Domain Name: Data Analytics with Cognos

Project Sales Analysis

Phase 3

Data analysis by loading and preprocessing dataset

Team members

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Overview of the data

In [4]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

df = pd.read_csv("statsfinal.csv")

print(df.shape)
```

```
(4600, 10)
```

In [5]:
```
print(df.columns)
```

```
Index(['Unnamed: 0', 'Date', 'Q-P1', 'Q-P2', 'Q-P3', 'Q-P4', 'S-P1', 'S-P2',
```

In [6]:
```
print(df.head(10))
```

```
       'S-P3', 'S-P4'],
      dtype='object')
```

```
   Unnamed: 0        Date  Q-P1  Q-P2  Q-P3  Q-P4      S-P1      S-P2  \
0           0  13-06-2010  5422  3725   576   907  17187.74  23616.50
1           1  14-06-2010  7047   779  3578  1574  22338.99   4938.86
2           2  15-06-2010  1572  2082   595  1145   4983.24  13199.88
3           3  16-06-2010  5657  2399  3140  1672  17932.69  15209.66
4           4  17-06-2010  3668  3207  2184   708  11627.56  20332.38
5           5  18-06-2010  2898  2539   311  1513   9186.66  16097.26
6           6  19-06-2010  6912  1470  1576  1608  21911.04   9319.80
7           7  20-06-2010  5209  2550  3415   842  16512.53  16167.00
8           8  21-06-2010  6322   852  3646  1377  20040.74   5401.68
9           9  22-06-2010  6865   414  3902   562  21762.05   2624.76

      S-P3      S-P4
0  3121.92   6466.91
1 19392.76  11222.62
2  3224.90   8163.85
3 17018.80  11921.36
4 11837.28   5048.04
5  1685.62  10787.69
6  8541.92  11465.04
7 18509.30   6003.46
8 19761.32   9818.01
9 21148.84   4007.06
```

In [8]:
```
print(df.dtypes)
```

```
Unnamed: 0      int64
Date           object
Q-P1            int64
Q-P2            int64
Q-P3            int64
Q-P4            int64
S-P1          float64
S-P2          float64
S-P3          float64
S-P4          float64
dtype: object
```

In [9]:
```
print(df.info)
```

```
<bound method DataFrame.info of       Unnamed: 0        Date  Q-P1  Q-P2  Q-P3  Q-P4
S-P1      S-P2  \
0               0  13-06-2010  5422  3725   576   907  17187.74  23616.50
1               1  14-06-2010  7047   779  3578  1574  22338.99   4938.86
2               2  15-06-2010  1572  2082   595  1145   4983.24  13199.88
3               3  16-06-2010  5657  2399  3140  1672  17932.69  15209.66
4               4  17-06-2010  3668  3207  2184   708  11627.56  20332.38
...           ...         ...   ...   ...   ...   ...       ...       ...
4595         4595  30-01-2023  2476  3419   525  1359   7848.92  21676.46
4596         4596  31-01-2023  7446   841  4825  1311  23603.82   5331.94
4597         4597  01-02-2023  6289  3143  3588   474  19936.13  19926.62
4598         4598  02-02-2023  3122  1188  5899   517   9896.74   7531.92
4599         4599  03-02-2023  1234  3854  2321   406   3911.78  24434.36

          S-P3      S-P4
0      3121.92   6466.91
1     19392.76  11222.62
2      3224.90   8163.85
3     17018.80  11921.36
4     11837.28   5048.04
...        ...       ...
4595   2845.50   9689.67
4596  26151.50   9347.43
4597  19446.96   3379.62
4598  31972.58   3686.21
4599  12579.82   2894.78

[4600 rows x 10 columns]>
```

In [10]:
```
print(df.isnull().sum())
```

```
Unnamed: 0    0
Date          0
Q-P1          0
Q-P2          0
Q-P3          0
Q-P4          0
S-P1          0
S-P2          0
S-P3          0
S-P4          0
dtype: int64
```

No Null Values

In [11]:
```
print(df.duplicated().sum())
```

```
0
```

No Duplicate Values

In [12]:
```
print(df.describe())
```

```
        Unnamed: 0         Q-P1         Q-P2         Q-P3         Q-P4  \
count  4600.000000  4600.000000  4600.000000  4600.000000  4600.000000
mean   2299.500000  4121.849130  2130.281522  3145.740000  1123.500000
std    1328.049949  2244.271323  1089.783705  1671.832231   497.385676
min       0.000000   254.000000   251.000000   250.000000   250.000000
25%    1149.750000  2150.500000  1167.750000  1695.750000   696.000000
50%    2299.500000  4137.000000  2134.000000  3202.500000  1136.500000
75%    3449.250000  6072.000000  3070.250000  4569.000000  1544.000000
max    4599.000000  7998.000000  3998.000000  6000.000000  2000.000000

