Vzletka Plaza"	191
Kursk TC " Pushkinskiy "	424
Moscow MTRC" Afi Mall "	244
Moscow Shop C21	119
Moscow TC" MEGA Belaya Dacha II "	868
Moscow TC" MEGA Teply Stan "II	986
Moscow TC" New Age "(Novokosino)	461
Moscow TC" Perlovsky "	360
Moscow TC" Semenovsky "	1154
Moscow TC" Serebryany House "	38
Moscow TEC" Atrium "	972
Moscow TK" Budenovskiy "(pav.A2)	71
Moscow TK" Budenovskiy "(pav.K7)	368
Moscow TTS" Areal "(Belyaevo)	307
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	41
N.Novgorod SEC" Fantasy "	382
N.Novgorod SEC" RIO "	0
Novosibirsk SEC" Gallery Novosibirsk "	0
Novosibirsk SEC" Mega "	226
Omsk TC" Mega "	485
Outbound Trade	22
RostovNaDon Mega shopping center	309
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	46
Samara Melody shopping center	128
Samara ParkHouse shopping center	210
Sergiev Posad 7Ya shopping center	472
St. Petersburg Nevsky Center shopping center	548
St. Petersburg Sennaya shopping center	354
Surgut SEC "City Mall"	552
Tomsk SEC "Emerald City"	104
Tyumen SEC "Crystal"	102
Tyumen SEC "Goodwin"	665
Tyumen TC "Green Coast "	222
Ufa TC" Central "	244
Ufa TC" Family "2	329
Volga TC "Volga Mall"	301
Vologda SEC "Marmelad"	229
Voronezh (Plekhanovskaya, 13)	414
Voronezh SEC "Maksimir"	447
Voronezh SEC City-Park "Grad"	19

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 Yakutsk Ordzhonikidze, 56                                  592
 Yakutsk TC" Central "                                      308
 Yaroslavl TC" Altair "                                     218
 Zhukovsky st. Chkalov 39m?                                 134
 Zhukovsky st. Chkalov 39m²                                   2
! Yakutsk Ordzhonikidze, 56 francs                           93
! Yakutsk TC "Central" fran                                  58

item_category_name                          Accessories - PS4  \
shop_name
 Adygea TC "Mega"                                           470
 Balashikha TC "Oktyabr-Kinomir"                            344
 Chekhov TC" Karnaval "                                     425
 Digital warehouse 1C-Online                                  0
 Internet-shop of emergency situations                      514
 Kaluga TC "XXI century"                                    460
 Kazan TC "Behetle"                                           8
 Kazan TC "ParkHouse" II                                    389
 Khimki TC" Mega "                                          868
 Kolomna TC "Rio"                                           469
 Krasnoyarsk TC "June"                                      636
 Krasnoyarsk TC "Vzletka Plaza"                             218
 Kursk TC " Pushkinskiy "                                   457
 Moscow MTRC" Afi Mall "                                    581
 Moscow Shop C21                                            322
 Moscow TC" MEGA Belaya Dacha II "                         1076
 Moscow TC" MEGA Teply Stan "II                            1229
 Moscow TC" New Age "(Novokosino)                           514
 Moscow TC" Perlovsky "                                     373
 Moscow TC" Semenovsky "                                   1614
 Moscow TC" Serebryany House "                               13
 Moscow TEC" Atrium "                                      1539
 Moscow TK" Budenovskiy "(pav.A2)                            11
 Moscow TK" Budenovskiy "(pav.K7)                           496
 Moscow TTS" Areal "(Belyaevo)                              492
 Moscow" Sale "                                               0
 Mytishchi SEC" XL-3 "                                       66
 N.Novgorod SEC" Fantasy "                                  563
 N.Novgorod SEC" RIO "                                       83
 Novosibirsk SEC" Gallery Novosibirsk "                       6
 Novosibirsk SEC" Mega "                                    357
 Omsk TC" Mega "                                            532
 Outbound Trade                                              34
 RostovNaDon Mega shopping center                           295
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…              1
 RostovNaDonu SEC" Megacenter Horizon                       141
 Samara Melody shopping center                              231
 Samara ParkHouse shopping center                           267
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Sergiev Posad 7Ya shopping center	645
St. Petersburg Nevsky Center shopping center	1117
St. Petersburg Sennaya shopping center	487
Surgut SEC "City Mall"	862
Tomsk SEC "Emerald City"	355
Tyumen SEC "Crystal"	239
Tyumen SEC "Goodwin"	638
Tyumen TC "Green Coast "	237
Ufa TC" Central "	358
Ufa TC" Family "2	426
Volga TC "Volga Mall"	317
Vologda SEC "Marmelad"	313
Voronezh (Plekhanovskaya, 13)	644
Voronezh SEC "Maksimir"	508
Voronezh SEC City-Park "Grad"	0
Yakutsk Ordzhonikidze, 56	786
Yakutsk TC" Central "	512
Yaroslavl TC" Altair "	370
Zhukovsky st. Chkalov 39m?	196
Zhukovsky st. Chkalov 39m²	4
! Yakutsk Ordzhonikidze, 56 francs	35
! Yakutsk TC "Central" fran	15

item_category_name	Accessories - PSP \
shop_name	
Adygea TC "Mega"	39
Balashikha TC "Oktyabr-Kinomir"	28
Chekhov TC" Karnaval "	45
Digital warehouse 1C-Online	0
Internet-shop of emergency situations	9
Kaluga TC "XXI century"	62
Kazan TC "Behetle"	0
Kazan TC "ParkHouse" II	19
Khimki TC" Mega "	98
Kolomna TC "Rio"	136
Krasnoyarsk TC "June"	49
Krasnoyarsk TC "Vzletka Plaza"	17
Kursk TC " Pushkinskiy "	59
Moscow MTRC" Afi Mall "	17
Moscow Shop C21	11
Moscow TC" MEGA Belaya Dacha II "	95
Moscow TC" MEGA Teply Stan "II	61
Moscow TC" New Age "(Novokosino)	52
Moscow TC" Perlovsky "	68
Moscow TC" Semenovsky "	136
Moscow TC" Serebryany House "	9
Moscow TEC" Atrium "	45
Moscow TK" Budenovskiy "(pav.A2)	4

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 Moscow TK" Budenovskiy "(pav.K7)                                38
 Moscow TTS" Areal "(Belyaevo)                                   21
 Moscow" Sale "                                                   0
 Mytishchi SEC" XL-3 "                                            1
 N.Novgorod SEC" Fantasy "                                       19
 N.Novgorod SEC" RIO "                                            0
 Novosibirsk SEC" Gallery Novosibirsk "                           0
 Novosibirsk SEC" Mega "                                         19
 Omsk TC" Mega "                                                 38
 Outbound Trade                                                   0
 RostovNaDon Mega shopping center                                44
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                 0
 RostovNaDonu SEC" Megacenter Horizon                             2
 Samara Melody shopping center                                    4
 Samara ParkHouse shopping center                                23
 Sergiev Posad 7Ya shopping center                               41
 St. Petersburg Nevsky Center shopping center                    35
 St. Petersburg Sennaya shopping center                          36
 Surgut SEC "City Mall"                                          85
 Tomsk SEC "Emerald City"                                         0
 Tyumen SEC "Crystal"                                            12
 Tyumen SEC "Goodwin"                                            90
 Tyumen TC "Green Coast "                                        55
 Ufa TC" Central "                                               55
 Ufa TC" Family "2                                               68
 Volga TC "Volga Mall"                                           90
 Vologda SEC "Marmelad"                                          39
 Voronezh (Plekhanovskaya, 13)                                   22
 Voronezh SEC "Maksimir"                                         90
 Voronezh SEC City-Park "Grad"                                    2
 Yakutsk Ordzhonikidze, 56                                      115
 Yakutsk TC" Central "                                           73
 Yaroslavl TC" Altair "                                          52
 Zhukovsky st. Chkalov 39m?                                       6
 Zhukovsky st. Chkalov 39m²                                       0
! Yakutsk Ordzhonikidze, 56 francs                               35
! Yakutsk TC "Central" fran                                      23

item_category_name                                Accessories - PSVita  \
shop_name
 Adygea TC "Mega"                                                 49
 Balashikha TC "Oktyabr-Kinomir"                                 107
 Chekhov TC" Karnaval "                                          153
 Digital warehouse 1C-Online                                       0
 Internet-shop of emergency situations                           100
 Kaluga TC "XXI century"                                          66
 Kazan TC "Behetle"                                                0
 Kazan TC "ParkHouse" II                                          48
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Khimki TC" Mega "	275
Kolomna TC "Rio"	176
Krasnoyarsk TC "June"	208
Krasnoyarsk TC "Vzletka Plaza"	64
Kursk TC " Pushkinskiy "	136
Moscow MTRC" Afi Mall "	169
Moscow Shop C21	115
Moscow TC" MEGA Belaya Dacha II "	403
Moscow TC" MEGA Teply Stan "II	306
Moscow TC" New Age "(Novokosino)	168
Moscow TC" Perlovsky "	167
Moscow TC" Semenovsky "	508
Moscow TC" Serebryany House "	21
Moscow TEC" Atrium "	449
Moscow TK" Budenovskiy "(pav.A2)	20
Moscow TK" Budenovskiy "(pav.K7)	160
Moscow TTS" Areal "(Belyaevo)	163
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	15
N.Novgorod SEC" Fantasy "	148
N.Novgorod SEC" RIO "	0
Novosibirsk SEC" Gallery Novosibirsk "	0
Novosibirsk SEC" Mega "	87
Omsk TC" Mega "	65
Outbound Trade	0
RostovNaDon Mega shopping center	83
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	19
Samara Melody shopping center	66
Samara ParkHouse shopping center	102
Sergiev Posad 7Ya shopping center	136
St. Petersburg Nevsky Center shopping center	389
St. Petersburg Sennaya shopping center	120
Surgut SEC "City Mall"	167
Tomsk SEC "Emerald City"	35
Tyumen SEC "Crystal"	39
Tyumen SEC "Goodwin"	242
Tyumen TC "Green Coast "	59
Ufa TC" Central "	117
Ufa TC" Family "2	113
Volga TC "Volga Mall"	155
Vologda SEC "Marmelad"	95
Voronezh (Plekhanovskaya, 13)	169
Voronezh SEC "Maksimir"	200
Voronezh SEC City-Park "Grad"	7
Yakutsk Ordzhonikidze, 56	231
Yakutsk TC" Central "	129
Yaroslavl TC" Altair "	52

Zhukovsky st. Chkalov 39m?	48
Zhukovsky st. Chkalov 39m²	1
! Yakutsk Ordzhonikidze, 56 francs	60
! Yakutsk TC "Central" fran	24

item_category_name	Accessories - XBOX 360 \
shop_name	
Adygea TC "Mega"	317
Balashikha TC "Oktyabr-Kinomir"	243
Chekhov TC" Karnaval "	492
Digital warehouse 1C-Online	0
Internet-shop of emergency situations	132
Kaluga TC "XXI century"	443
Kazan TC "Behetle"	0
Kazan TC "ParkHouse" II	231
Khimki TC" Mega "	691
Kolomna TC "Rio"	439
Krasnoyarsk TC "June"	368
Krasnoyarsk TC "Vzletka Plaza"	125
Kursk TC " Pushkinskiy "	330
Moscow MTRC" Afi Mall "	266
Moscow Shop C21	121
Moscow TC" MEGA Belaya Dacha II "	988
Moscow TC" MEGA Teply Stan "II	963
Moscow TC" New Age "(Novokosino)	288
Moscow TC" Perlovsky "	362
Moscow TC" Semenovsky "	1096
Moscow TC" Serebryany House "	26
Moscow TEC" Atrium "	888
Moscow TK" Budenovskiy "(pav.A2)	37
Moscow TK" Budenovskiy "(pav.K7)	430
Moscow TTS" Areal "(Belyaevo)	307
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	37
N.Novgorod SEC" Fantasy "	338
N.Novgorod SEC" RIO "	8
Novosibirsk SEC" Gallery Novosibirsk "	2
Novosibirsk SEC" Mega "	208
Omsk TC" Mega "	467
Outbound Trade	21
RostovNaDon Mega shopping center	334
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	57
Samara Melody shopping center	108
Samara ParkHouse shopping center	211
Sergiev Posad 7Ya shopping center	569
St. Petersburg Nevsky Center shopping center	520
St. Petersburg Sennaya shopping center	349

Surgut SEC "City Mall"	355
Tomsk SEC "Emerald City"	179
Tyumen SEC "Crystal"	145
Tyumen SEC "Goodwin"	571
Tyumen TC "Green Coast "	174
Ufa TC" Central "	337
Ufa TC" Family "2	481
Volga TC "Volga Mall"	319
Vologda SEC "Marmelad"	207
Voronezh (Plekhanovskaya, 13)	352
Voronezh SEC "Maksimir"	419
Voronezh SEC City-Park "Grad"	11
Yakutsk Ordzhonikidze, 56	826
Yakutsk TC" Central "	655
Yaroslavl TC" Altair "	247
Zhukovsky st. Chkalov 39m?	138
Zhukovsky st. Chkalov 39m²	6
! Yakutsk Ordzhonikidze, 56 francs	116
! Yakutsk TC "Central" fran	57

item_category_name	Accessories - XBOX ONE \
shop_name	
Adygea TC "Mega"	68
Balashikha TC "Oktyabr-Kinomir"	60
Chekhov TC" Karnaval "	57
Digital warehouse 1C-Online	0
Internet-shop of emergency situations	161
Kaluga TC "XXI century"	87
Kazan TC "Behetle"	0
Kazan TC "ParkHouse" II	58
Khimki TC" Mega "	123
Kolomna TC "Rio"	54
Krasnoyarsk TC "June"	77
Krasnoyarsk TC "Vzletka Plaza"	28
Kursk TC " Pushkinskiy "	45
Moscow MTRC" Afi Mall "	153
Moscow Shop C21	74
Moscow TC" MEGA Belaya Dacha II "	206
Moscow TC" MEGA Teply Stan "II	238
Moscow TC" New Age "(Novokosino)	53
Moscow TC" Perlovsky "	34
Moscow TC" Semenovsky "	212
Moscow TC" Serebryany House "	0
Moscow TEC" Atrium "	289
Moscow TK" Budenovskiy "(pav.A2)	0
Moscow TK" Budenovskiy "(pav.K7)	65
Moscow TTS" Areal "(Belyaevo)	119
Moscow" Sale "	0

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 Mytishchi SEC" XL-3 "                                          23
 N.Novgorod SEC" Fantasy "                                     131
 N.Novgorod SEC" RIO "                                          40
 Novosibirsk SEC" Gallery Novosibirsk "                          0
 Novosibirsk SEC" Mega "                                        87
 Omsk TC" Mega "                                               122
 Outbound Trade                                                 15
 RostovNaDon Mega shopping center                               46
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                0
 RostovNaDonu SEC" Megacenter Horizon                           80
 Samara Melody shopping center                                  47
 Samara ParkHouse shopping center                               56
 Sergiev Posad 7Ya shopping center                              79
 St. Petersburg Nevsky Center shopping center                  271
 St. Petersburg Sennaya shopping center                         72
 Surgut SEC "City Mall"                                         99
 Tomsk SEC "Emerald City"                                       94
 Tyumen SEC "Crystal"                                           56
 Tyumen SEC "Goodwin"                                           71
 Tyumen TC "Green Coast "                                       28
 Ufa TC" Central "                                              56
 Ufa TC" Family "2                                              73
 Volga TC "Volga Mall"                                          45
 Vologda SEC "Marmelad"                                         65
 Voronezh (Plekhanovskaya, 13)                                  92
 Voronezh SEC "Maksimir"                                        63
 Voronezh SEC City-Park "Grad"                                   0
 Yakutsk Ordzhonikidze, 56                                     168
 Yakutsk TC" Central "                                          81
 Yaroslavl TC" Altair "                                         72
 Zhukovsky st. Chkalov 39m?                                     36
 Zhukovsky st. Chkalov 39m²                                      1
! Yakutsk Ordzhonikidze, 56 francs                               0
! Yakutsk TC "Central" fran                                     0

item_category_name                              Android games - Number  \
shop_name
 Adygea TC "Mega"                                               0
 Balashikha TC "Oktyabr-Kinomir"                                0
 Chekhov TC" Karnaval "                                         0
 Digital warehouse 1C-Online                                   91
 Internet-shop of emergency situations                          0
 Kaluga TC "XXI century"                                        0
 Kazan TC "Behetle"                                             0
 Kazan TC "ParkHouse" II                                        0
 Khimki TC" Mega "                                              0
 Kolomna TC "Rio"                                               0
 Krasnoyarsk TC "June"                                          0
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Krasnoyarsk TC "Vzletka Plaza"	0
Kursk TC " Pushkinskiy "	0
Moscow MTRC" Afi Mall "	0
Moscow Shop C21	0
Moscow TC" MEGA Belaya Dacha II "	0
Moscow TC" MEGA Teply Stan "II	0
Moscow TC" New Age "(Novokosino)	0
Moscow TC" Perlovsky "	0
Moscow TC" Semenovsky "	0
Moscow TC" Serebryany House "	0
Moscow TEC" Atrium "	0
Moscow TK" Budenovskiy "(pav.A2)	0
Moscow TK" Budenovskiy "(pav.K7)	0
Moscow TTS" Areal "(Belyaevo)	0
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	0
N.Novgorod SEC" Fantasy "	0
N.Novgorod SEC" RIO "	0
Novosibirsk SEC" Gallery Novosibirsk "	0
Novosibirsk SEC" Mega "	0
Omsk TC" Mega "	0
Outbound Trade	0
RostovNaDon Mega shopping center	0
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	0
Samara Melody shopping center	0
Samara ParkHouse shopping center	0
Sergiev Posad 7Ya shopping center	0
St. Petersburg Nevsky Center shopping center	0
St. Petersburg Sennaya shopping center	0
Surgut SEC "City Mall"	0
Tomsk SEC "Emerald City"	0
Tyumen SEC "Crystal"	0
Tyumen SEC "Goodwin"	0
Tyumen TC "Green Coast "	0
Ufa TC" Central "	0
Ufa TC" Family "2	0
Volga TC "Volga Mall"	0
Vologda SEC "Marmelad"	0
Voronezh (Plekhanovskaya, 13)	0
Voronezh SEC "Maksimir"	0
Voronezh SEC City-Park "Grad"	0
Yakutsk Ordzhonikidze, 56	0
Yakutsk TC" Central "	0
Yaroslavl TC" Altair "	0
Zhukovsky st. Chkalov 39m?	0
Zhukovsky st. Chkalov 39m²	0
! Yakutsk Ordzhonikidze, 56 francs	0