              S-P1          S-P2          S-P3         S-P4
count  4600.000000   4600.000000   4600.000000  4600.000000
mean  13066.261743  13505.984848  17049.910800  8010.555000
std    7114.340094   6909.228687   9061.330694  3546.359869
min     805.180000   1591.340000   1355.000000  1782.500000
25%    6817.085000   7403.535000   9190.965000  4962.480000
50%   13114.290000  13529.560000  17357.550000  8103.245000
75%   19248.240000  19465.385000  24763.980000 11008.720000
max   25353.660000  25347.320000  32520.000000 14260.000000
```

Data Cleaning

In [13]:
```
#Data Cleaning

print(df.sample(2))
```

```
      Unnamed: 0        Date  Q-P1  Q-P2  Q-P3  Q-P4      S-P1     S-P2  \
2198        2198  29-06-2016  7530   696  3976  1993  23870.10  4412.64
919          919  22-12-2012  6502  1305  5079  1911  20611.34  8273.70

          S-P3      S-P4
2198  21549.92  14210.09
919   27528.18  13625.43
```

In [14]:
```
from datetime import datetime as dt

df[df["Date"] == "31-9-2010"]
```

Out[14]:

	Unnamed: 0	Date	Q-P1	Q-P2	Q-P3	Q-P4	S-P1	S-P2	S-P3	S-P4
109	109	31-9-2010	4986	342	4978	558	15805.62	2168.28	26980.76	3978.54

In [15]:
```
df['Date'] = pd.to_datetime(df['Date'], errors='coerce')
```

```
C:\Users\sbrsh\AppData\Local\Temp\ipykernel_5656\2263964175.py:1: UserWarning: Parsi
ng dates in %d-%m-%Y format when dayfirst=False (the default) was specified. Pass `d
ayfirst=True` or specify a format to silence this warning.
  df['Date'] = pd.to_datetime(df['Date'], errors='coerce')
```

In [16]:
```
df[df['Date'].isnull()]
```

Out[16]:

	Unnamed: 0	Date	Q-P1	Q-P2	Q-P3	Q-P4	S-P1	S-P2	S-P3	S-P4
109	109	NaT	4986	342	4978	558	15805.62	2168.28	26980.76	3978.54
170	170	NaT	4632	3930	523	1581	14683.44	24916.20	2834.66	11272.53
473	473	NaT	2242	401	5926	789	7107.14	2542.34	32118.92	5625.57
534	534	NaT	325	3476	4588	1771	1030.25	22037.84	24866.96	12627.23
836	836	NaT	1003	256	1346	1449	3179.51	1623.04	7295.32	10331.37
897	897	NaT	2509	2666	4146	593	7953.53	16902.44	22471.32	4228.09
1200	1200	NaT	597	709	5470	1994	1892.49	4495.06	29647.40	14217.22
1261	1261	NaT	7681	1235	347	1087	24348.77	7829.90	1880.74	7750.31
1564	1564	NaT	5333	833	3494	618	16905.61	5281.22	18937.48	4406.34
1625	1625	NaT	3870	2779	3246	1290	12267.90	17618.86	17593.32	9197.70
1928	1928	NaT	3583	2111	4225	1401	11358.11	13383.74	22899.50	9989.13
1989	1989	NaT	7516	3423	3116	458	23825.72	21701.82	16888.72	3265.54
2291	2291	NaT	7891	741	2280	1068	25014.47	4697.94	12357.60	7614.84
2352	2352	NaT	2457	3144	533	1184	7788.69	19932.96	2888.86	8441.92
2655	2655	NaT	3512	2851	4072	1597	11133.04	18075.34	22070.24	11386.61
2716	2716	NaT	6094	3798	5849	881	19317.98	24079.32	31701.58	6281.53
3019	3019	NaT	1727	2645	5715	1295	5474.59	16769.30	30975.30	9233.35
3080	3080	NaT	7360	2974	2717	1127	23331.20	18855.16	14726.14	8035.51
3383	3383	NaT	3195	2525	5918	1003	10128.15	16008.50	32075.56	7151.39
3444	3444	NaT	2660	2674	2732	934	8432.20	16953.16	14807.44	6659.42
3746	3746	NaT	4713	1227	4065	403	14940.21	7779.18	22032.30	2873.39
3807	3807	NaT	870	3463	798	851	2757.90	21955.42	4325.16	6067.63
4110	4110	NaT	3511	2609	1543	853	11129.87	16541.06	8363.06	6081.89
4171	4171	NaT	506	3333	3897	574	1604.02	21131.22	21121.74	4092.62
4474	4474	NaT	6964	1873	5481	1336	22075.88	11874.82	29707.02	9525.68
4535	4535	NaT	4600	2006	3796	1426	14582.00	12718.04	20574.32	10167.38

In [17]:
```
# Filling the NaT values with average of time