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! Yakutsk TC "Central" fran                                          0

item_category_name                                  Batteries  \
shop_name
 Adygea TC "Mega"                                          34
 Balashikha TC "Oktyabr-Kinomir"                           36
 Chekhov TC" Karnaval "                                   152
 Digital warehouse 1C-Online                                0
 Internet-shop of emergency situations                      2
 Kaluga TC "XXI century"                                   62
 Kazan TC "Behetle"                                         0
 Kazan TC "ParkHouse" II                                  164
 Khimki TC" Mega "                                        169
 Kolomna TC "Rio"                                         202
 Krasnoyarsk TC "June"                                    122
 Krasnoyarsk TC "Vzletka Plaza"                             0
 Kursk TC " Pushkinskiy "                                  96
 Moscow MTRC" Afi Mall "                                  129
 Moscow Shop C21                                           84
 Moscow TC" MEGA Belaya Dacha II "                         53
 Moscow TC" MEGA Teply Stan "II                           411
 Moscow TC" New Age "(Novokosino)                         108
 Moscow TC" Perlovsky "                                   130
 Moscow TC" Semenovsky "                                  439
 Moscow TC" Serebryany House "                              0
 Moscow TEC" Atrium "                                     338
 Moscow TK" Budenovskiy "(pav.A2)                           0
 Moscow TK" Budenovskiy "(pav.K7)                          44
 Moscow TTS" Areal "(Belyaevo)                             73
 Moscow" Sale "                                             2
 Mytishchi SEC" XL-3 "                                     29
 N.Novgorod SEC" Fantasy "                                 67
 N.Novgorod SEC" RIO "                                     43
 Novosibirsk SEC" Gallery Novosibirsk "                     2
 Novosibirsk SEC" Mega "                                  157
 Omsk TC" Mega "                                           74
 Outbound Trade                                             0
 RostovNaDon Mega shopping center                          75
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…           0
 RostovNaDonu SEC" Megacenter Horizon                      73
 Samara Melody shopping center                            546
 Samara ParkHouse shopping center                         136
 Sergiev Posad 7Ya shopping center                        128
 St. Petersburg Nevsky Center shopping center             155
 St. Petersburg Sennaya shopping center                   155
 Surgut SEC "City Mall"                                   134
 Tomsk SEC "Emerald City"                                  49
 Tyumen SEC "Crystal"                                      36
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Tyumen SEC "Goodwin"	241
Tyumen TC "Green Coast "	242
Ufa TC" Central "	183
Ufa TC" Family "2	117
Volga TC "Volga Mall"	50
Vologda SEC "Marmelad"	82
Voronezh (Plekhanovskaya, 13)	392
Voronezh SEC "Maksimir"	110
Voronezh SEC City-Park "Grad"	0
Yakutsk Ordzhonikidze, 56	374
Yakutsk TC" Central "	170
Yaroslavl TC" Altair "	347
Zhukovsky st. Chkalov 39m?	89
Zhukovsky st. Chkalov 39m²	0
! Yakutsk Ordzhonikidze, 56 francs	48
! Yakutsk TC "Central" fran	41

item_category_name	Blank media (piece) \
shop_name	
Adygea TC "Mega"	42
Balashikha TC "Oktyabr-Kinomir"	0
Chekhov TC" Karnaval "	310
Digital warehouse 1C-Online	0
Internet-shop of emergency situations	3
Kaluga TC "XXI century"	0
Kazan TC "Behetle"	105
Kazan TC "ParkHouse" II	0
Khimki TC" Mega "	120
Kolomna TC "Rio"	186
Krasnoyarsk TC "June"	86
Krasnoyarsk TC "Vzletka Plaza"	0
Kursk TC " Pushkinskiy "	0
Moscow MTRC" Afi Mall "	0
Moscow Shop C21	101
Moscow TC" MEGA Belaya Dacha II "	0
Moscow TC" MEGA Teply Stan "II	0
Moscow TC" New Age "(Novokosino)	285
Moscow TC" Perlovsky "	266
Moscow TC" Semenovsky "	0
Moscow TC" Serebryany House "	0
Moscow TEC" Atrium "	254
Moscow TK" Budenovskiy "(pav.A2)	0
Moscow TK" Budenovskiy "(pav.K7)	0
Moscow TTS" Areal "(Belyaevo)	0
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	0
N.Novgorod SEC" Fantasy "	0
N.Novgorod SEC" RIO "	0

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 Novosibirsk SEC" Gallery Novosibirsk "                                0
 Novosibirsk SEC" Mega "                                              84
 Omsk TC" Mega "                                                       0
 Outbound Trade                                                        0
 RostovNaDon Mega shopping center                                     67
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                     0
 RostovNaDonu SEC" Megacenter Horizon                                  0
 Samara Melody shopping center                                       548
 Samara ParkHouse shopping center                                      0
 Sergiev Posad 7Ya shopping center                                     0
 St. Petersburg Nevsky Center shopping center                          0
 St. Petersburg Sennaya shopping center                                0
 Surgut SEC "City Mall"                                                0
 Tomsk SEC "Emerald City"                                              0
 Tyumen SEC "Crystal"                                                  0
 Tyumen SEC "Goodwin"                                                  0
 Tyumen TC "Green Coast "                                            508
 Ufa TC" Central "                                                   291
 Ufa TC" Family "2                                                     0
 Volga TC "Volga Mall"                                               208
 Vologda SEC "Marmelad"                                                0
 Voronezh (Plekhanovskaya, 13)                                       290
 Voronezh SEC "Maksimir"                                               0
 Voronezh SEC City-Park "Grad"                                         0
 Yakutsk Ordzhonikidze, 56                                           228
 Yakutsk TC" Central "                                               170
 Yaroslavl TC" Altair "                                                0
 Zhukovsky st. Chkalov 39m?                                          110
 Zhukovsky st. Chkalov 39m²                                            0
! Yakutsk Ordzhonikidze, 56 francs                                     69
! Yakutsk TC "Central" fran                                           59

item_category_name                                 …  \
shop_name                                          …
 Adygea TC "Mega"                                  …
 Balashikha TC "Oktyabr-Kinomir"                   …
 Chekhov TC" Karnaval "                            …
 Digital warehouse 1C-Online                       …
 Internet-shop of emergency situations             …
 Kaluga TC "XXI century"                           …
 Kazan TC "Behetle"                                …
 Kazan TC "ParkHouse" II                           …
 Khimki TC" Mega "                                 …
 Kolomna TC "Rio"                                  …
 Krasnoyarsk TC "June"                             …
 Krasnoyarsk TC "Vzletka Plaza"                    …
 Kursk TC " Pushkinskiy "                          …
 Moscow MTRC" Afi Mall "                           …
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 Moscow Shop C21                                    …
 Moscow TC" MEGA Belaya Dacha II "                  …
 Moscow TC" MEGA Teply Stan "II                     …
 Moscow TC" New Age "(Novokosino)                   …
 Moscow TC" Perlovsky "                             …
 Moscow TC" Semenovsky "                            …
 Moscow TC" Serebryany House "                      …
 Moscow TEC" Atrium "                               …
 Moscow TK" Budenovskiy "(pav.A2)                   …
 Moscow TK" Budenovskiy "(pav.K7)                   …
 Moscow TTS" Areal "(Belyaevo)                      …
 Moscow" Sale "                                     …
 Mytishchi SEC" XL-3 "                              …
 N.Novgorod SEC" Fantasy "                          …
 N.Novgorod SEC" RIO "                              …
 Novosibirsk SEC" Gallery Novosibirsk "             …
 Novosibirsk SEC" Mega "                            …
 Omsk TC" Mega "                                    …
 Outbound Trade                                     …
 RostovNaDon Mega shopping center                   …
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…    …
 RostovNaDonu SEC" Megacenter Horizon               …
 Samara Melody shopping center                      …
 Samara ParkHouse shopping center                   …
 Sergiev Posad 7Ya shopping center                  …
 St. Petersburg Nevsky Center shopping center       …
 St. Petersburg Sennaya shopping center             …
 Surgut SEC "City Mall"                             …
 Tomsk SEC "Emerald City"                           …
 Tyumen SEC "Crystal"                               …
 Tyumen SEC "Goodwin"                               …
 Tyumen TC "Green Coast "                           …
 Ufa TC" Central "                                  …
 Ufa TC" Family "2                                  …
 Volga TC "Volga Mall"                              …
 Vologda SEC "Marmelad"                             …
 Voronezh (Plekhanovskaya, 13)                      …
 Voronezh SEC "Maksimir"                            …
 Voronezh SEC City-Park "Grad"                      …
 Yakutsk Ordzhonikidze, 56                          …
 Yakutsk TC" Central "                              …
 Yaroslavl TC" Altair "                             …
 Zhukovsky st. Chkalov 39m?                         …
 Zhukovsky st. Chkalov 39m²                         …
! Yakutsk Ordzhonikidze, 56 francs                  …
! Yakutsk TC "Central" fran                         …

item_category_name                                  Programs - 1C: Enterprise 8
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shop_name

Adygea TC "Mega"	165
Balashikha TC "Oktyabr-Kinomir"	62
Chekhov TC" Karnaval "	136
Digital warehouse 1C-Online	0
Internet-shop of emergency situations	1447
Kaluga TC "XXI century"	115
Kazan TC "Behetle"	8
Kazan TC "ParkHouse" II	128
Khimki TC" Mega "	402
Kolomna TC "Rio"	222
Krasnoyarsk TC "June"	102
Krasnoyarsk TC "Vzletka Plaza"	30
Kursk TC " Pushkinskiy "	113
Moscow MTRC" Afi Mall "	206
Moscow Shop C21	2134
Moscow TC" MEGA Belaya Dacha II "	833
Moscow TC" MEGA Teply Stan "II	387
Moscow TC" New Age "(Novokosino)	260
Moscow TC" Perlovsky "	239
Moscow TC" Semenovsky "	641
Moscow TC" Serebryany House "	52
Moscow TEC" Atrium "	784
Moscow TK" Budenovskiy "(pav.A2)	49
Moscow TK" Budenovskiy "(pav.K7)	520
Moscow TTS" Areal "(Belyaevo)	389
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	9
N.Novgorod SEC" Fantasy "	86
N.Novgorod SEC" RIO "	19
Novosibirsk SEC" Gallery Novosibirsk "	0
Novosibirsk SEC" Mega "	171
Omsk TC" Mega "	135
Outbound Trade	0
RostovNaDon Mega shopping center	95
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	27
Samara Melody shopping center	68
Samara ParkHouse shopping center	101
Sergiev Posad 7Ya shopping center	144
St. Petersburg Nevsky Center shopping center	430
St. Petersburg Sennaya shopping center	241
Surgut SEC "City Mall"	183
Tomsk SEC "Emerald City"	26
Tyumen SEC "Crystal"	29
Tyumen SEC "Goodwin"	79
Tyumen TC "Green Coast "	49

Ufa TC" Central "	114
Ufa TC" Family "2	171
Volga TC "Volga Mall"	87
Vologda SEC "Marmelad"	47
Voronezh (Plekhanovskaya, 13)	235
Voronezh SEC "Maksimir"	129
Voronezh SEC City-Park "Grad"	6
Yakutsk Ordzhonikidze, 56	214
Yakutsk TC" Central "	120
Yaroslavl TC" Altair "	106
Zhukovsky st. Chkalov 39m?	130
Zhukovsky st. Chkalov 39m²	3
! Yakutsk Ordzhonikidze, 56 francs	20
! Yakutsk TC "Central" fran	14

item_category_name	Programs - Educational	\
shop_name		
Adygea TC "Mega"	33	
Balashikha TC "Oktyabr-Kinomir"	12	
Chekhov TC" Karnaval "	126	
Digital warehouse 1C-Online	0	
Internet-shop of emergency situations	140	
Kaluga TC "XXI century"	24	
Kazan TC "Behetle"	5	
Kazan TC "ParkHouse" II	7	
Khimki TC" Mega "	118	
Kolomna TC "Rio"	126	
Krasnoyarsk TC "June"	60	
Krasnoyarsk TC "Vzletka Plaza"	4	
Kursk TC " Pushkinskiy "	22	
Moscow MTRC" Afi Mall "	52	
Moscow Shop C21	543	
Moscow TC" MEGA Belaya Dacha II "	5	
Moscow TC" MEGA Teply Stan "II	69	
Moscow TC" New Age "(Novokosino)	61	
Moscow TC" Perlovsky "	49	
Moscow TC" Semenovsky "	29	
Moscow TC" Serebryany House "	48	
Moscow TEC" Atrium "	227	
Moscow TK" Budenovskiy "(pav.A2)	54	
Moscow TK" Budenovskiy "(pav.K7)	66	
Moscow TTS" Areal "(Belyaevo)	12	
Moscow" Sale "	0	
Mytishchi SEC" XL-3 "	0	
N.Novgorod SEC" Fantasy "	79	
N.Novgorod SEC" RIO "	0	
Novosibirsk SEC" Gallery Novosibirsk "	0	
Novosibirsk SEC" Mega "	108	

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 Omsk TC" Mega "                                                  130
 Outbound Trade                                                     0
 RostovNaDon Mega shopping center                                  59
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                    0
 RostovNaDonu SEC" Megacenter Horizon                               1
 Samara Melody shopping center                                     89
 Samara ParkHouse shopping center                                  11
 Sergiev Posad 7Ya shopping center                                 25
 St. Petersburg Nevsky Center shopping center                      30
 St. Petersburg Sennaya shopping center                             8
 Surgut SEC "City Mall"                                             1
 Tomsk SEC "Emerald City"                                           3
 Tyumen SEC "Crystal"                                               1
 Tyumen SEC "Goodwin"                                               7
 Tyumen TC "Green Coast "                                          85
 Ufa TC" Central "                                                153
 Ufa TC" Family "2                                                  8
 Volga TC "Volga Mall"                                            103
 Vologda SEC "Marmelad"                                            12
 Voronezh (Plekhanovskaya, 13)                                    176
 Voronezh SEC "Maksimir"                                           17
 Voronezh SEC City-Park "Grad"                                     20
 Yakutsk Ordzhonikidze, 56                                        324
 Yakutsk TC" Central "                                            172
 Yaroslavl TC" Altair "                                             4
 Zhukovsky st. Chkalov 39m?                                         8
 Zhukovsky st. Chkalov 39m²                                         0
! Yakutsk Ordzhonikidze, 56 francs                                 104
! Yakutsk TC "Central" fran                                        61

item_category_name                                Programs - Educational
(Digit)  \
shop_name
 Adygea TC "Mega"
0
 Balashikha TC "Oktyabr-Kinomir"
0
 Chekhov TC" Karnaval "
0
 Digital warehouse 1C-Online
2346
 Internet-shop of emergency situations
0
 Kaluga TC "XXI century"
0
 Kazan TC "Behetle"
0
 Kazan TC "ParkHouse" II
```

0
 Khimki TC" Mega "
0
 Kolomna TC "Rio"
0
 Krasnoyarsk TC "June"
0
 Krasnoyarsk TC "Vzletka Plaza"
0
 Kursk TC " Pushkinskiy "
0
 Moscow MTRC" Afi Mall "
0
 Moscow Shop C21
0
 Moscow TC" MEGA Belaya Dacha II "
0
 Moscow TC" MEGA Teply Stan "II
0
 Moscow TC" New Age "(Novokosino)
0
 Moscow TC" Perlovsky "
0
 Moscow TC" Semenovsky "
0
 Moscow TC" Serebryany House "
0
 Moscow TEC" Atrium "
0
 Moscow TK" Budenovskiy "(pav.A2)
0
 Moscow TK" Budenovskiy "(pav.K7)
0
 Moscow TTS" Areal "(Belyaevo)
0
 Moscow" Sale "
0
 Mytishchi SEC" XL-3 "
0
 N.Novgorod SEC" Fantasy "
0
 N.Novgorod SEC" RIO "
0
 Novosibirsk SEC" Gallery Novosibirsk "
0
 Novosibirsk SEC" Mega "
0
 Omsk TC" Mega "

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0
 Outbound Trade
0
 RostovNaDon Mega shopping center
0
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…
0
 RostovNaDonu SEC" Megacenter Horizon
0
 Samara Melody shopping center
0
 Samara ParkHouse shopping center
0
 Sergiev Posad 7Ya shopping center
0
 St. Petersburg Nevsky Center shopping center
0
 St. Petersburg Sennaya shopping center
0
 Surgut SEC "City Mall"
0
 Tomsk SEC "Emerald City"
0
 Tyumen SEC "Crystal"
0
 Tyumen SEC "Goodwin"
0
 Tyumen TC "Green Coast "
0
 Ufa TC" Central "
0
 Ufa TC" Family "2
0
 Volga TC "Volga Mall"
0
 Vologda SEC "Marmelad"
0
 Voronezh (Plekhanovskaya, 13)
0
 Voronezh SEC "Maksimir"
0
 Voronezh SEC City-Park "Grad"
0
 Yakutsk Ordzhonikidze, 56
0
 Yakutsk TC" Central "
0
 Yaroslavl TC" Altair "
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0
 Zhukovsky st. Chkalov 39m?
0
 Zhukovsky st. Chkalov 39m²
0
! Yakutsk Ordzhonikidze, 56 francs
0
! Yakutsk TC "Central" fran
0

item_category_name                                    Programs - For home and
office  \
shop_name
 Adygea TC "Mega"
481
 Balashikha TC "Oktyabr-Kinomir"
152
 Chekhov TC" Karnaval "
434
 Digital warehouse 1C-Online
0
 Internet-shop of emergency situations
417
 Kaluga TC "XXI century"
1825
 Kazan TC "Behetle"
38
 Kazan TC "ParkHouse" II
328
 Khimki TC" Mega "
1237
 Kolomna TC "Rio"
1087
 Krasnoyarsk TC "June"
515
 Krasnoyarsk TC "Vzletka Plaza"
192
 Kursk TC " Pushkinskiy "
761
 Moscow MTRC" Afi Mall "
500
 Moscow Shop C21
2773
 Moscow TC" MEGA Belaya Dacha II "
1486
 Moscow TC" MEGA Teply Stan "II
804
 Moscow TC" New Age "(Novokosino)
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1694
 Moscow TC" Perlovsky "
671
 Moscow TC" Semenovsky "
3177
 Moscow TC" Serebryany House "
168
 Moscow TEC" Atrium "
1556
 Moscow TK" Budenovskiy "(pav.A2)
501
 Moscow TK" Budenovskiy "(pav.K7)
3780
 Moscow TTS" Areal "(Belyaevo)
909
 Moscow" Sale "
0
 Mytishchi SEC" XL-3 "
25
 N.Novgorod SEC" Fantasy "
219
 N.Novgorod SEC" RIO "
18
 Novosibirsk SEC" Gallery Novosibirsk "
3
 Novosibirsk SEC" Mega "
617
 Omsk TC" Mega "
509
 Outbound Trade
4
 RostovNaDon Mega shopping center
603
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…
0
 RostovNaDonu SEC" Megacenter Horizon
41
 Samara Melody shopping center
608
 Samara ParkHouse shopping center
388
 Sergiev Posad 7Ya shopping center
845
 St. Petersburg Nevsky Center shopping center
630
 St. Petersburg Sennaya shopping center
330
 Surgut SEC "City Mall"
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568
 Tomsk SEC "Emerald City"
56
 Tyumen SEC "Crystal"
115
 Tyumen SEC "Goodwin"
740
 Tyumen TC "Green Coast "
542
 Ufa TC" Central "
464
 Ufa TC" Family "2
574
 Volga TC "Volga Mall"
718
 Vologda SEC "Marmelad"
122
 Voronezh (Plekhanovskaya, 13)
1421
 Voronezh SEC "Maksimir"
856
 Voronezh SEC City-Park "Grad"
35
 Yakutsk Ordzhonikidze, 56
2760
 Yakutsk TC" Central "
1111
 Yaroslavl TC" Altair "
742
 Zhukovsky st. Chkalov 39m?
920
 Zhukovsky st. Chkalov 39m²
20
! Yakutsk Ordzhonikidze, 56 francs
252
! Yakutsk TC "Central" fran
121

item_category_name                                    Programs - For home and
office (Digit)  \
shop_name
 Adygea TC "Mega"
0
 Balashikha TC "Oktyabr-Kinomir"
0
 Chekhov TC" Karnaval "
0
 Digital warehouse 1C-Online
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3746
 Internet-shop of emergency situations
0
 Kaluga TC "XXI century"
0
 Kazan TC "Behetle"
0
 Kazan TC "ParkHouse" II
0
 Khimki TC" Mega "
0
 Kolomna TC "Rio"
0
 Krasnoyarsk TC "June"
0
 Krasnoyarsk TC "Vzletka Plaza"
0
 Kursk TC " Pushkinskiy "
0
 Moscow MTRC" Afi Mall "
0
 Moscow Shop C21
0
 Moscow TC" MEGA Belaya Dacha II "
0
 Moscow TC" MEGA Teply Stan "II
0
 Moscow TC" New Age "(Novokosino)
0
 Moscow TC" Perlovsky "
0
 Moscow TC" Semenovsky "
0
 Moscow TC" Serebryany House "
0
 Moscow TEC" Atrium "
0
 Moscow TK" Budenovskiy "(pav.A2)
0
 Moscow TK" Budenovskiy "(pav.K7)
0
 Moscow TTS" Areal "(Belyaevo)
0
 Moscow" Sale "
0
 Mytishchi SEC" XL-3 "
0
 N.Novgorod SEC" Fantasy "
```

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0
 N.Novgorod SEC" RIO "
0
 Novosibirsk SEC" Gallery Novosibirsk "
0
 Novosibirsk SEC" Mega "
0
 Omsk TC" Mega "
0
 Outbound Trade
0
 RostovNaDon Mega shopping center
0
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…
0
 RostovNaDonu SEC" Megacenter Horizon
0
 Samara Melody shopping center
0
 Samara ParkHouse shopping center
0
 Sergiev Posad 7Ya shopping center
0
 St. Petersburg Nevsky Center shopping center
0
 St. Petersburg Sennaya shopping center
0
 Surgut SEC "City Mall"
0
 Tomsk SEC "Emerald City"
0
 Tyumen SEC "Crystal"
0
 Tyumen SEC "Goodwin"
0
 Tyumen TC "Green Coast "
0
 Ufa TC" Central "
0
 Ufa TC" Family "2
0
 Volga TC "Volga Mall"
0
 Vologda SEC "Marmelad"
0
 Voronezh (Plekhanovskaya, 13)
0
 Voronezh SEC "Maksimir"
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0
 Voronezh SEC City-Park "Grad"
0
 Yakutsk Ordzhonikidze, 56
0
 Yakutsk TC" Central "
0
 Yaroslavl TC" Altair "
0
 Zhukovsky st. Chkalov 39m?
0
 Zhukovsky st. Chkalov 39m²
0
! Yakutsk Ordzhonikidze, 56 francs
0
! Yakutsk TC "Central" fran
0

item_category_name                                  Programs - MAC (Digit)  \
shop_name
 Adygea TC "Mega"                                                        0
 Balashikha TC "Oktyabr-Kinomir"                                         0
 Chekhov TC" Karnaval "                                                  0
 Digital warehouse 1C-Online                                            56
 Internet-shop of emergency situations                                   0
 Kaluga TC "XXI century"                                                 0
 Kazan TC "Behetle"                                                      0
 Kazan TC "ParkHouse" II                                                 0
 Khimki TC" Mega "                                                       0
 Kolomna TC "Rio"                                                        0
 Krasnoyarsk TC "June"                                                   0
 Krasnoyarsk TC "Vzletka Plaza"                                          0
 Kursk TC " Pushkinskiy "                                                0
 Moscow MTRC" Afi Mall "                                                 0
 Moscow Shop C21                                                         0
 Moscow TC" MEGA Belaya Dacha II "                                       0
 Moscow TC" MEGA Teply Stan "II                                          0
 Moscow TC" New Age "(Novokosino)                                        0
 Moscow TC" Perlovsky "                                                  0
 Moscow TC" Semenovsky "                                                 0
 Moscow TC" Serebryany House "                                           0
 Moscow TEC" Atrium "                                                    0
 Moscow TK" Budenovskiy "(pav.A2)                                        0
 Moscow TK" Budenovskiy "(pav.K7)                                        0
 Moscow TTS" Areal "(Belyaevo)                                           0
 Moscow" Sale "                                                          0
 Mytishchi SEC" XL-3 "                                                   0
 N.Novgorod SEC" Fantasy "                                               0
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 N.Novgorod SEC" RIO "                                                0
 Novosibirsk SEC" Gallery Novosibirsk "                               0
 Novosibirsk SEC" Mega "                                              0
 Omsk TC" Mega "                                                      0
 Outbound Trade                                                       0
 RostovNaDon Mega shopping center                                     0
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                      0
 RostovNaDonu SEC" Megacenter Horizon                                 0
 Samara Melody shopping center                                        0
 Samara ParkHouse shopping center                                     0
 Sergiev Posad 7Ya shopping center                                    0
 St. Petersburg Nevsky Center shopping center                         0
 St. Petersburg Sennaya shopping center                               0
 Surgut SEC "City Mall"                                               0
 Tomsk SEC "Emerald City"                                             0
 Tyumen SEC "Crystal"                                                 0
 Tyumen SEC "Goodwin"                                                 0
 Tyumen TC "Green Coast "                                             0
 Ufa TC" Central "                                                    0
 Ufa TC" Family "2                                                    0
 Volga TC "Volga Mall"                                                0
 Vologda SEC "Marmelad"                                               0
 Voronezh (Plekhanovskaya, 13)                                        0
 Voronezh SEC "Maksimir"                                              0
 Voronezh SEC City-Park "Grad"                                        0
 Yakutsk Ordzhonikidze, 56                                            0
 Yakutsk TC" Central "                                                0
 Yaroslavl TC" Altair "                                               0
 Zhukovsky st. Chkalov 39m?                                           0
 Zhukovsky st. Chkalov 39m²                                           0
! Yakutsk Ordzhonikidze, 56 francs                                    0
! Yakutsk TC "Central" fran                                          0

item_category_name                                  Service  \
shop_name
 Adygea TC "Mega"                                       161
 Balashikha TC "Oktyabr-Kinomir"                        179
 Chekhov TC" Karnaval "                                 159
 Digital warehouse 1C-Online                              0
 Internet-shop of emergency situations                    0
 Kaluga TC "XXI century"                                185
 Kazan TC "Behetle"                                       0
 Kazan TC "ParkHouse" II                                178
 Khimki TC" Mega "                                      179
 Kolomna TC "Rio"                                       218
 Krasnoyarsk TC "June"                                  193
 Krasnoyarsk TC "Vzletka Plaza"                          62
 Kursk TC " Pushkinskiy "                               176
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Moscow MTRC" Afi Mall "	218
Moscow Shop C21	262
Moscow TC" MEGA Belaya Dacha II "	373
Moscow TC" MEGA Teply Stan "II	248
Moscow TC" New Age "(Novokosino)	162
Moscow TC" Perlovsky "	156
Moscow TC" Semenovsky "	478
Moscow TC" Serebryany House "	8
Moscow TEC" Atrium "	288
Moscow TK" Budenovskiy "(pav.A2)	8
Moscow TK" Budenovskiy "(pav.K7)	245
Moscow TTS" Areal "(Belyaevo)	265
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	49
N.Novgorod SEC" Fantasy "	279
N.Novgorod SEC" RIO "	72
Novosibirsk SEC" Gallery Novosibirsk "	1
Novosibirsk SEC" Mega "	129
Omsk TC" Mega "	274
Outbound Trade	4
RostovNaDon Mega shopping center	97
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	4
RostovNaDonu SEC" Megacenter Horizon	104
Samara Melody shopping center	90
Samara ParkHouse shopping center	145
Sergiev Posad 7Ya shopping center	226
St. Petersburg Nevsky Center shopping center	382
St. Petersburg Sennaya shopping center	165
Surgut SEC "City Mall"	212
Tomsk SEC "Emerald City"	195
Tyumen SEC "Crystal"	105
Tyumen SEC "Goodwin"	117
Tyumen TC "Green Coast "	0
Ufa TC" Central "	156
Ufa TC" Family "2	223
Volga TC "Volga Mall"	302
Vologda SEC "Marmelad"	195
Voronezh (Plekhanovskaya, 13)	330
Voronezh SEC "Maksimir"	328
Voronezh SEC City-Park "Grad"	1
Yakutsk Ordzhonikidze, 56	160
Yakutsk TC" Central "	116
Yaroslavl TC" Altair "	205
Zhukovsky st. Chkalov 39m?	0
Zhukovsky st. Chkalov 39m^2	0
! Yakutsk Ordzhonikidze, 56 francs	0
! Yakutsk TC "Central" fran	0

item_category_name shop_name	Service - Tickets
Adygea TC "Mega"	0
Balashikha TC "Oktyabr-Kinomir"	44
Chekhov TC" Karnaval "	36
Digital warehouse 1C-Online	3
Internet-shop of emergency situations	169
Kaluga TC "XXI century"	46
Kazan TC "Behetle"	0
Kazan TC "ParkHouse" II	18
Khimki TC" Mega "	0
Kolomna TC "Rio"	73
Krasnoyarsk TC "June"	4
Krasnoyarsk TC "Vzletka Plaza"	0
Kursk TC " Pushkinskiy "	20
Moscow MTRC" Afi Mall "	65
Moscow Shop C21	53
Moscow TC" MEGA Belaya Dacha II "	19
Moscow TC" MEGA Teply Stan "II	109
Moscow TC" New Age "(Novokosino)	1
Moscow TC" Perlovsky "	0
Moscow TC" Semenovsky "	134
Moscow TC" Serebryany House "	0
Moscow TEC" Atrium "	144
Moscow TK" Budenovskiy "(pav.A2)	0
Moscow TK" Budenovskiy "(pav.K7)	41
Moscow TTS" Areal "(Belyaevo)	61
Moscow" Sale "	0
Mytishchi SEC" XL-3 "	0
N.Novgorod SEC" Fantasy "	30
N.Novgorod SEC" RIO "	18
Novosibirsk SEC" Gallery Novosibirsk "	0
Novosibirsk SEC" Mega "	2
Omsk TC" Mega "	5
Outbound Trade	0
RostovNaDon Mega shopping center	3
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	9
Samara Melody shopping center	10
Samara ParkHouse shopping center	10
Sergiev Posad 7Ya shopping center	65
St. Petersburg Nevsky Center shopping center	43
St. Petersburg Sennaya shopping center	0
Surgut SEC "City Mall"	3
Tomsk SEC "Emerald City"	0
Tyumen SEC "Crystal"	0
Tyumen SEC "Goodwin"	10
Tyumen TC "Green Coast "	0

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 Ufa TC" Central "                                    2
 Ufa TC" Family "2                                    4
 Volga TC "Volga Mall"                                2
 Vologda SEC "Marmelad"                              11
 Voronezh (Plekhanovskaya, 13)                       32
 Voronezh SEC "Maksimir"                             13
 Voronezh SEC City-Park "Grad"                        0
 Yakutsk Ordzhonikidze, 56                            0
 Yakutsk TC" Central "                                0
 Yaroslavl TC" Altair "                              12
 Zhukovsky st. Chkalov 39m?                           0
 Zhukovsky st. Chkalov 39m²                           0
! Yakutsk Ordzhonikidze, 56 francs                     0
! Yakutsk TC "Central" fran                           0

item_category_name                          Tickets (Digital)  \
shop_name
 Adygea TC "Mega"                                     3
 Balashikha TC "Oktyabr-Kinomir"                     35
 Chekhov TC" Karnaval "                              41
 Digital warehouse 1C-Online                        507
 Internet-shop of emergency situations              111
 Kaluga TC "XXI century"                             46
 Kazan TC "Behetle"                                   0
 Kazan TC "ParkHouse" II                              9
 Khimki TC" Mega "                                   76
 Kolomna TC "Rio"                                    66
 Krasnoyarsk TC "June"                                0
 Krasnoyarsk TC "Vzletka Plaza"                       1
 Kursk TC " Pushkinskiy "                            21
 Moscow MTRC" Afi Mall "                             57
 Moscow Shop C21                                     55
 Moscow TC" MEGA Belaya Dacha II "                   82
 Moscow TC" MEGA Teply Stan "II                      57
 Moscow TC" New Age "(Novokosino)                    44
 Moscow TC" Perlovsky "                              70
 Moscow TC" Semenovsky "                            114
 Moscow TC" Serebryany House "                        0
 Moscow TEC" Atrium "                                98
 Moscow TK" Budenovskiy "(pav.A2)                     0
 Moscow TK" Budenovskiy "(pav.K7)                    39
 Moscow TTS" Areal "(Belyaevo)                       62
 Moscow" Sale "                                       0
 Mytishchi SEC" XL-3 "                                8
 N.Novgorod SEC" Fantasy "                           25
 N.Novgorod SEC" RIO "                                5
 Novosibirsk SEC" Gallery Novosibirsk "               0
 Novosibirsk SEC" Mega "                              1
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Omsk TC" Mega "	2
Outbound Trade	0
RostovNaDon Mega shopping center	9
RostovNaDon Megatsentr Gorizont Ostrovnoy shop…	0
RostovNaDonu SEC" Megacenter Horizon	7
Samara Melody shopping center	4
Samara ParkHouse shopping center	7
Sergiev Posad 7Ya shopping center	52
St. Petersburg Nevsky Center shopping center	26
St. Petersburg Sennaya shopping center	22
Surgut SEC "City Mall"	2
Tomsk SEC "Emerald City"	0
Tyumen SEC "Crystal"	0
Tyumen SEC "Goodwin"	2
Tyumen TC "Green Coast "	0
Ufa TC" Central "	3
Ufa TC" Family "2	8
Volga TC "Volga Mall"	2
Vologda SEC "Marmelad"	26
Voronezh (Plekhanovskaya, 13)	25
Voronezh SEC "Maksimir"	8
Voronezh SEC City-Park "Grad"	0
Yakutsk Ordzhonikidze, 56	5
Yakutsk TC" Central "	1
Yaroslavl TC" Altair "	27
Zhukovsky st. Chkalov 39m?	0
Zhukovsky st. Chkalov 39m²	0
! Yakutsk Ordzhonikidze, 56 francs	0
! Yakutsk TC "Central" fran	0

item_category_name	PC - Headsets / Headphones
shop_name	
Adygea TC "Mega"	0
Balashikha TC "Oktyabr-Kinomir"	0
Chekhov TC" Karnaval "	0
Digital warehouse 1C-Online	0
Internet-shop of emergency situations	0
Kaluga TC "XXI century"	0
Kazan TC "Behetle"	0
Kazan TC "ParkHouse" II	0
Khimki TC" Mega "	0
Kolomna TC "Rio"	0
Krasnoyarsk TC "June"	0
Krasnoyarsk TC "Vzletka Plaza"	0
Kursk TC " Pushkinskiy "	0
Moscow MTRC" Afi Mall "	0
Moscow Shop C21	0
Moscow TC" MEGA Belaya Dacha II "	0

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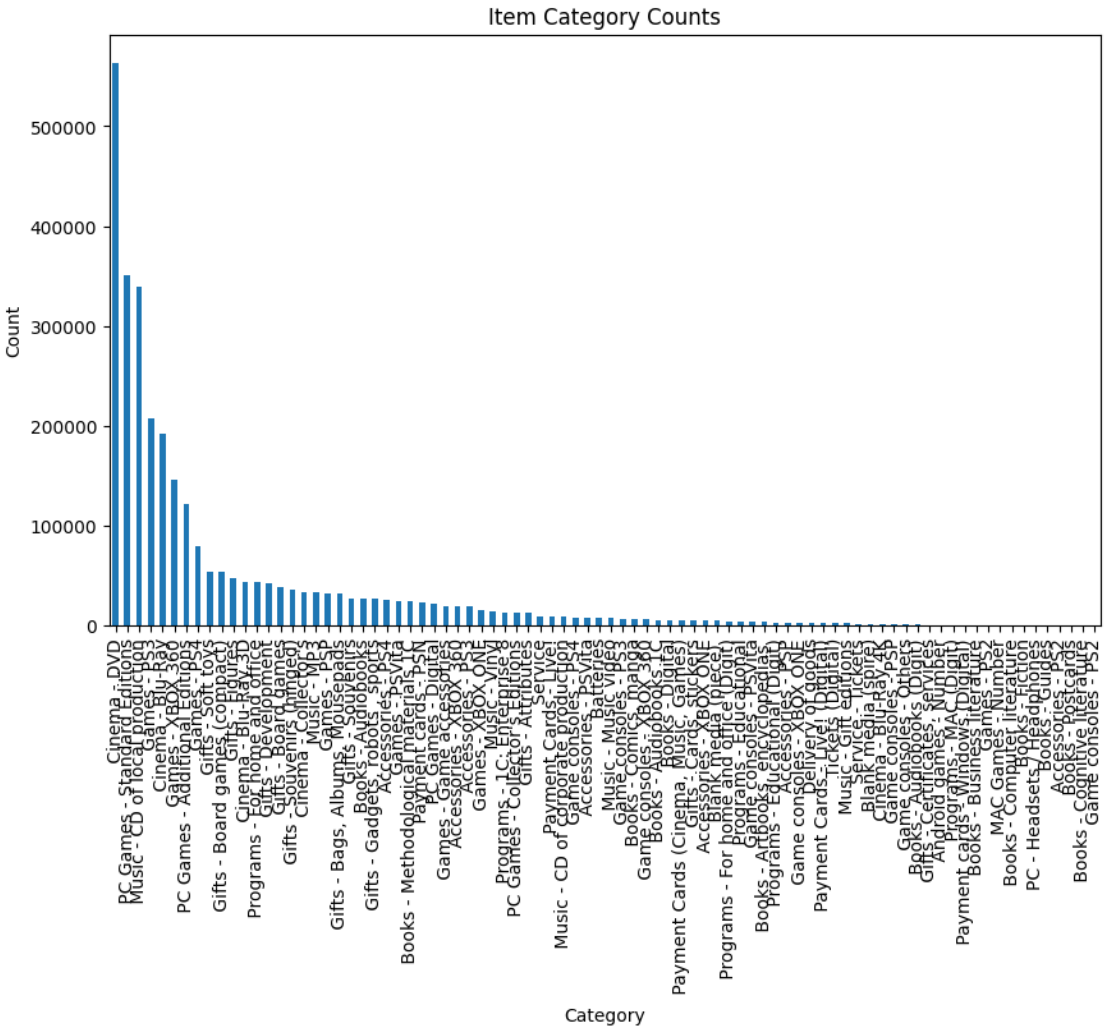
 Moscow TC" MEGA Teply Stan "II                                    0
 Moscow TC" New Age "(Novokosino)                                  0
 Moscow TC" Perlovsky "                                            0
 Moscow TC" Semenovsky "                                           0
 Moscow TC" Serebryany House "                                     0
 Moscow TEC" Atrium "                                              1
 Moscow TK" Budenovskiy "(pav.A2)                                  0
 Moscow TK" Budenovskiy "(pav.K7)                                  0
 Moscow TTS" Areal "(Belyaevo)                                     0
 Moscow" Sale "                                                    0
 Mytishchi SEC" XL-3 "                                             0
 N.Novgorod SEC" Fantasy "                                         0
 N.Novgorod SEC" RIO "                                             0
 Novosibirsk SEC" Gallery Novosibirsk "                            0
 Novosibirsk SEC" Mega "                                           0
 Omsk TC" Mega "                                                   1
 Outbound Trade                                                    0
 RostovNaDon Mega shopping center                                  0
 RostovNaDon Megatsentr Gorizont Ostrovnoy shop…                   0
 RostovNaDonu SEC" Megacenter Horizon                              0
 Samara Melody shopping center                                     0
 Samara ParkHouse shopping center                                  0
 Sergiev Posad 7Ya shopping center                                 0
 St. Petersburg Nevsky Center shopping center                      0
 St. Petersburg Sennaya shopping center                            0
 Surgut SEC "City Mall"                                            0
 Tomsk SEC "Emerald City"                                          0
 Tyumen SEC "Crystal"                                              0
 Tyumen SEC "Goodwin"                                              0
 Tyumen TC "Green Coast "                                          0
 Ufa TC" Central "                                                 0
 Ufa TC" Family "2                                                 0
 Volga TC "Volga Mall"                                             0
 Vologda SEC "Marmelad"                                            0
 Voronezh (Plekhanovskaya, 13)                                     0
 Voronezh SEC "Maksimir"                                           0
 Voronezh SEC City-Park "Grad"                                     0
 Yakutsk Ordzhonikidze, 56                                         0
 Yakutsk TC" Central "                                             0
 Yaroslavl TC" Altair "                                            0
 Zhukovsky st. Chkalov 39m?                                        0
 Zhukovsky st. Chkalov 39m²                                        0
! Yakutsk Ordzhonikidze, 56 francs                                 1
! Yakutsk TC "Central" fran                                        0