df['Date'].fillna(df["Date"].mean(), inplace=True)
```

In [18]:
```
df['Date'].isnull().sum()
```

Out[18]:
```
0
```

In [19]:
```
df.dtypes
```

Out[19]:
```
Unnamed: 0             int64
Date          datetime64[ns]
Q-P1                   int64
Q-P2                   int64
Q-P3                   int64
Q-P4                   int64
S-P1                 float64
S-P2                 float64
S-P3                 float64
S-P4                 float64
dtype: object
```

In [20]:
```
#fetching month,day of week, weekday
df["month"]=df["Date"].dt.month_name()
df["day"]=df["Date"].dt.day_name()
df["dayoftheweek"]=df["Date"].dt.weekday
df["year"]=df["Date"].dt.year
df.sample()
```

Out[20]:

	Unnamed: 0	Date	Q-P1	Q-P2	Q-P3	Q-P4	S-P1	S-P2	S-P3	S-P4	mo
3763	3763	2020-10-17	4509	498	1618	1733	14293.53	3157.32	8769.56	12356.29	Octo

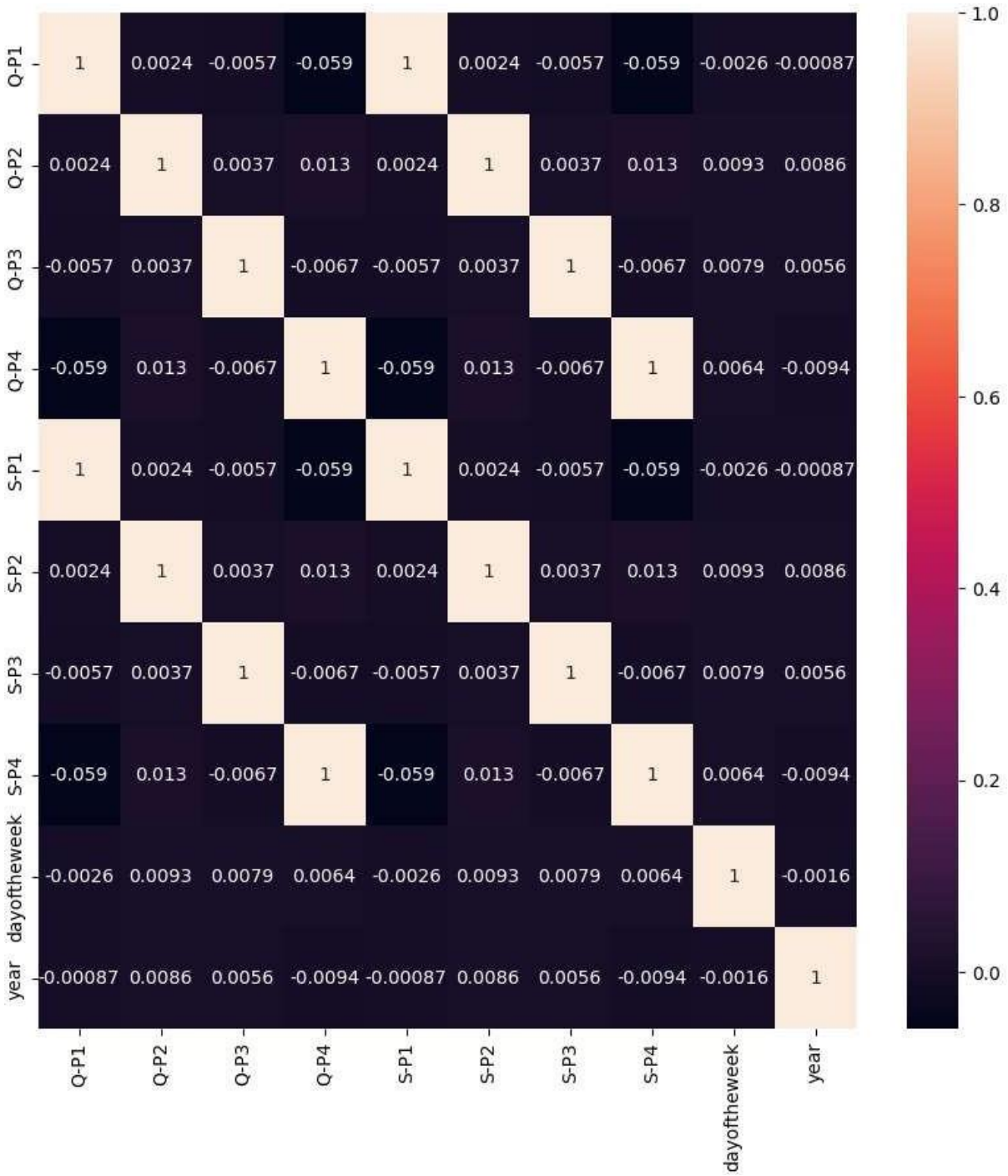
In [21]:
```
## Droping column unnamed as it is not usefull for us
df.drop(columns=["Unnamed: 0"],inplace=True)
df.sample()
```

Out[21]:

	Date	Q-P1	Q-P2	Q-P3	Q-P4	S-P1	S-P2	S-P3	S-P4	month	day	da
2858	2018-04-22	2881	2904	955	427	9132.77	18411.36	5176.1	3044.51	April	Sunday	

In [29]:
```
plt.figure(figsize=(10,10))
correlation = df.select_dtypes(include=['number'])