[60 rows x 84 columns]
Frequency of 'Low' price range: 0
item_category_name
```

```
 Accessories - PS2              215.500000
 Accessories - PS3             2255.981900
 Accessories - PS4             2105.419083
 Accessories - PSP              555.057055
 Accessories - PSVita           864.652948
                                    ...
 Programs - MAC (Digit)        3403.571429
 Service                       1094.625747
 Service - Tickets             1246.023391
 Tickets (Digital)             1344.607752
PC - Headsets / Headphones       87.800000
Name: item_price, Length: 84, dtype: float64
```



[ ]:
```
#stationarity analysis
```

[ ]:
```
# Convert the date column to datetime format
final_dataset['date'] = pd.to_datetime(final_dataset['date'], format='%d.%m.%Y')

monthly_data = final_dataset.groupby(final_dataset['date'].dt.to_period('M')).
 ↪agg({
    'item_cnt_month': 'sum',
}).reset_index()

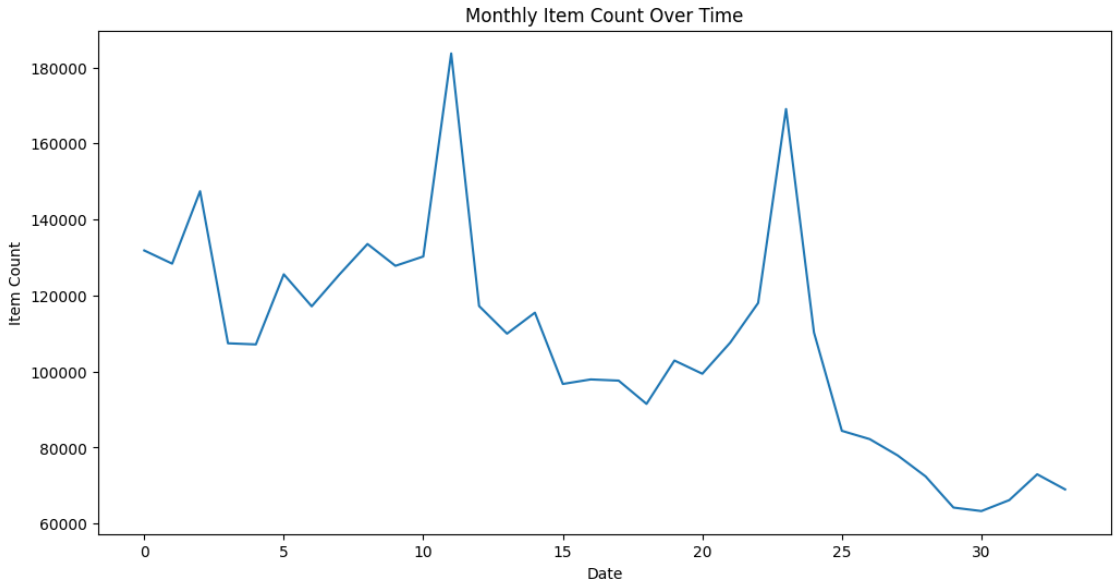
def adf_test(timeseries):
    result = adfuller(timeseries, autolag='AIC')
    print('ADF Statistic:', result[0])
    print('p-value:', result[1])
    print('Critical Values:')
    for key, value in result[4].items():
        print(f'   {key}: {value}')

    if result[1] <= 0.05:
        print("Stationary (Reject the null hypothesis)")
    else:
        print("Non-Stationary (Fail to reject the null hypothesis)")

item_cnt_month_series = monthly_data['item_cnt_month']

plt.figure(figsize=(12, 6))
plt.plot(item_cnt_month_series)
plt.title('Monthly Item Count Over Time')
plt.xlabel('Date')
plt.ylabel('Item Count')
plt.show()

adf_test(item_cnt_month_series)
```




```
ADF Statistic: -2.372251519825604
p-value: 0.1497218397733845
Critical Values:
   1%: -3.6461350877925254
   5%: -2.954126991123355
   10%: -2.6159676124885216
Non-Stationary (Fail to reject the null hypothesis)
```

[ ]:
```
print("\n\nHead of final_dataset:\n")
print(final_dataset.head(20))
print(final_dataset.shape)
print(final_dataset.info())
```

```
Head of final_dataset:

         date date_num  month_name  year_num  shop_id  \
0  2013-01-02       02           1         0       59
1  2013-01-03       03           1         0       25
3  2013-01-06       06           1         0       25
4  2013-01-15       15           1         0       25
5  2013-01-10       10           1         0       25
6  2013-01-02       02           1         0       25
7  2013-01-04       04           1         0       25
8  2013-01-11       11           1         0       25
9  2013-01-03       03           1         0       25
10 2013-01-03       03           1         0       25
```

```
11 2013-01-05       05           1         0       25
12 2013-01-07       07           1         0       25
13 2013-01-08       08           1         0       25
14 2013-01-10       10           1         0       25
15 2013-01-11       11           1         0       25
16 2013-01-13       13           1         0       25
17 2013-01-16       16           1         0       25
18 2013-01-26       26           1         0       25
19 2013-01-27       27           1         0       25
20 2013-01-09       09           1         0       25

                  shop_name  item_id  \
0    Yaroslavl TC" Altair "    22154
1      Moscow TEC" Atrium "     2552
3      Moscow TEC" Atrium "     2554
4      Moscow TEC" Atrium "     2555
5      Moscow TEC" Atrium "     2564
6      Moscow TEC" Atrium "     2565
7      Moscow TEC" Atrium "     2572
8      Moscow TEC" Atrium "     2572
9      Moscow TEC" Atrium "     2573
10     Moscow TEC" Atrium "     2574
11     Moscow TEC" Atrium "     2574
12     Moscow TEC" Atrium "     2574
13     Moscow TEC" Atrium "     2574
14     Moscow TEC" Atrium "     2574
15     Moscow TEC" Atrium "     2574
16     Moscow TEC" Atrium "     2574
17     Moscow TEC" Atrium "     2574
18     Moscow TEC" Atrium "     2574
19     Moscow TEC" Atrium "     2574
20     Moscow TEC" Atrium "     2593

                                          item_name  category_id  \
0                                   SCENE 2012 (BD)           37
1              DEEP PURPLE The House Of Blue Light LP           58
3              DEEP PURPLE Who Do You Think We Are LP           58
4       DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                   DEEP PURPLE Stormbringer (firms).           56
7                              DEFTONES Koi No Yokan            55
8                              DEFTONES Koi No Yokan            55
9                           DEL REY LANA Born To Die            55
10  DEL REY LANA Born To Die The Paradise Edition 2CD           55
11  DEL REY LANA Born To Die The Paradise Edition 2CD           55
12  DEL REY LANA Born To Die The Paradise Edition 2CD           55
13  DEL REY LANA Born To Die The Paradise Edition 2CD           55
14  DEL REY LANA Born To Die The Paradise Edition 2CD           55
```

```
15  DEL REY LANA Born To Die The Paradise Edition 2CD           55
16  DEL REY LANA Born To Die The Paradise Edition 2CD           55
17  DEL REY LANA Born To Die The Paradise Edition 2CD           55
18  DEL REY LANA Born To Die The Paradise Edition 2CD           55
19  DEL REY LANA Born To Die The Paradise Edition 2CD           55
20                 DEPECHE MODE Music For The Masses           55

                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00
11       Music - CD of local production      399.00               1   399.00
12       Music - CD of local production      399.00               1   399.00
13       Music - CD of local production      399.00               2   798.00
14       Music - CD of local production      399.00               1   399.00
15       Music - CD of local production      399.00               2   798.00
16       Music - CD of local production      399.00               1   399.00
17       Music - CD of local production      399.00               1   399.00
18       Music - CD of local production      399.00               1   399.00
19       Music - CD of local production      399.00               1   399.00
20       Music - CD of local production      279.00               1   279.00

   price_range  log_revenue  scaled_revenue
0   900-100000     6.906755        0.000546
1      800-900     6.801283        0.000491
3   900-100000     7.443693        0.000934
4   900-100000     7.002156        0.000601
5      300-400     5.855072        0.000191
6      500-600     6.308098        0.000300
7      200-300     5.476464        0.000131
8      200-300     5.700444        0.000163
9      200-300     6.799056        0.000490
10     300-400     6.682109        0.000436
11     300-400     5.988961        0.000218
12     300-400     5.988961        0.000218
13     300-400     6.682109        0.000436
14     300-400     5.988961        0.000218
15     300-400     6.682109        0.000436
16     300-400     5.988961        0.000218
17     300-400     5.988961        0.000218
18     300-400     5.988961        0.000218
```

```
19     300-400     5.988961        0.000218
20     200-300     5.631212        0.000152
(2928483, 16)
<class 'pandas.core.frame.DataFrame'>
Index: 2928483 entries, 0 to 2935848
Data columns (total 16 columns):
 #   Column              Dtype
---  ------              -----
 0   date                datetime64[ns]
 1   date_num            object
 2   month_name          int64
 3   year_num            int64
 4   shop_id             int64
 5   shop_name           object
 6   item_id             int64
 7   item_name           object
 8   category_id         int64
 9   item_category_name  object
 10  item_price          float64
 11  item_cnt_month      int64
 12  revenue             float64
 13  price_range         category
 14  log_revenue         float64
 15  scaled_revenue      float64
dtypes: category(1), datetime64[ns](1), float64(4), int64(6), object(4)
memory usage: 360.3+ MB
None
```

[ ]:
```
#export the final dataset to csv file
final_dataset.to_csv('./data-set/output/final_dataset_with_cleaning.csv',␣
↪index=False)
```

1.5 Model Development, Error Analysis & Comparison

[ ]:
```
#prepare the data for modeling
df = pd.read_csv('./data-set/sales_train.csv')
#rename item_cnt_day column
df.rename(columns={'item_cnt_day': 'item_count'}, inplace=True)
#removes duplicates
df.drop_duplicates(inplace=True)
#outlier treatment
df = df[(df['item_count'] > 0) & (df['item_count'] < 307980)]
df = df[df['item_count'] < 1000]
#handles incorrect data
df = df[(df['item_price'] > 0) & (df['item_price'] < 100000)]
#converts date column to datetime format
df['date'] = pd.to_datetime(df['date'], format='%d.%m.%Y')
```

```
#convert date to year-month format
df['year-month'] = df['date'].dt.strftime('%Y-%m')
#drop date column and item_price column
df.drop(columns=['date', 'item_price'], inplace=True)
# group features
df_train_group = df.groupby(['year-month', 'shop_id', 'item_id']).sum().
 ↪reset_index()
# pivot table
df = df_train_group.pivot_table(index=['shop_id', 'item_id'],␣
 ↪columns='year-month', values='item_count', fill_value=0).reset_index()

print(df.head(10))
print(df.shape)
print(df.info())
```

```
year-month  shop_id  item_id  2013-01  2013-02  2013-03  2013-04  2013-05  \
0                 0       30        0       31        0        0        0
1                 0       31        0       11        0        0        0
2                 0       32        6       10        0        0        0
3                 0       33        3        3        0        0        0
4                 0       35        1       14        0        0        0
5                 0       36        0        1        0        0        0
6                 0       40        0        1        0        0        0
7                 0       42        0        1        0        0        0
8                 0       43        1        0        0        0        0
9                 0       49        0        2        0        0        0

year-month  2013-06  2013-07  2013-08  …  2015-01  2015-02  2015-03  \
0                 0        0        0  …        0        0        0
1                 0        0        0  …        0        0        0
2                 0        0        0  …        0        0        0
3                 0        0        0  …        0        0        0
4                 0        0        0  …        0        0        0
5                 0        0        0  …        0        0        0
6                 0        0        0  …        0        0        0
7                 0        0        0  …        0        0        0
8                 0        0        0  …        0        0        0
9                 0        0        0  …        0        0        0

year-month  2015-04  2015-05  2015-06  2015-07  2015-08  2015-09  2015-10
0                 0        0        0        0        0        0        0
1                 0        0        0        0        0        0        0
2                 0        0        0        0        0        0        0
3                 0        0        0        0        0        0        0
4                 0        0        0        0        0        0        0
5                 0        0        0        0        0        0        0
6                 0        0        0        0        0        0        0
```

```
7                0        0        0        0        0        0        0
8                0        0        0        0        0        0        0
9                0        0        0        0        0        0        0

[10 rows x 36 columns]
(424097, 36)
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 424097 entries, 0 to 424096
Data columns (total 36 columns):
 #   Column   Non-Null Count   Dtype
---  ------   --------------   -----
 0   shop_id  424097 non-null  int64
 1   item_id  424097 non-null  int64
 2   2013-01  424097 non-null  int64
 3   2013-02  424097 non-null  int64
 4   2013-03  424097 non-null  int64
 5   2013-04  424097 non-null  int64
 6   2013-05  424097 non-null  int64
 7   2013-06  424097 non-null  int64
 8   2013-07  424097 non-null  int64
 9   2013-08  424097 non-null  int64
 10  2013-09  424097 non-null  int64
 11  2013-10  424097 non-null  int64
 12  2013-11  424097 non-null  int64
 13  2013-12  424097 non-null  int64
 14  2014-01  424097 non-null  int64
 15  2014-02  424097 non-null  int64
 16  2014-03  424097 non-null  int64
 17  2014-04  424097 non-null  int64
 18  2014-05  424097 non-null  int64
 19  2014-06  424097 non-null  int64
 20  2014-07  424097 non-null  int64
 21  2014-08  424097 non-null  int64
 22  2014-09  424097 non-null  int64
 23  2014-10  424097 non-null  int64
 24  2014-11  424097 non-null  int64
 25  2014-12  424097 non-null  int64
 26  2015-01  424097 non-null  int64
 27  2015-02  424097 non-null  int64
 28  2015-03  424097 non-null  int64
 29  2015-04  424097 non-null  int64
 30  2015-05  424097 non-null  int64
 31  2015-06  424097 non-null  int64
 32  2015-07  424097 non-null  int64
 33  2015-08  424097 non-null  int64
 34  2015-09  424097 non-null  int64
 35  2015-10  424097 non-null  int64
dtypes: int64(36)
```

```
memory usage: 116.5 MB
None
```

[ ]:
```
#export the final dataset to csv file
final_dataset.to_csv('./data-set/output/dataset_for_modeling.csv', index=False)
```

[ ]:
```
# Create X and y variables for train and test sets
X = df[df.columns[:-1]]
y = df[df.columns[-1]]


X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)

print(X_train.shape)
print(X_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(339277, 35)
(84820, 35)
(339277,)
(84820,)
```

[ ]:
```
#creating evaluation metrics
scores_and_names = []

# Create a function to evaluate the model
def evaluate_the_model(y_true, y_pred, model_name, model):

    # Calculate the MAE
    mae = mean_absolute_error(y_true, y_pred)
    print(f"MAE for {model_name}: {mae:.5f}")

    # Calculate the MSE
    mse = mean_squared_error(y_true, y_pred)
    print(f"MSE for {model_name}: {mse:.5f}")

    # Calculate the RMSE
    rmse = np.sqrt(mse)
    print(f"RMSE for {model_name}: {rmse:.5f}")

    # Plot the predictions vs. the actual values
    plt.figure(figsize=(12, 6))
    plt.plot(y_true, label='Actual Values')
    plt.plot(y_pred, label='Predicted Values')
    plt.title(f'Predictions vs. Actual Values ({model_name})')
    plt.xlabel('Observation')
```

```
    plt.ylabel('Item Count')
    plt.legend()
    plt.show()

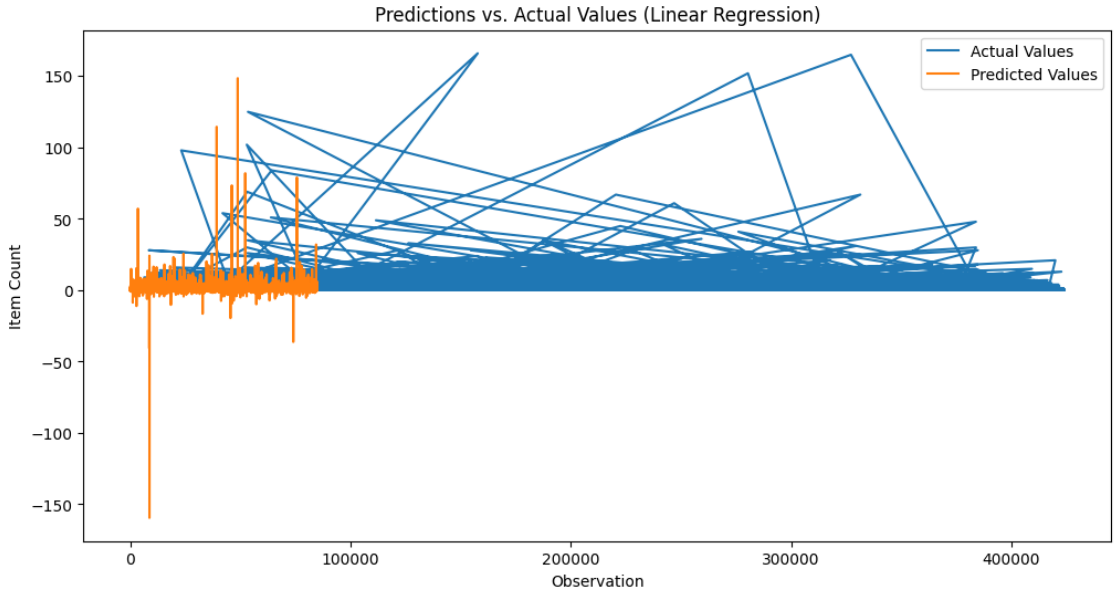
    scores_and_names.append((model_name, rmse))
```

1.5.1 linear regression

[ ]:
```
# Create a Linear Regression model
lin_reg = LinearRegression()
lin_reg.fit(X_train, y_train)
y_pred = lin_reg.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Linear Regression', lin_reg)
```

```
MAE for Linear Regression: 0.29022
MSE for Linear Regression: 2.39626
RMSE for Linear Regression: 1.54798
```



1.5.2 Logistic Regression

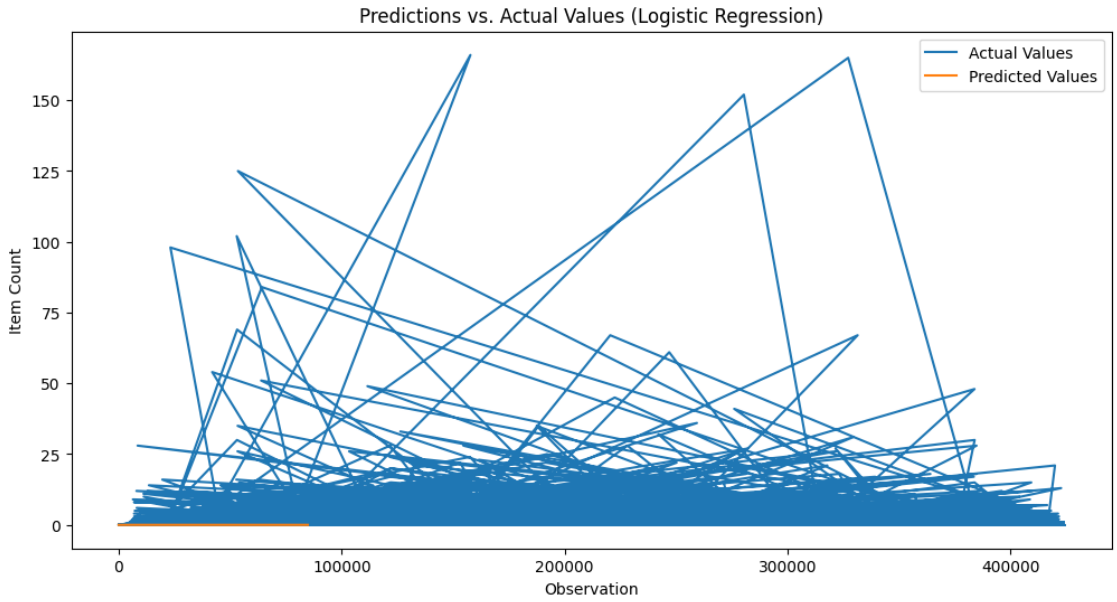
[ ]:
```
# Create a logistic regression model
log_reg = LogisticRegression()
log_reg.fit(X_train, y_train)
y_pred = log_reg.predict(X_test)
```

```
evaluate_the_model(y_test, y_pred, 'Logistic Regression', log_reg)
```

```
C:\Users\srume\AppData\Roaming\Python\Python311\site-
packages\sklearn\linear_model\_logistic.py:460: ConvergenceWarning: lbfgs failed
to converge (status=1):
STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
```

```
MAE for Logistic Regression: 0.16065
MSE for Logistic Regression: 2.61462
RMSE for Logistic Regression: 1.61698
```

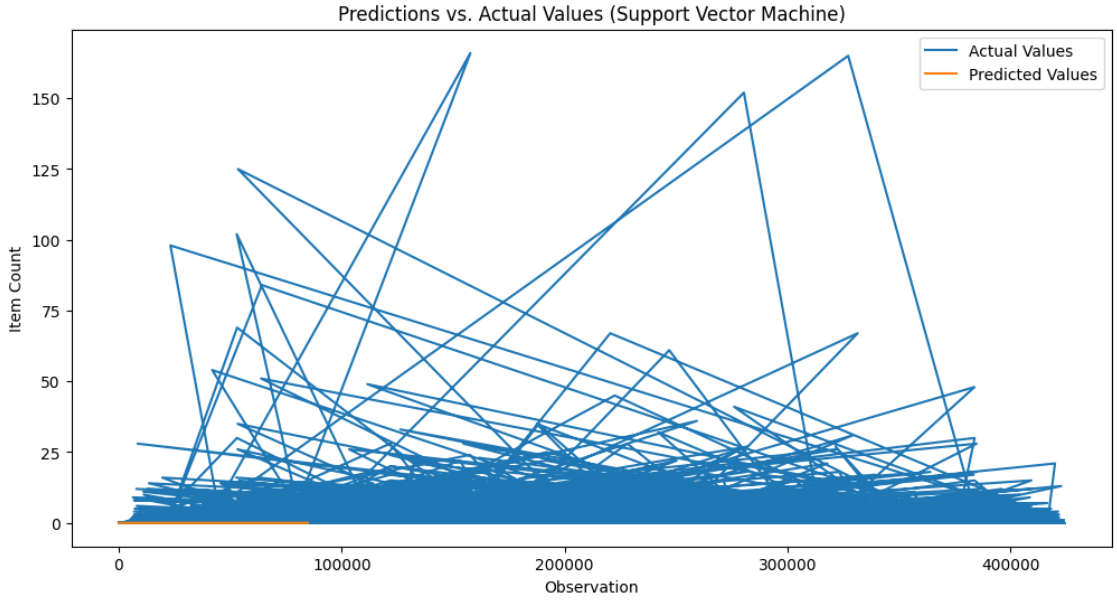


1.5.3 SVM

[ ]:
```
# create a support vector machine model
svm = SVC()
svm.fit(X_train, y_train)
y_pred = svm.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Support Vector Machine', svm)
```

```
MAE for Support Vector Machine: 0.16065
MSE for Support Vector Machine: 2.61462
RMSE for Support Vector Machine: 1.61698
```

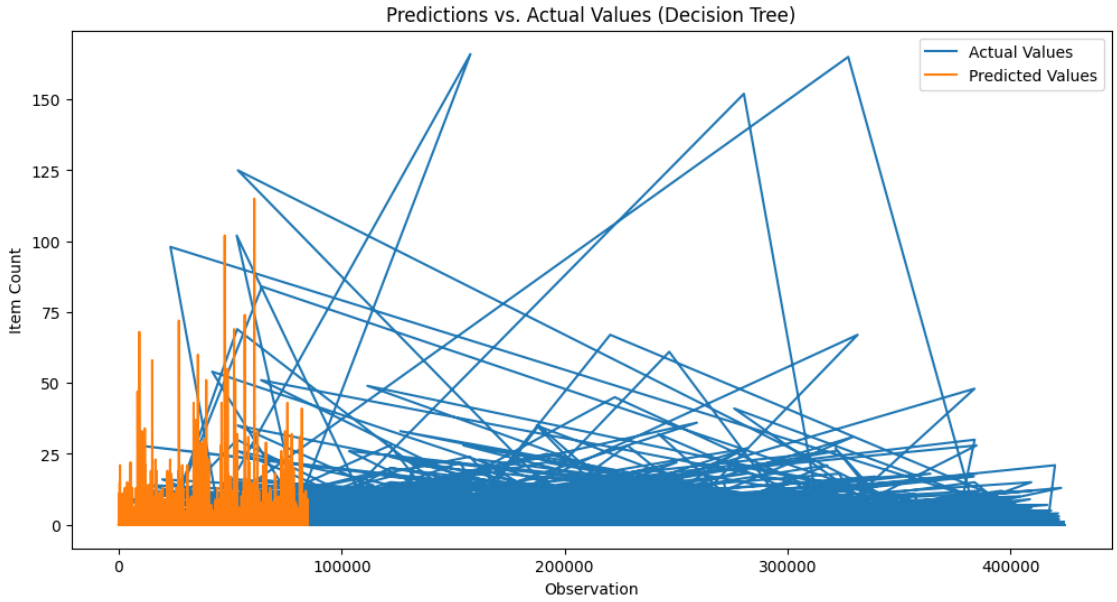


1.5.4 Decision Tree

[ ]:
```
# create a decision tree model
dt = DecisionTreeClassifier()
dt.fit(X_train, y_train)
y_pred = dt.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Decision Tree', dt)
```

```
MAE for Decision Tree: 0.17817
MSE for Decision Tree: 1.88140
RMSE for Decision Tree: 1.37164
```

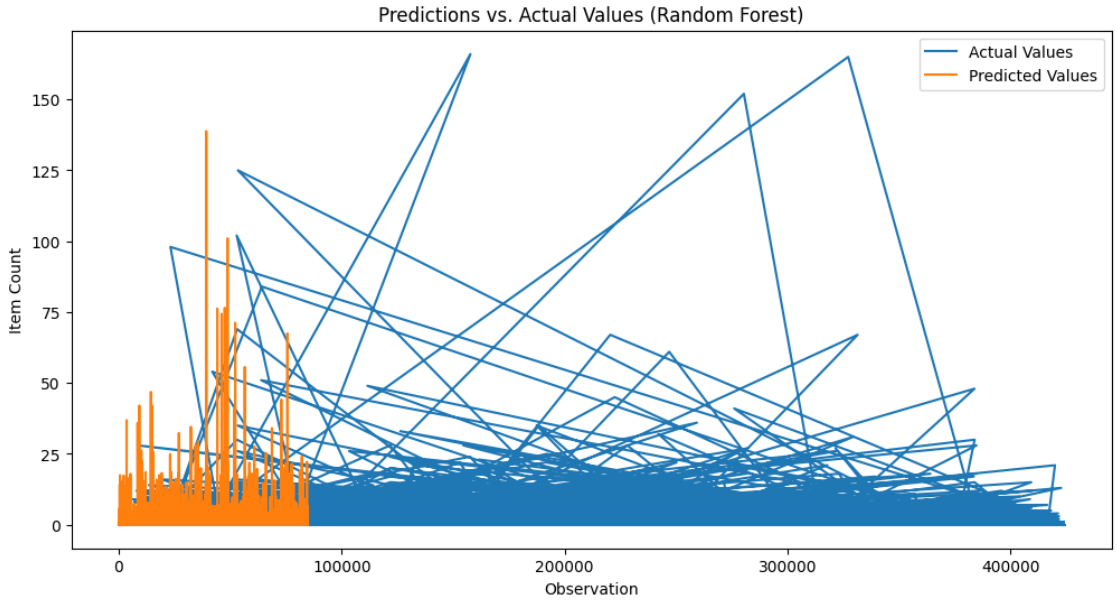


1.5.5 random forest

[ ]:
```
# create a random forest model
rf = RandomForestRegressor()
rf.fit(X_train, y_train)
y_pred = rf.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Random Forest', rf)
```

```
MAE for Random Forest: 0.16314
MSE for Random Forest: 1.13545
RMSE for Random Forest: 1.06558
```

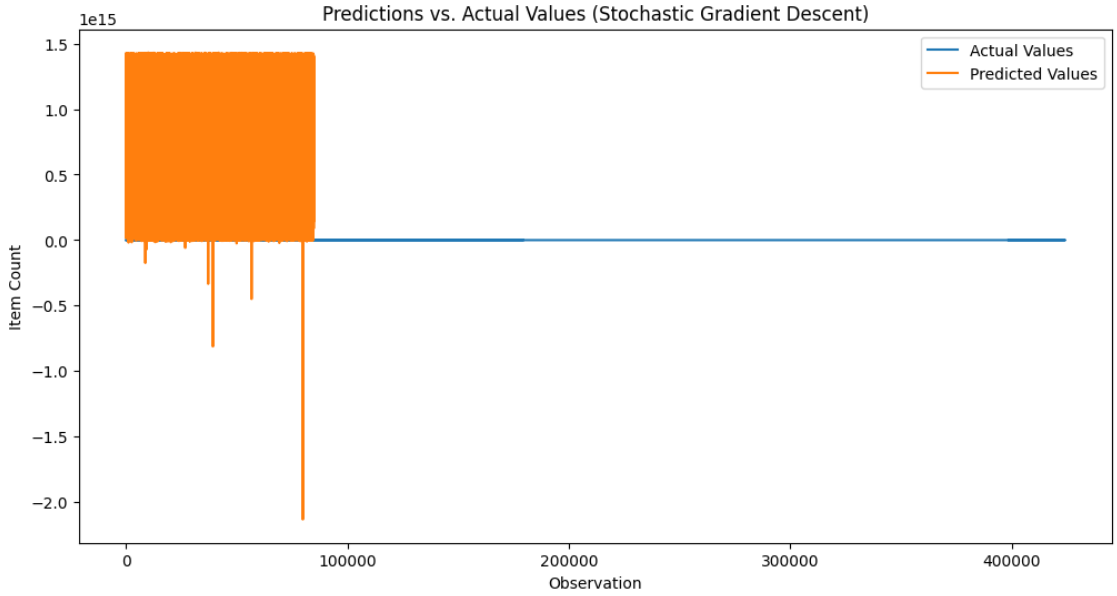


1.5.6 Stochastic Gradient Descent

[ ]:
```
#create a stochastic gradient descent model
sgd_reg = SGDRegressor()
sgd_reg.fit(X_train, y_train)
y_pred = sgd_reg.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Stochastic Gradient Descent', sgd_reg)
```

```
MAE for Stochastic Gradient Descent: 735578716284226.25000
MSE for Stochastic Gradient Descent: 6980481550025679562194844385 28.00000
RMSE for Stochastic Gradient Descent: 835492761789453.12500
```

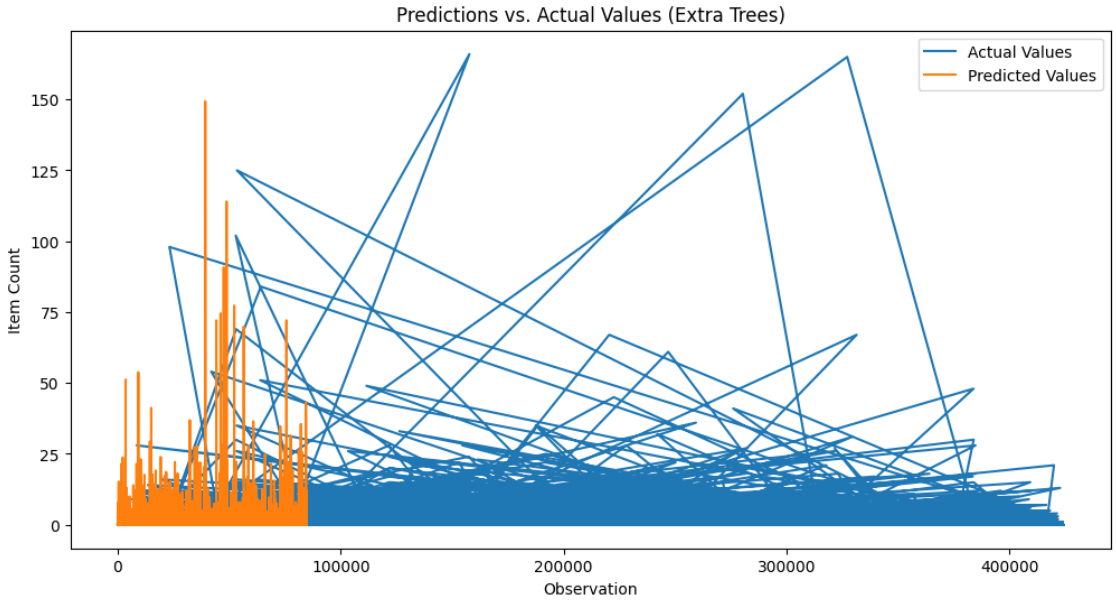


1.5.7 xtra tree

[ ]:
```
#create a extra trees model
et = ExtraTreesRegressor()
et.fit(X_train, y_train)
y_pred = et.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Extra Trees', et)
```

```
MAE for Extra Trees: 0.17591
MSE for Extra Trees: 1.14391
RMSE for Extra Trees: 1.06954
```

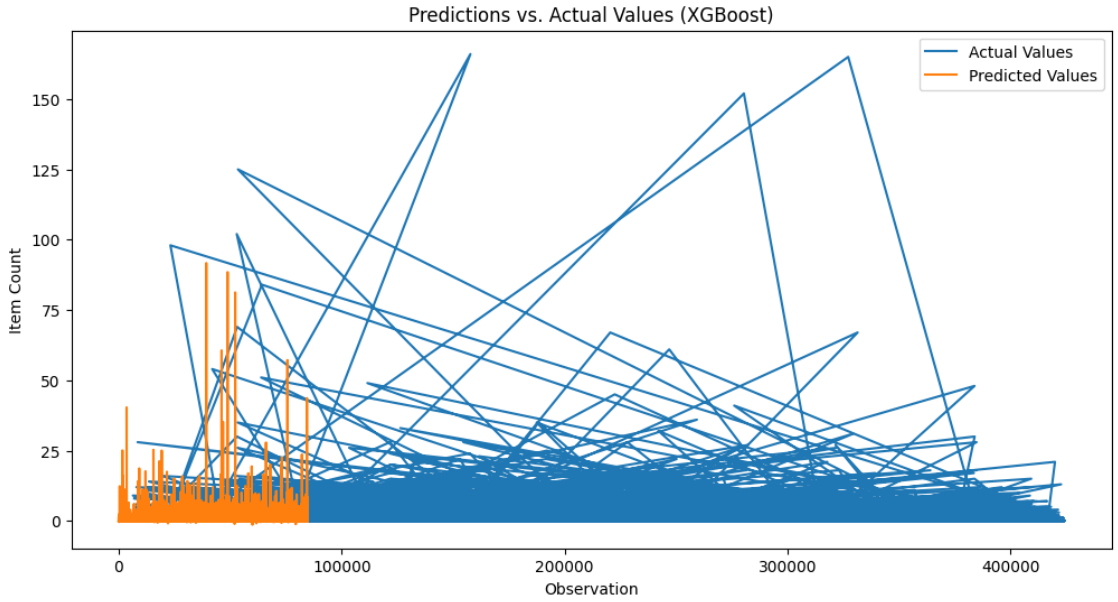


1.5.8 XGBoost

[ ]:
```
#create a xgboost model
xgb = XGBRegressor()
xgb.fit(X_train, y_train)
y_pred = xgb.predict(X_test)

evaluate_the_model(y_test, y_pred, 'XGBoost', xgb)
```

```
MAE for XGBoost: 0.21046
MSE for XGBoost: 1.69069
RMSE for XGBoost: 1.30027
```

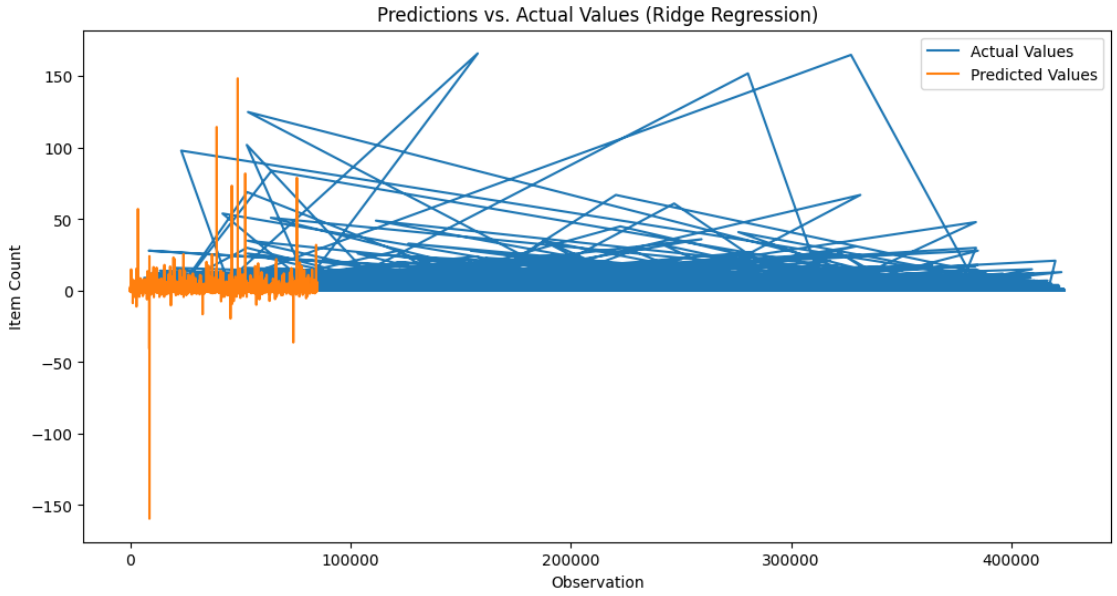


1.5.9 ridge regression

[ ]:
```
#create ridge regression model
ridge = Ridge()
ridge.fit(X_train, y_train)
y_pred = ridge.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Ridge Regression', ridge)
```