sns.heatmap(correlation.corr(), annot=True)
```

Out[29]:
```
<Axes: >
```

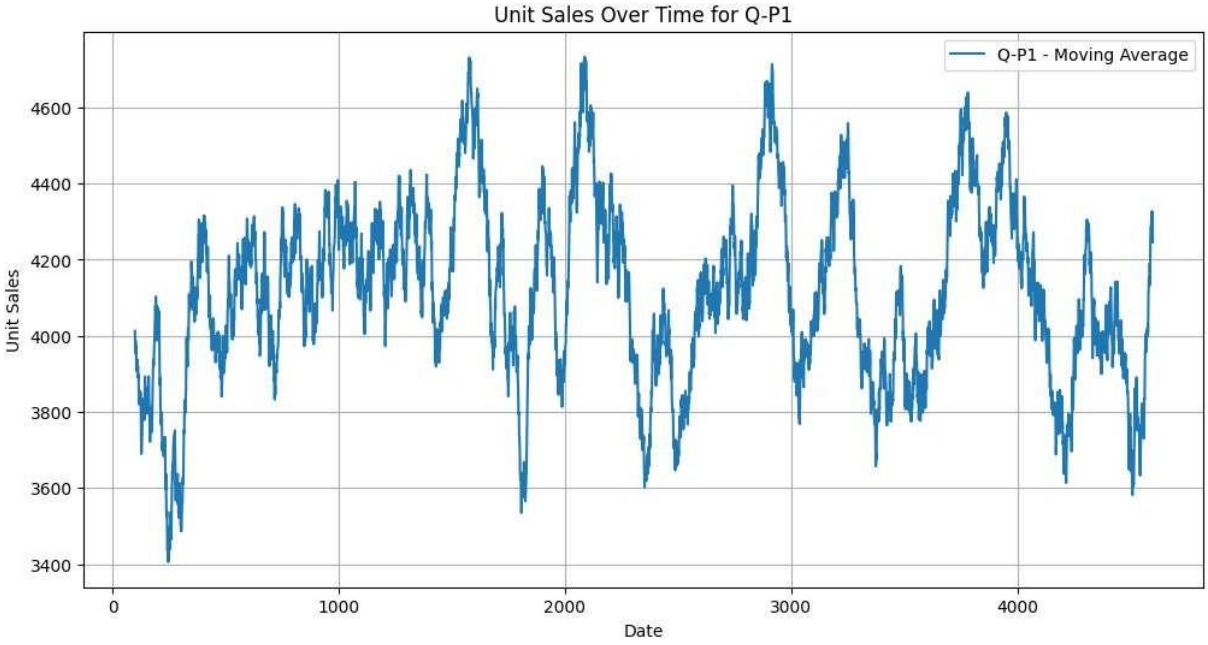


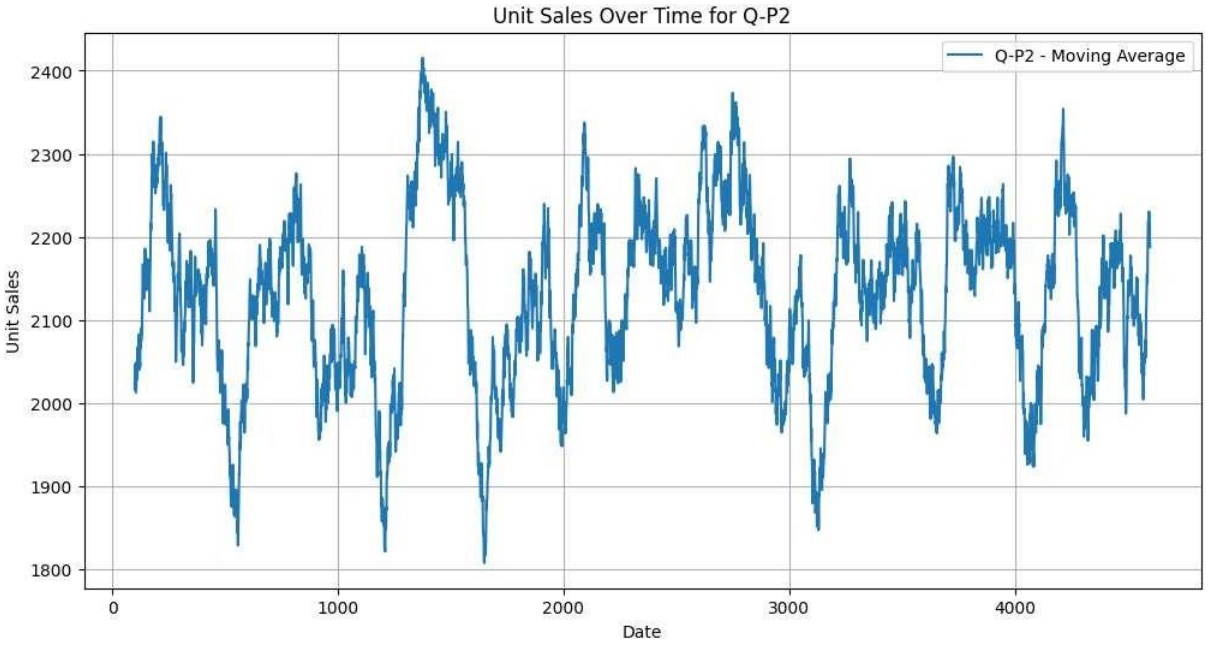
In [30]:
```
for i in df.columns:
    print(i,"---------",df[i].unique())
```

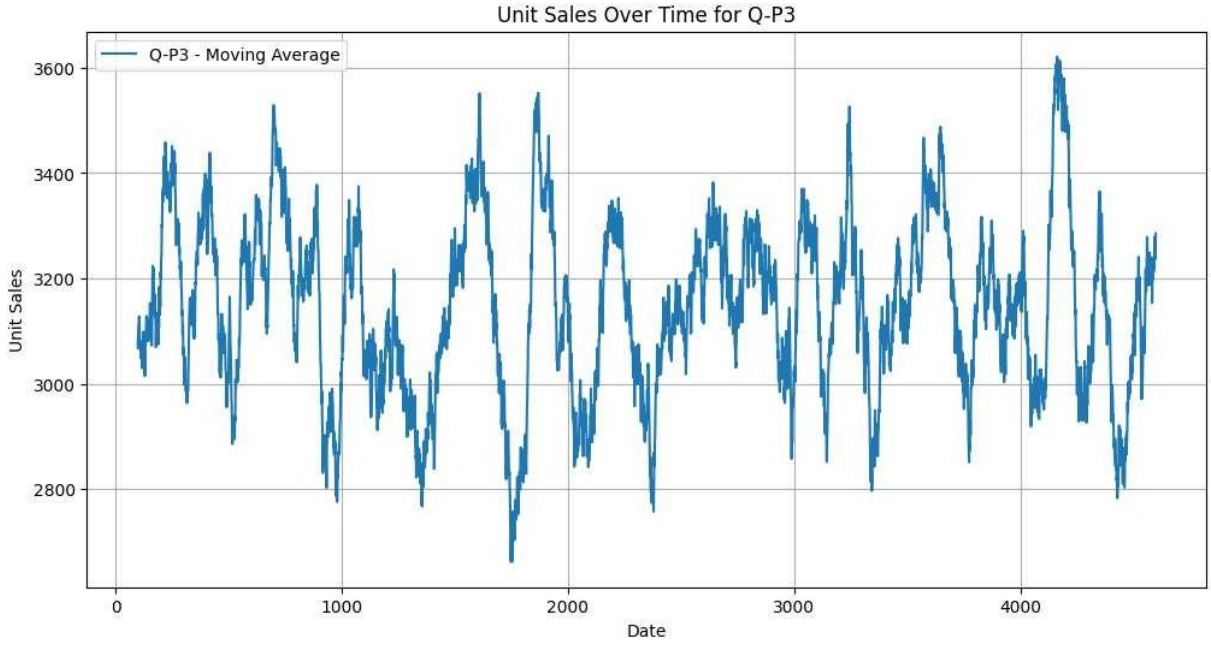
```
Date --------- <DatetimeArray>
['2010-06-13 00:00:00', '2010-06-14 00:00:00', '2010-06-15 00:00:00',
 '2010-06-16 00:00:00', '2010-06-17 00:00:00', '2010-06-18 00:00:00',
 '2010-06-19 00:00:00', '2010-06-20 00:00:00', '2010-06-21 00:00:00',
 '2010-06-22 00:00:00',
 ...
 '2023-01-25 00:00:00', '2023-01-26 00:00:00', '2023-01-27 00:00:00',