```
MAE for Ridge Regression: 0.29022
MSE for Ridge Regression: 2.39625
RMSE for Ridge Regression: 1.54798
```

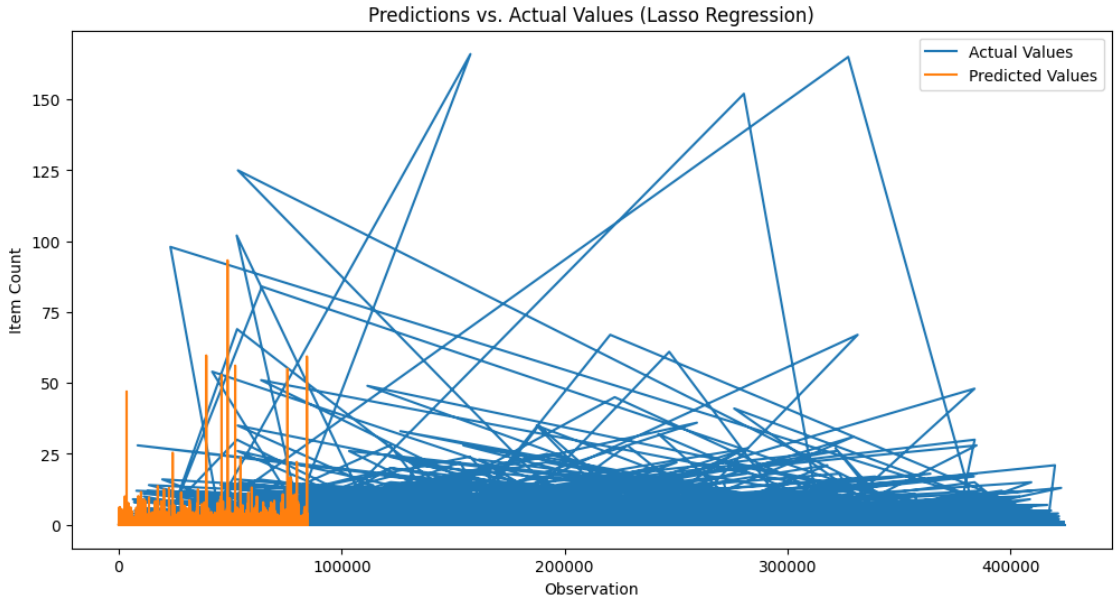


1.5.10 lasso regression

[ ]:
```
#create lasso regression model
lasso = Lasso()
lasso.fit(X_train, y_train)
y_pred = lasso.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Lasso Regression', lasso)
```

```
MAE for Lasso Regression: 0.26487
MSE for Lasso Regression: 2.11585
RMSE for Lasso Regression: 1.45460
```



1.5.11 ARIMA

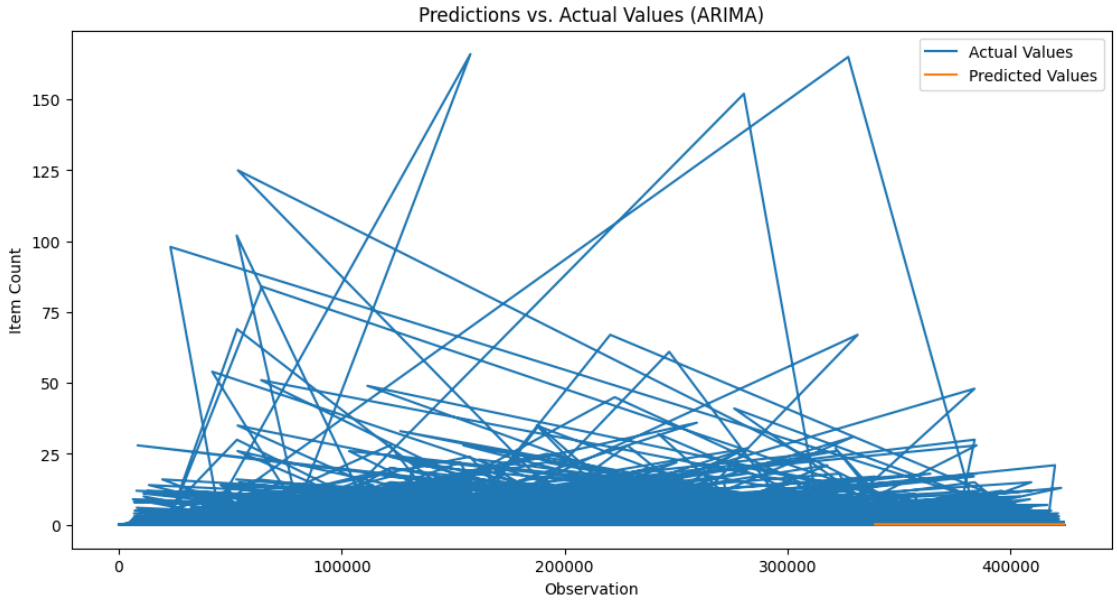
[ ]:
```
#create ARIMA model
arima = ARIMA(y_train, order=(1, 1, 1))
model = arima.fit()
y_pred = model.predict(start=len(y_train), end=len(y_train) + len(X_test) - 1,␣
 ↪exog=X_test)

evaluate_the_model(y_test, y_pred, 'ARIMA', arima)
```

```
c:\Users\srume\anaconda3\Lib\site-
packages\statsmodels\tsa\base\tsa_model.py:473: ValueWarning: An unsupported
index was provided and will be ignored when e.g. forecasting.
  self._init_dates(dates, freq)
c:\Users\srume\anaconda3\Lib\site-
packages\statsmodels\tsa\base\tsa_model.py:473: ValueWarning: An unsupported
index was provided and will be ignored when e.g. forecasting.
  self._init_dates(dates, freq)
c:\Users\srume\anaconda3\Lib\site-
packages\statsmodels\tsa\base\tsa_model.py:473: ValueWarning: An unsupported
index was provided and will be ignored when e.g. forecasting.
  self._init_dates(dates, freq)
c:\Users\srume\anaconda3\Lib\site-
packages\statsmodels\tsa\base\tsa_model.py:836: ValueWarning: No supported index
is available. Prediction results will be given with an integer index beginning
at `start`.
  return get_prediction_index(
```

```
c:\Users\srume\anaconda3\Lib\site-
packages\statsmodels\tsa\base\tsa_model.py:836: FutureWarning: No supported
index is available. In the next version, calling this method in a model without
a supported index will result in an exception.
  return get_prediction_index(
```

```
MAE for ARIMA: 0.30035
MSE for ARIMA: 2.58882
RMSE for ARIMA: 1.60898
```

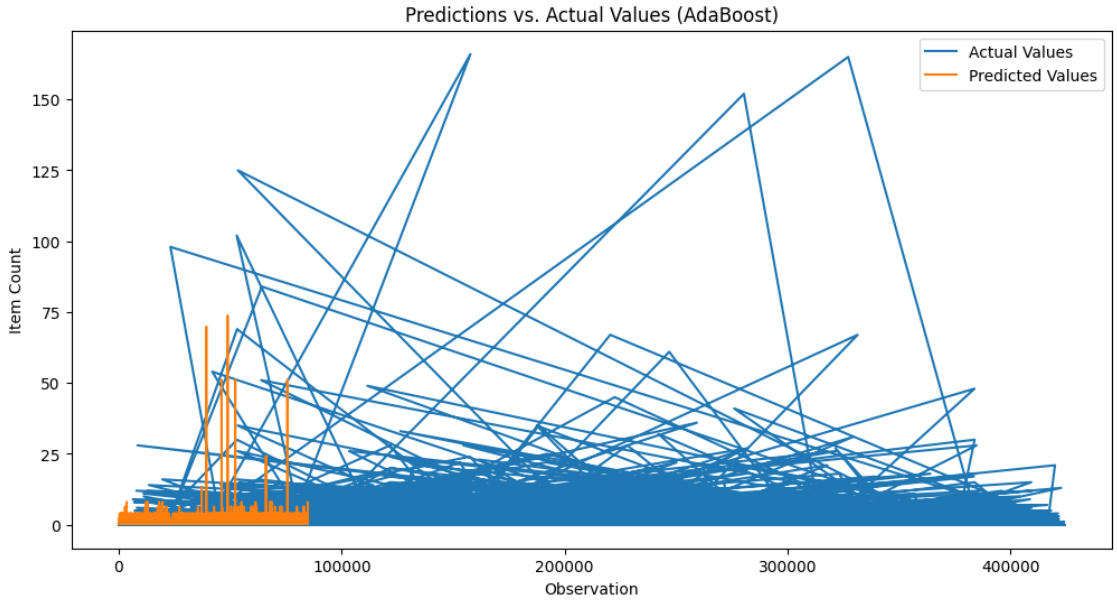


1.5.12 ADABOOST

[ ]:
```
#create adaboost model
ada = AdaBoostRegressor()
ada.fit(X_train, y_train)
y_pred = ada.predict(X_test)

evaluate_the_model(y_test, y_pred, 'AdaBoost', ada)
```

```
MAE for AdaBoost: 0.63456
MSE for AdaBoost: 2.36423
RMSE for AdaBoost: 1.53760
```

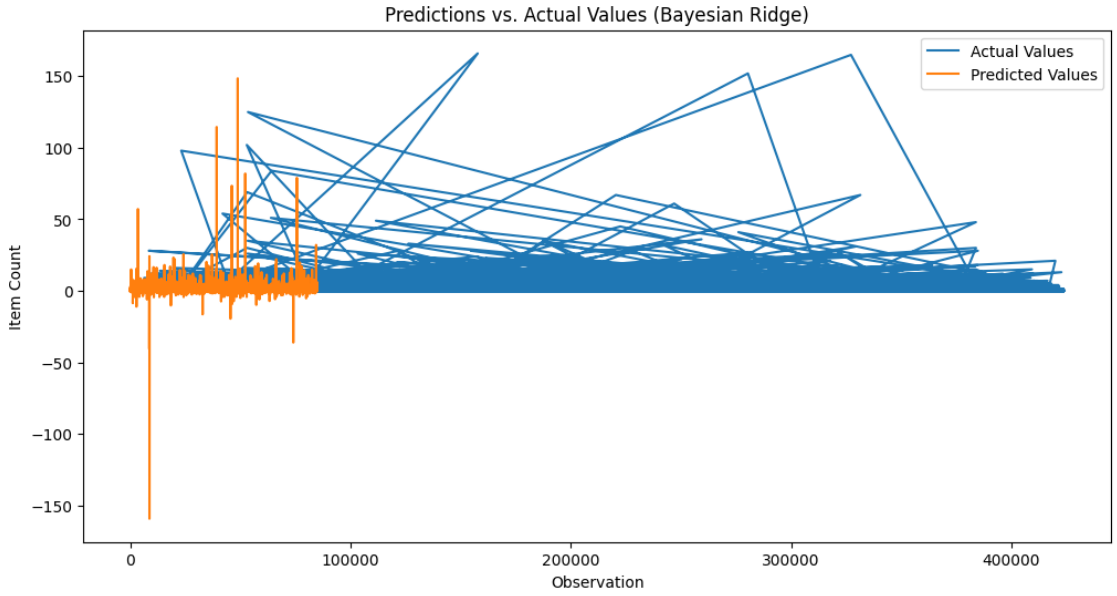


1.5.13 BayesianRidge

[ ]:
```
# create bayesian ridge model
br = BayesianRidge()
br.fit(X_train, y_train)
y_pred = br.predict(X_test)

evaluate_the_model(y_test, y_pred, 'Bayesian Ridge', br)
```

```
MAE for Bayesian Ridge: 0.29018
MSE for Bayesian Ridge: 2.39567
RMSE for Bayesian Ridge: 1.54780
```

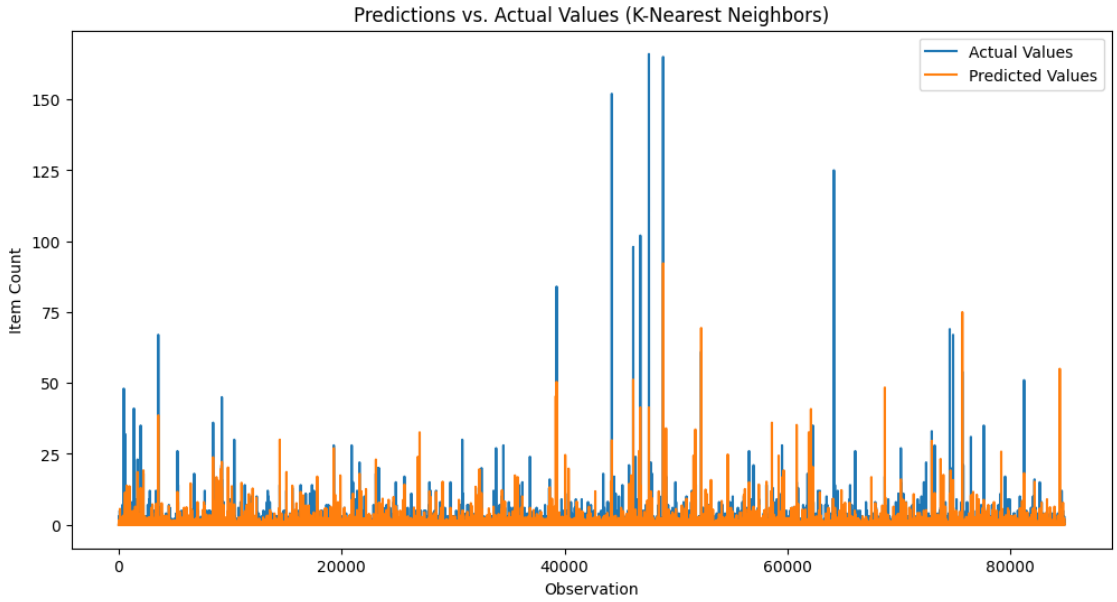


1.5.14 KNN

[ ]:
```
# create a knn model
knn = KNeighborsRegressor(n_neighbors=5)
knn.fit(X_train.values, y_train.values)
y_pred = knn.predict(X_test.values)

evaluate_the_model(y_test.values, y_pred, 'K-Nearest Neighbors', knn)
```

```
MAE for K-Nearest Neighbors: 0.18599
MSE for K-Nearest Neighbors: 1.60036
RMSE for K-Nearest Neighbors: 1.26505
```



1.5.15 Compare Models

[ ]:
```
results = pd.DataFrame(scores_and_names, columns=['Model', 'RMSE'])
```

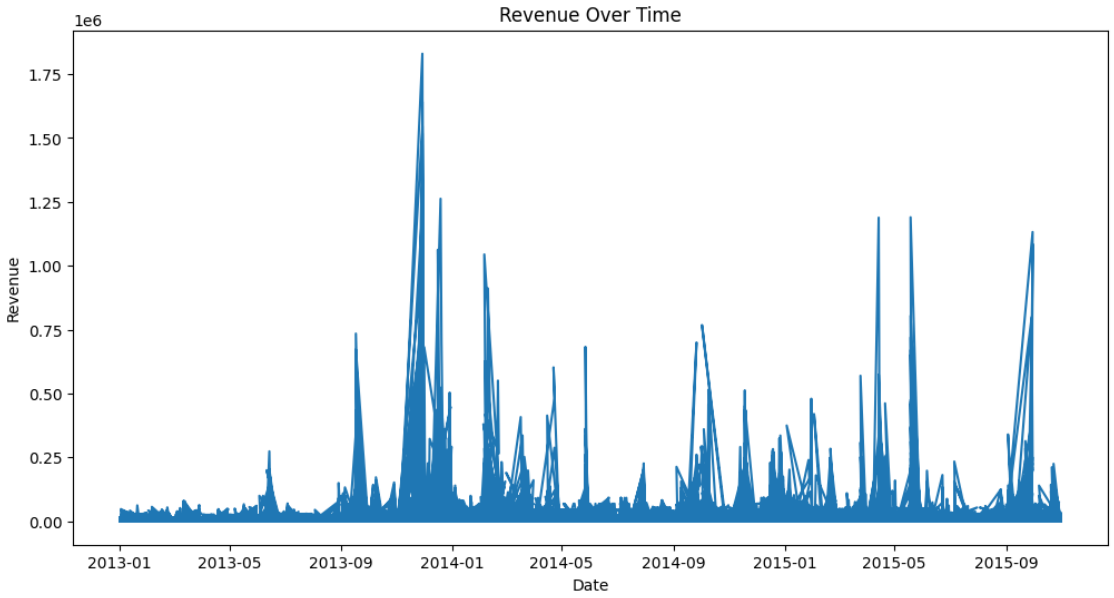
[ ]:
```
#sort the results
results.sort_values(by='RMSE', ascending=True, inplace=True)
```

[ ]:
```
#print the results in tabel format
print(results)
```

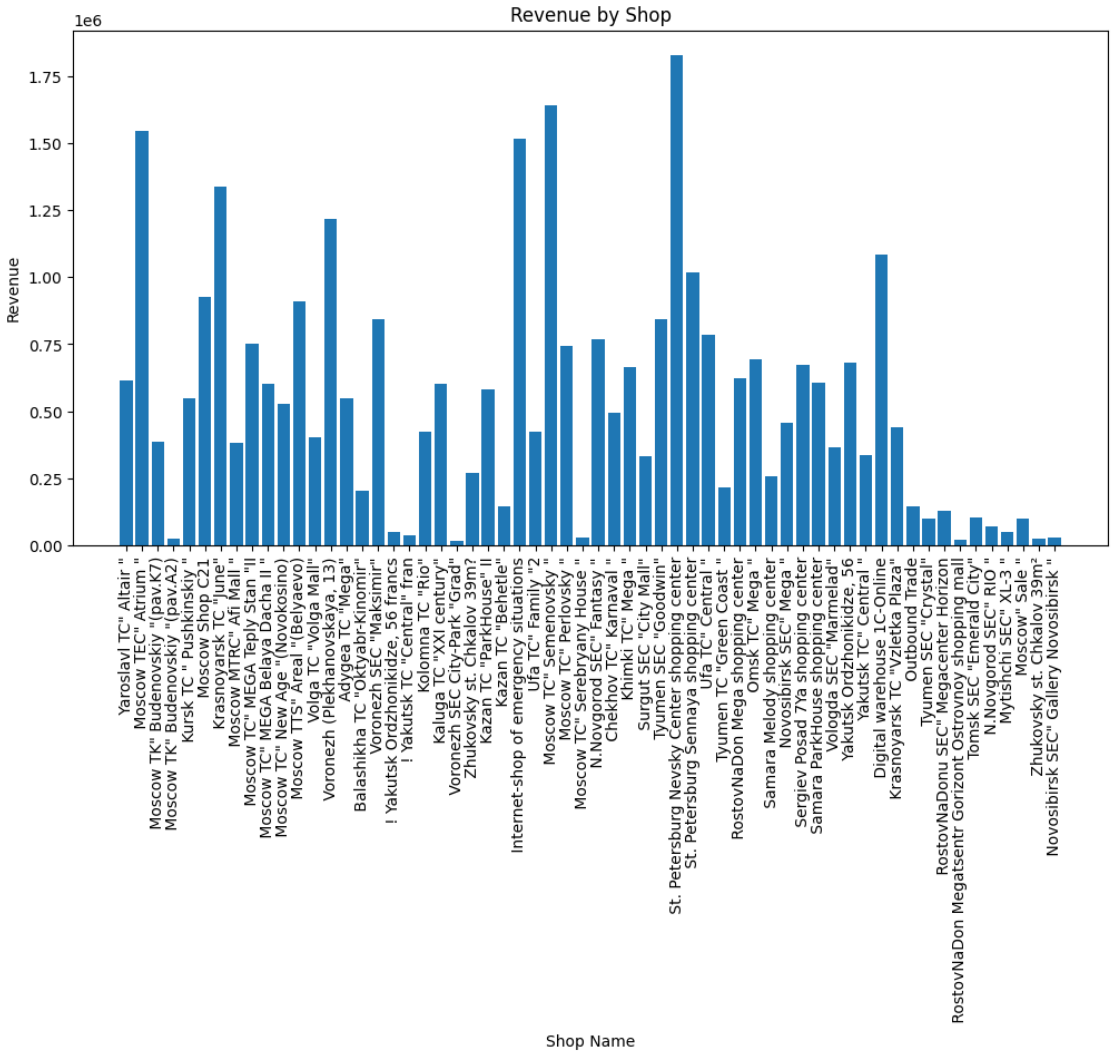
```
                          Model          RMSE
4                 Random Forest  1.065577e+00
6                   Extra Trees  1.069535e+00
13          K-Nearest Neighbors  1.265051e+00
7                       XGBoost  1.300267e+00
3                 Decision Tree  1.371640e+00
9               Lasso Regression  1.454596e+00
11                     AdaBoost  1.537605e+00
12               Bayesian Ridge  1.547795e+00
8               Ridge Regression  1.547984e+00
0               Linear Regression  1.547985e+00
10                         ARIMA  1.608982e+00
1           Logistic Regression  1.616978e+00
2         Support Vector Machine  1.616978e+00
5   Stochastic Gradient Descent  8.354928e+14
```

1.6 Data Visualization

[ ]:
```
#line chart
plt.figure(figsize=(12, 6))
plt.plot(final_dataset['date'], final_dataset['revenue'])
plt.title('Revenue Over Time')
plt.xlabel('Date')
plt.ylabel('Revenue')
plt.show()
```

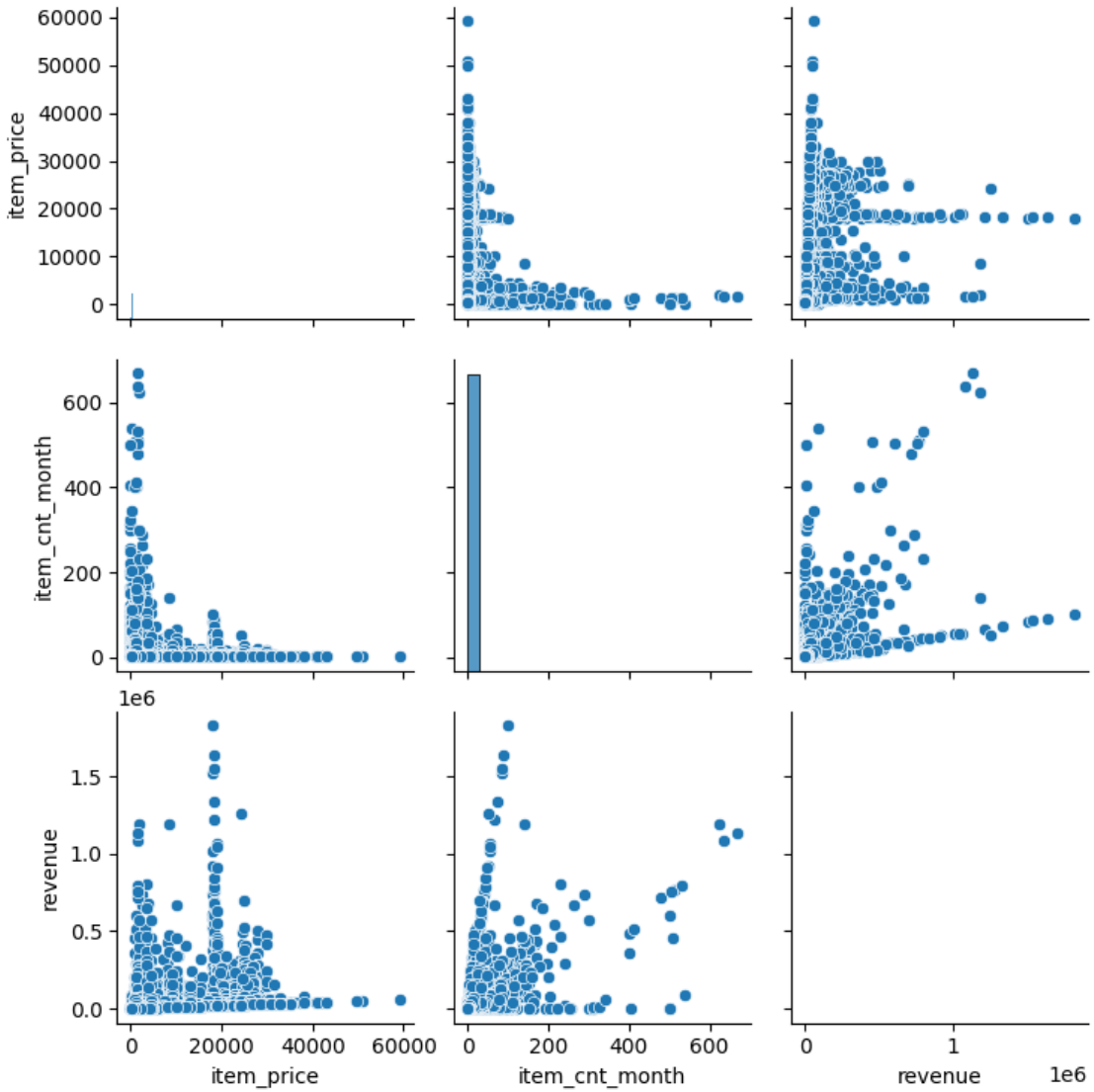


[ ]:
```
#bar chart
plt.figure(figsize=(12, 6))
plt.bar(final_dataset['shop_name'], final_dataset['revenue'])
plt.title('Revenue by Shop')
plt.xlabel('Shop Name')
plt.ylabel('Revenue')
plt.xticks(rotation=90)
plt.show()
```

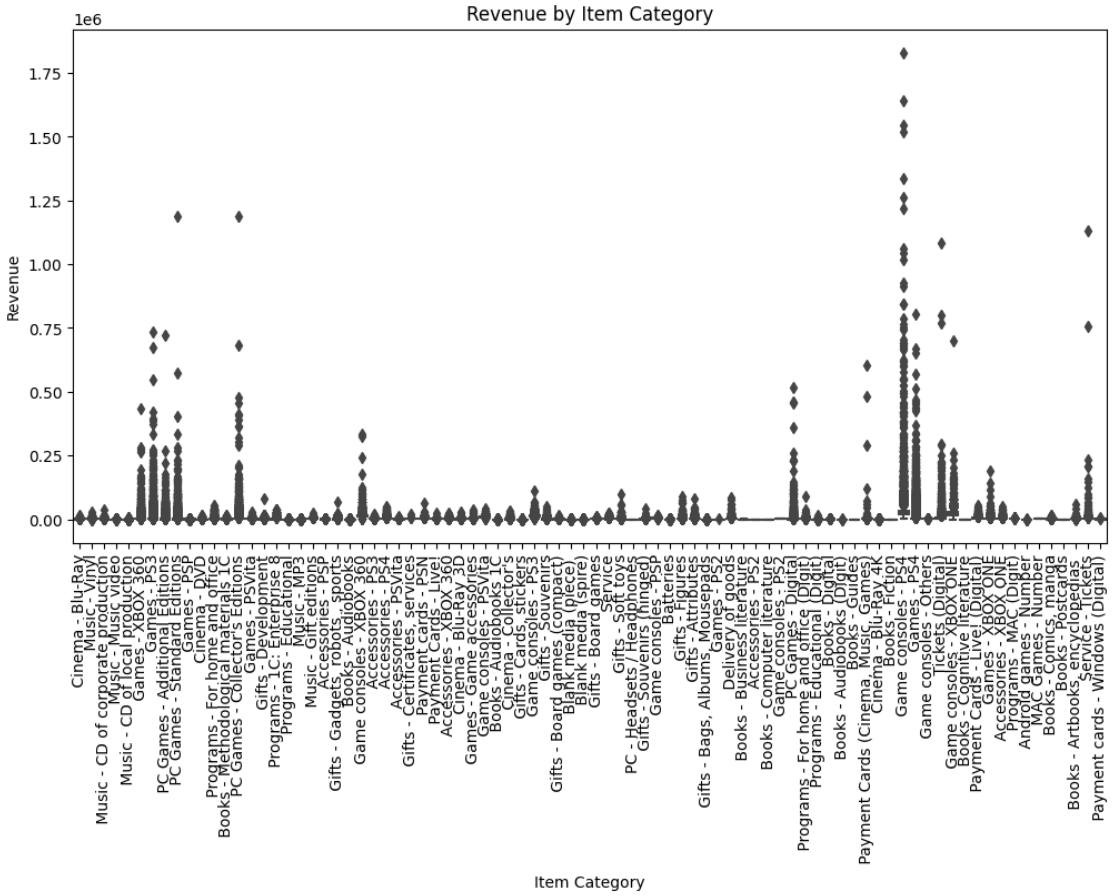


[ ]:
```
#pairplot
sns.pairplot(final_dataset[['item_price', 'item_cnt_month', 'revenue']])
plt.show()
```

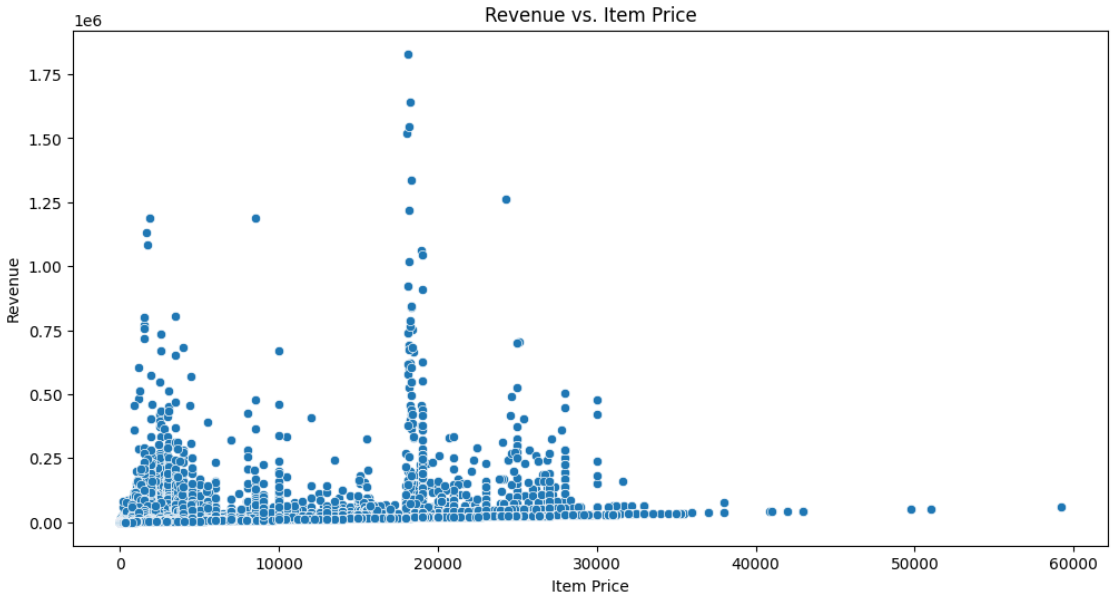
```
c:\Users\srume\anaconda3\Lib\site-packages\seaborn\axisgrid.py:118: UserWarning:
The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```



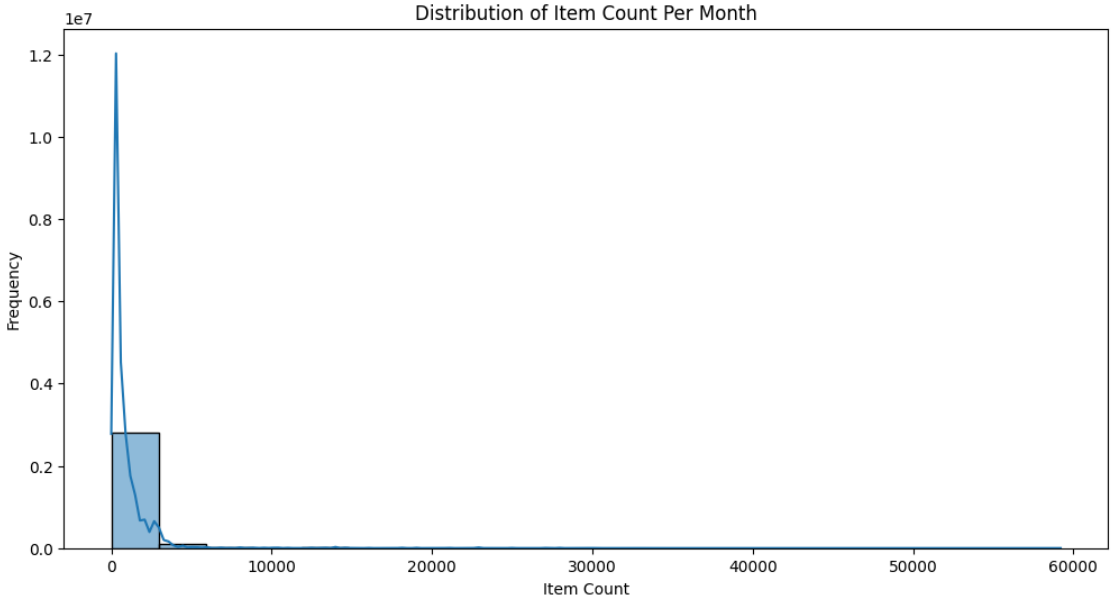

```
[ ]: #boxplot
plt.figure(figsize=(12, 6))
sns.boxplot(data=final_dataset, x='item_category_name', y='revenue')
plt.title('Revenue by Item Category')
plt.xlabel('Item Category')
plt.ylabel('Revenue')
plt.xticks(rotation=90)
plt.show()
```



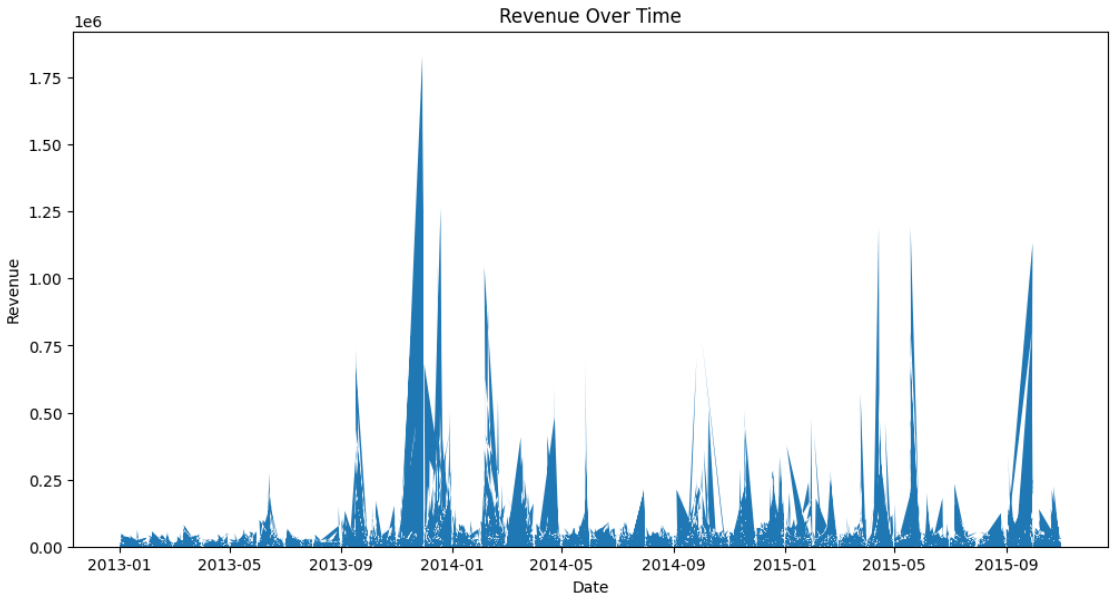
[ ]:
```
#scatter chart
plt.figure(figsize=(12, 6))
sns.scatterplot(data=final_dataset, x='item_price', y='revenue')
plt.title('Revenue vs. Item Price')
plt.xlabel('Item Price')
plt.ylabel('Revenue')
plt.show()
```