 '2023-01-28 00:00:00', '2023-01-29 00:00:00', '2023-01-30 00:00:00',
 '2023-01-31 00:00:00', '2023-02-01 00:00:00', '2023-02-02 00:00:00',
 '2023-02-03 00:00:00']
Length: 4575, dtype: datetime64[ns]
Q-P1 --------- [5422 7047 1572 ... 1227 3122 1234]
Q-P2 --------- [3725  779 2082 ... 3404  841 3143]
Q-P3 --------- [ 576 3578  595 ... 4825 3588 5899]
Q-P4 --------- [ 907 1574 1145 ... 1161 1151 1112]
S-P1 --------- [17187.74 22338.99  4983.24 ...  3889.59  9896.74  3911.78]
S-P2 --------- [23616.5   4938.86 13199.88 ... 21581.36  5331.94 19926.62]
S-P3 --------- [ 3121.92 19392.76  3224.9  ... 26151.5  19446.96 31972.58]
S-P4 --------- [ 6466.91 11222.62  8163.85 ...  8277.93  8206.63  7928.56]
month --------- ['June' 'July' 'August' 'September' 'October' 'November' 'December'
 'January' 'February' 'March' 'April' 'May']
day --------- ['Sunday' 'Monday' 'Tuesday' 'Wednesday' 'Thursday' 'Friday' 'Saturda
y']
dayoftheweek --------- [6 0 1 2 3 4 5]
year --------- [2010 2016 2011 2012 2013 2014 2015 2017 2018 2019 2020 2021 2022 202
3]
```

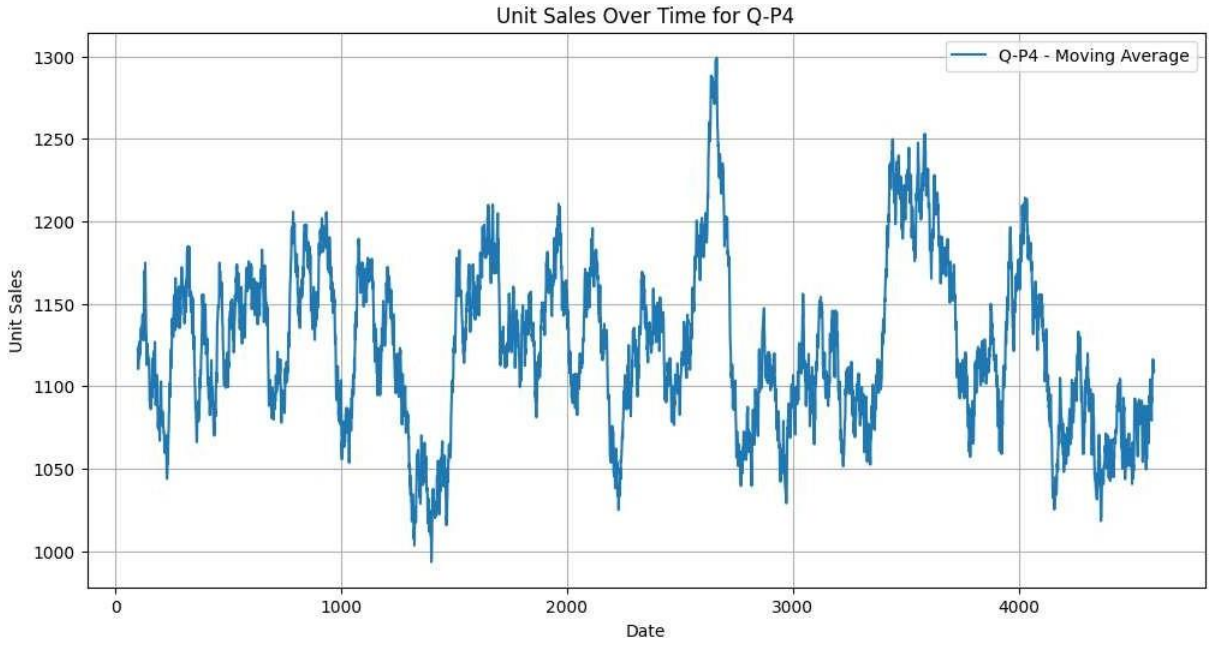
Visualizing discrete numeric values

In [31]:
```python
products = ['Q-P1', 'Q-P2', 'Q-P3', 'Q-P4']