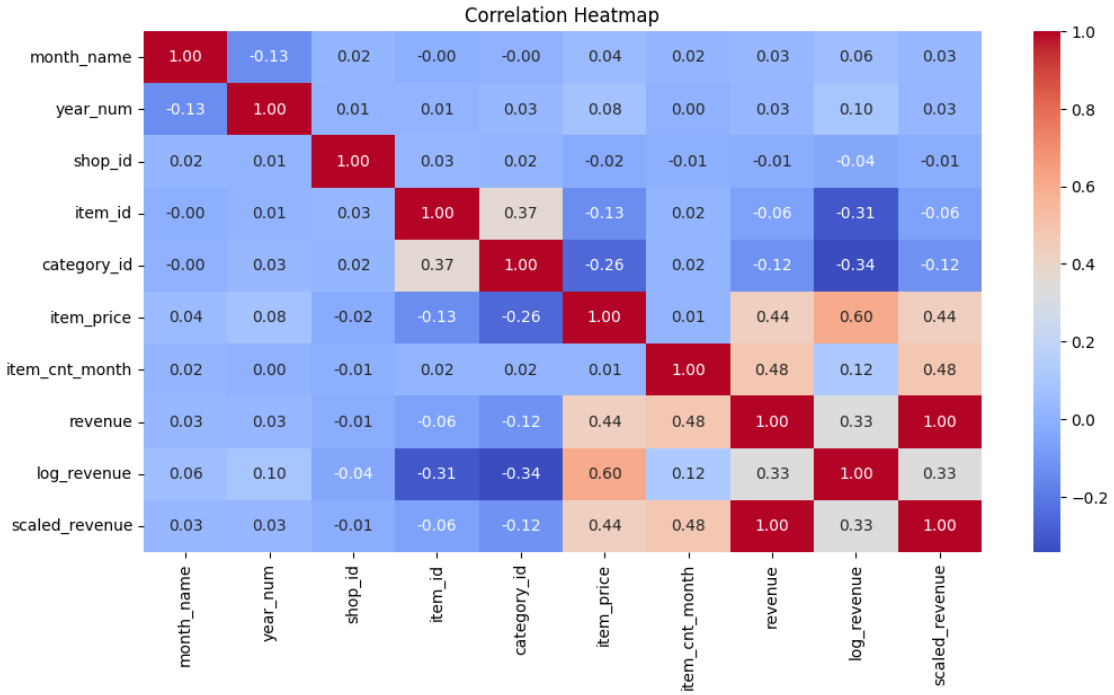
[ ]:
```
#histogram
plt.figure(figsize=(12, 6))
sns.histplot(data=final_dataset, x='item_price', kde=True, bins=20)
plt.title('Distribution of Item Count Per Month')
plt.xlabel('Item Count')
plt.ylabel('Frequency')
plt.show()
```



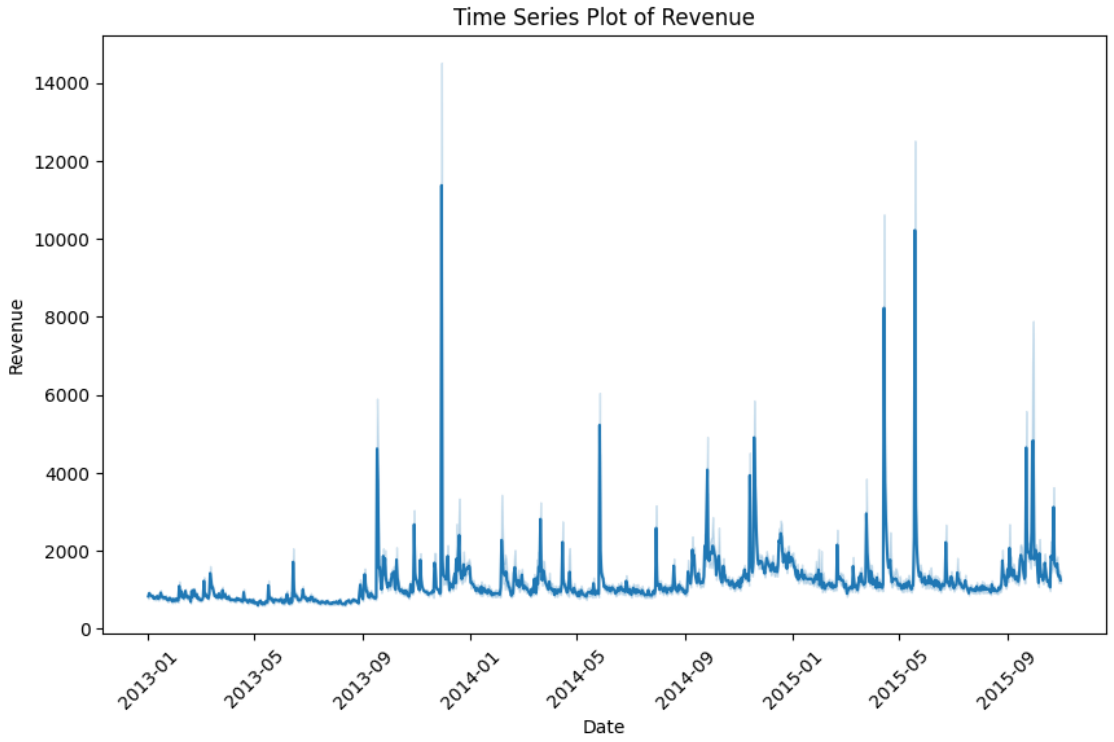
[ ]:
```
#area plot
plt.figure(figsize=(12, 6))
plt.stackplot(final_dataset['date'], final_dataset['revenue'])
plt.title('Revenue Over Time')
plt.xlabel('Date')
plt.ylabel('Revenue')
plt.show()
```



[ ]:
```
#heatmap
plt.figure(figsize=(12, 6))
sns.heatmap(numeric_columns.corr(), annot=True, cmap='coolwarm', fmt='.2f')
plt.title('Correlation Heatmap')
plt.show()
```



[ ]:
```
# Time Series Plot
plt.figure(figsize=(10, 6))
final_dataset['date'] = pd.to_datetime(final_dataset['date'])
sns.lineplot(x='date', y='revenue', data=final_dataset)
plt.title('Time Series Plot of Revenue')
plt.xlabel('Date')
plt.ylabel('Revenue')
plt.xticks(rotation=45)
plt.show()
```



1.7 Dashboard Creation

[ ]:
```
print(final_dataset.head(10))
print(final_dataset.shape)
print(final_dataset.info())
```

```
         date date_num  month_name  year_num  shop_id  \
0  2013-01-02       02           1         0       59
1  2013-01-03       03           1         0       25
3  2013-01-06       06           1         0       25
4  2013-01-15       15           1         0       25
5  2013-01-10       10           1         0       25
6  2013-01-02       02           1         0       25
7  2013-01-04       04           1         0       25
8  2013-01-11       11           1         0       25
9  2013-01-03       03           1         0       25
10 2013-01-03       03           1         0       25

                 shop_name  item_id  \
0    Yaroslavl TC" Altair "    22154
1      Moscow TEC" Atrium "     2552
3      Moscow TEC" Atrium "     2554
4      Moscow TEC" Atrium "     2555
```

```
5      Moscow TEC" Atrium "     2564
6      Moscow TEC" Atrium "     2565
7      Moscow TEC" Atrium "     2572
8      Moscow TEC" Atrium "     2572
9      Moscow TEC" Atrium "     2573
10     Moscow TEC" Atrium "     2574

                                          item_name  category_id  \
0                                   SCENE 2012 (BD)           37
1              DEEP PURPLE The House Of Blue Light LP           58
3              DEEP PURPLE Who Do You Think We Are LP           58
4       DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
5   DEEP PURPLE Perihelion: Live In Concert DVD (C…           59
6                   DEEP PURPLE Stormbringer (firms).           56
7                              DEFTONES Koi No Yokan           55
8                              DEFTONES Koi No Yokan           55
9                           DEL REY LANA Born To Die           55
10  DEL REY LANA Born To Die The Paradise Edition 2CD           55

                     item_category_name  item_price  item_cnt_month  revenue  \
0                       Cinema - Blu-Ray      999.00               1   999.00
1                          Music - Vinyl      899.00               1   899.00
3                          Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00

   price_range  log_revenue  scaled_revenue
0   900-100000     6.906755        0.000546
1      800-900     6.801283        0.000491
3   900-100000     7.443693        0.000934
4   900-100000     7.002156        0.000601
5      300-400     5.855072        0.000191
6      500-600     6.308098        0.000300
7      200-300     5.476464        0.000131
8      200-300     5.700444        0.000163
9      200-300     6.799056        0.000490
10     300-400     6.682109        0.000436
(2928483, 16)
<class 'pandas.core.frame.DataFrame'>
Index: 2928483 entries, 0 to 2935848
Data columns (total 16 columns):
 #   Column              Dtype
---  ------              -----
```

```
 0   date                datetime64[ns]
 1   date_num            object
 2   month_name          int64
 3   year_num            int64
 4   shop_id             int64
 5   shop_name           object
 6   item_id             int64
 7   item_name           object
 8   category_id         int64
 9   item_category_name  object
 10  item_price          float64
 11  item_cnt_month      int64
 12  revenue             float64
 13  price_range         category
 14  log_revenue         float64
 15  scaled_revenue      float64
dtypes: category(1), datetime64[ns](1), float64(4), int64(6), object(4)
memory usage: 360.3+ MB
None
```

[ ]:
```
#decoding year_num column and month_name column
final_dataset['year_num'] = final_dataset['year_num'].replace({0: '2013', 1:␣
 ↪'2014', 2: '2015'})
final_dataset['month_name'] = final_dataset['month_name'].replace({1:␣
 ↪'January', 2: 'February', 3: 'March', 4: 'April', 5: 'May', 6:'June', 7:␣
 ↪'July', 8: 'August', 9: 'September', 10: 'October', 11:'November', 12:␣
 ↪'December'})

print(final_dataset.head(10))
print(final_dataset.tail(10))
```

```
         date date_num month_name year_num  shop_id                shop_name  \
0  2013-01-02       02    January     2013       59   Yaroslavl TC" Altair "
1  2013-01-03       03    January     2013       25     Moscow TEC" Atrium "
3  2013-01-06       06    January     2013       25     Moscow TEC" Atrium "
4  2013-01-15       15    January     2013       25     Moscow TEC" Atrium "
5  2013-01-10       10    January     2013       25     Moscow TEC" Atrium "
6  2013-01-02       02    January     2013       25     Moscow TEC" Atrium "
7  2013-01-04       04    January     2013       25     Moscow TEC" Atrium "
8  2013-01-11       11    January     2013       25     Moscow TEC" Atrium "
9  2013-01-03       03    January     2013       25     Moscow TEC" Atrium "
10 2013-01-03       03    January     2013       25     Moscow TEC" Atrium "

    item_id                                        item_name  category_id  \
0     22154                                SCENE 2012 (BD)           37
1      2552            DEEP PURPLE The House Of Blue Light LP           58
3      2554            DEEP PURPLE Who Do You Think We Are LP           58
4      2555     DEEP PURPLE 30 Very Best Of 2CD (Businesses).           56
```

```
5      2564  DEEP PURPLE Perihelion: Live In Concert DVD (C…          59
6      2565                  DEEP PURPLE Stormbringer (firms).          56
7      2572                               DEFTONES Koi No Yokan          55
8      2572                               DEFTONES Koi No Yokan          55
9      2573                            DEL REY LANA Born To Die          55
10     2574  DEL REY LANA Born To Die The Paradise Edition 2CD          55

                    item_category_name  item_price  item_cnt_month  revenue  \
0                     Cinema - Blu-Ray      999.00               1   999.00
1                        Music - Vinyl      899.00               1   899.00
3                        Music - Vinyl     1709.05               1  1709.05
4    Music - CD of corporate production     1099.00               1  1099.00
5                   Music - Music video      349.00               1   349.00
6    Music - CD of corporate production      549.00               1   549.00
7        Music - CD of local production      239.00               1   239.00
8        Music - CD of local production      299.00               1   299.00
9        Music - CD of local production      299.00               3   897.00
10       Music - CD of local production      399.00               2   798.00

   price_range  log_revenue  scaled_revenue
0   900-100000     6.906755        0.000546
1      800-900     6.801283        0.000491
3   900-100000     7.443693        0.000934
4   900-100000     7.002156        0.000601
5      300-400     5.855072        0.000191
6      500-600     6.308098        0.000300
7      200-300     5.476464        0.000131
8      200-300     5.700444        0.000163
9      200-300     6.799056        0.000490
10     300-400     6.682109        0.000436
              date date_num month_name year_num  shop_id  \
2935839 2015-10-24       24    October     2015       25
2935840 2015-10-31       31    October     2015       25
2935841 2015-10-11       11    October     2015       25
2935842 2015-10-10       10    October     2015       25
2935843 2015-10-09       09    October     2015       25
2935844 2015-10-10       10    October     2015       25
2935845 2015-10-09       09    October     2015       25
2935846 2015-10-14       14    October     2015       25
2935847 2015-10-22       22    October     2015       25
2935848 2015-10-03       03    October     2015       25

                    shop_name  item_id  \
2935839   Moscow TEC" Atrium "     7315
2935840   Moscow TEC" Atrium "     7409
2935841   Moscow TEC" Atrium "     7393
2935842   Moscow TEC" Atrium "     7384
2935843   Moscow TEC" Atrium "     7409
```

```
2935844   Moscow TEC" Atrium "     7409
2935845   Moscow TEC" Atrium "     7460
2935846   Moscow TEC" Atrium "     7459
2935847   Moscow TEC" Atrium "     7440
2935848   Moscow TEC" Atrium "     7460

                                              item_name  category_id  \
2935839                   V/A Dance Kick! 2CD (digipack)           55
2935840                 V/A Nu Jazz Selection (digipack)           55
2935841               V/A Lounge Del Mar 3 2CD (digipack)           55
2935842                     V/A Ladies Sing The Blues 3CD           55
2935843                 V/A Nu Jazz Selection (digipack)           55
2935844                 V/A Nu Jazz Selection (digipack)           55
2935845              V/A The Golden Jazz Collection 1 2CD           55
2935846                      V/A The Best Of The 3 Tenors           55
2935847  V/A Relax Collection Planet MP3 (mp3-CD) (jewel)           57
2935848              V/A The Golden Jazz Collection 1 2CD           55

                     item_category_name  item_price  item_cnt_month  revenue  \
2935839   Music - CD of local production       399.0               1    399.0
2935840   Music - CD of local production       299.0               1    299.0
2935841   Music - CD of local production       349.0               1    349.0
2935842   Music - CD of local production       749.0               1    749.0
2935843   Music - CD of local production       299.0               1    299.0
2935844   Music - CD of local production       299.0               1    299.0
2935845   Music - CD of local production       299.0               1    299.0
2935846   Music - CD of local production       349.0               1    349.0
2935847                      Music - MP3       299.0               1    299.0
2935848   Music - CD of local production       299.0               1    299.0

        price_range  log_revenue  scaled_revenue
2935839     300-400     5.988961        0.000218
2935840     200-300     5.700444        0.000163
2935841     300-400     5.855072        0.000191
2935842     700-800     6.618739        0.000409
2935843     200-300     5.700444        0.000163
2935844     200-300     5.700444        0.000163
2935845     200-300     5.700444        0.000163
2935846     300-400     5.855072        0.000191
2935847     200-300     5.700444        0.000163
2935848     200-300     5.700444        0.000163
```

[ ]:
```
#make data frame for the dashboard interactive
df_interactive = final_dataset.interactive()
```

[ ]:
```
#creates menu button for the dashboard to select years
```

```
year_num_menu = pn.widgets.Select(name='Year',␣
 ↪options=df_interactive['year_num'].unique().tolist(), value='2015')

updated_year_df = df_interactive[df_interactive['year_num'] == year_num_menu]
```

[ ]:
```
#montly revenue
update_monthly_revenue = (updated_year_df.groupby('month_name')['revenue'].
 ↪mean().to_frame().reset_index().sort_values(by='month_name').
 ↪reset_index(drop=True))
update_monthly_revenue_plot = update_monthly_revenue.hvplot.bar(x='month_name',␣
 ↪y='revenue', rot=90, title='Average Revenue Per Month by year')
```

[ ]:
```
#monthly item count
update_monthly_item_count = (updated_year_df.
 ↪groupby('month_name')['item_cnt_month'].mean().to_frame().reset_index().
 ↪sort_values(by='month_name').reset_index(drop=True))
update_monthly_item_count_pie = update_monthly_item_count.plot(kind='pie',␣
 ↪y='item_cnt_month', label='month_name', autopct='%1.1f%%', title='Average␣
 ↪Item Count Per Month by year')
```

[ ]:
```
#sales by category
update_sales_by_category = (updated_year_df.
 ↪groupby('item_category_name')['revenue'].mean().to_frame().reset_index().
 ↪sort_values(by='revenue').reset_index(drop=True))
update_sales_by_category_plot = update_sales_by_category.hvplot.
 ↪area(x='item_category_name', y='revenue', rot=90, title='Average Revenue Per␣
 ↪Category by year', height=500, width=1000)
```

[ ]:
```
#sales by shop
update_sales_by_shop = (updated_year_df.groupby('shop_name')['revenue'].mean().
 ↪to_frame().reset_index().sort_values(by='revenue').reset_index(drop=True))
update_sales_by_shop_plot = update_sales_by_shop.hvplot.area(x='shop_name',␣
 ↪y='revenue', rot=90, title='Average Revenue Per Shop by year', height=500,␣
 ↪width=1000)
```

[ ]:
```
#best selling category in all year
update_best_selling_category = (df_interactive.
 ↪groupby('item_category_name')['item_cnt_month'].mean().to_frame().
 ↪reset_index().sort_values(by='item_cnt_month', ascending=False).
 ↪reset_index(drop=True))
update_best_selling_category_plot = update_best_selling_category.hvplot.
 ↪barh(x='item_category_name', y='item_cnt_month', rot=90, title='Average Item␣
 ↪Count Per Category', height=1000, width=1000)
```

[ ]:
```
#creates echarts bar for the dashboard to display revenue by year
```

```
revenue_by_year_bar = { 'title' : { 'text' : 'Revenue by Year' }, 'tooltip' : {␣
 ↪'trigger': 'axis' }, 'legend': { 'data': ['Revenue'] }, 'xAxis' : { 'data' :␣
 ↪final_dataset['year_num'].unique().tolist() }, 'yAxis' : { }, 'series' : [{␣
 ↪'name' : 'Revenue', 'type' : 'bar', 'data' : final_dataset.
 ↪groupby('year_num')['revenue'].sum().tolist() }] }
revenue_by_year_echart_pane = pn.pane.ECharts(revenue_by_year_bar, width=400,␣
 ↪height=400)
```

[ ]:
```
template = pn.template.FastListTemplate(
    title='Grocerry Sales Dashboard',
    sidebar=[pn.pane.Markdown("# Revenue by Year"),
                revenue_by_year_echart_pane,
             pn.pane.Markdown("#### Select Year"),
             year_num_menu],
    main=[pn.Row(pn.Column(update_monthly_revenue_plot.panel(width=500)),
                pn.Column(update_monthly_item_count_pie.panel(width=500),␣
 ↪margin=(0,25)),
                 ),
          pn.Row(update_sales_by_category_plot),
          pn.Row(update_sales_by_shop_plot),
          pn.Row(update_best_selling_category_plot)],

    accent_base_color="#88d8b0",
    header_background="#88d8b0",
)

template.show()
```

```
Launching server at http://localhost:53043
```

[ ]:
```
<panel.io.server.Server at 0x1270fb93150>
```

```
WARNING:bokeh.core.validation.check:W-1005 (FIXED_SIZING_MODE): 'fixed' sizing
mode requires width and height to be set:
Column(id='75fa204f-25bf-4df4-950f-c52628c0f79e', …)
```