for product in products:
    product_data = df[product]

    moving_average = product_data.rolling(window=100).mean()

    plt.figure(figsize=(12, 6))
    plt.plot(df.index, moving_average, label=f'{product} - Moving Average')
    plt.xlabel('Date')
    plt.ylabel('Unit Sales')
    plt.title(f'Unit Sales Over Time for {product}')
    plt.grid(True)
    plt.legend()
    plt.show()
```


Unit Sales Over Time for Q-P1
Q-P1 - Moving Average
Unit Sales
Date
4600
4400
4200
4000
3800
3600
3400
0
1000
2000
3000
4000

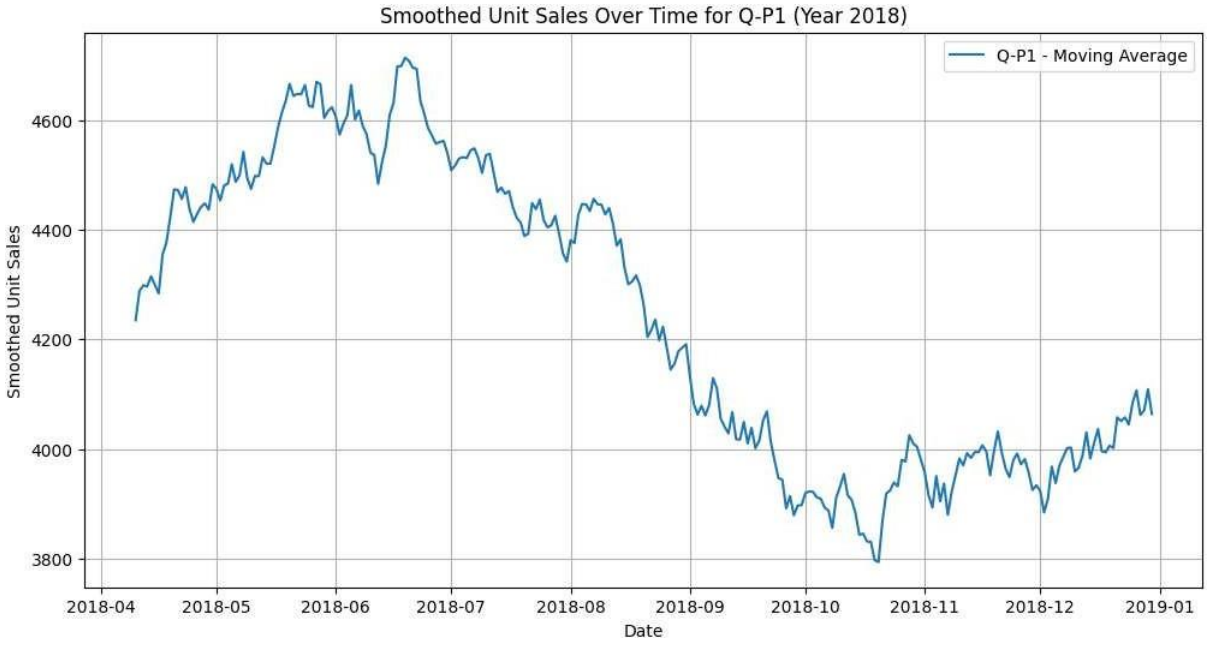

Unit Sales Over Time for Q-P2
Q-P2 - Moving Average
Unit Sales
Date
2400
2300
2200
2100
2000
1900
1800
0
1000
2000
3000
4000

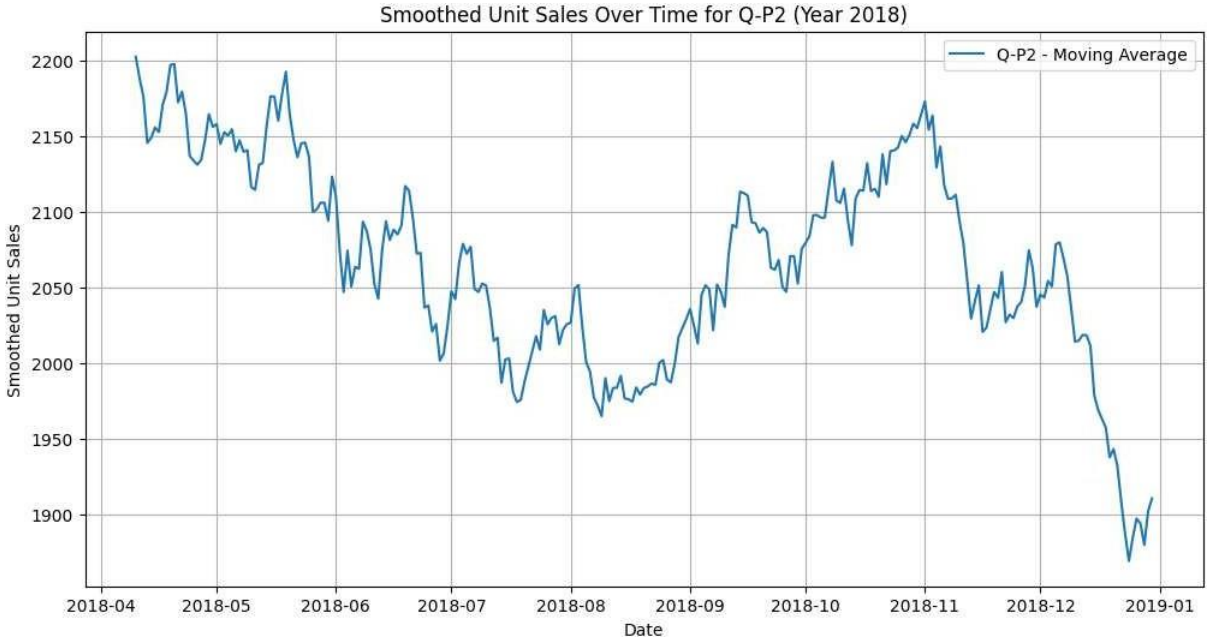


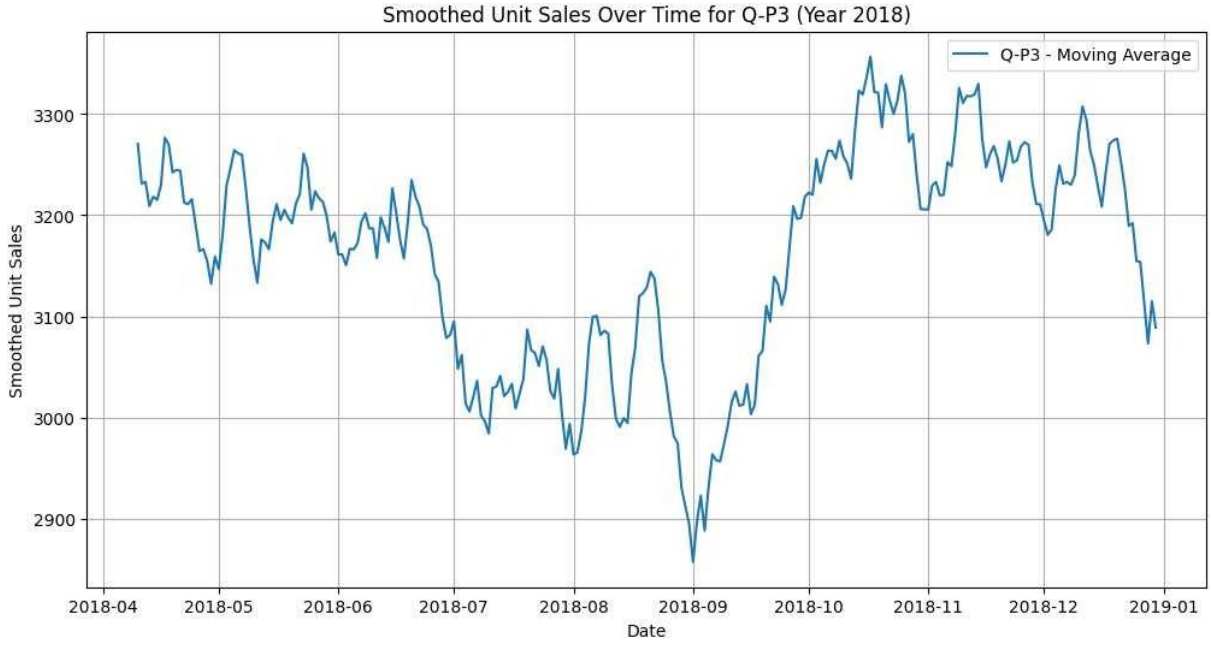


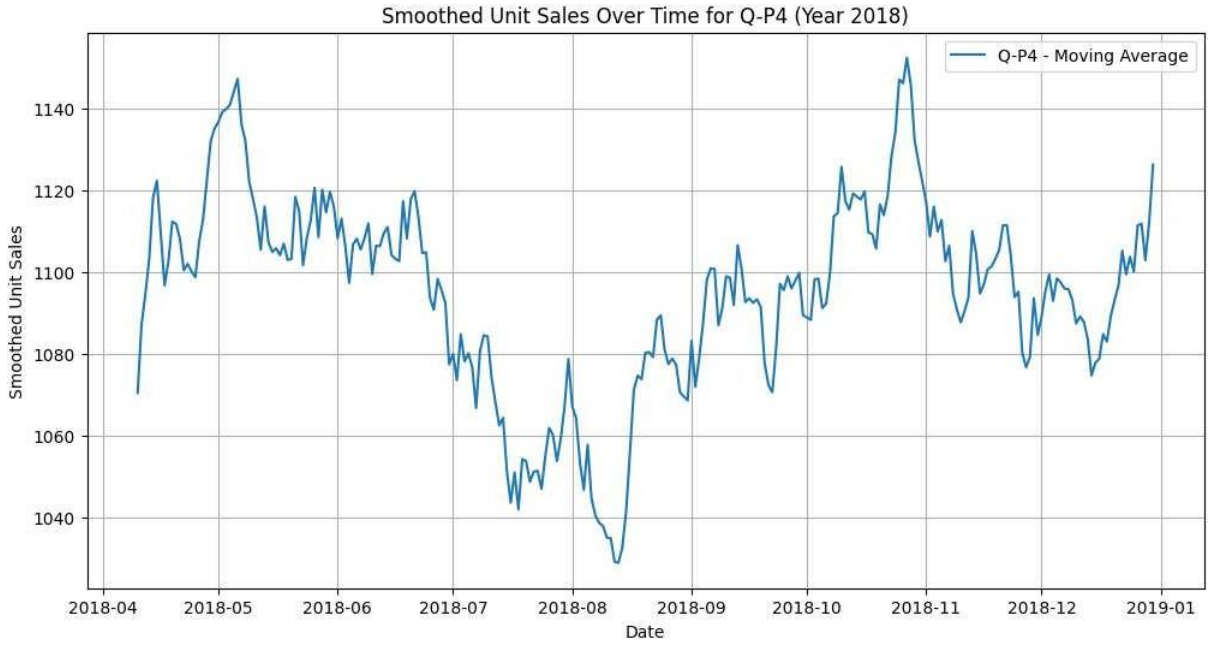
In [37]:
```
df1 = df

try:
    df1['Date'] = pd.to_datetime(df1['Date'], format='%d-%m-%Y', errors='coerce')
except pd.errors.ParserError:
    pass

df1 = df1.dropna(subset=['Date'])
df1['Date'] = pd.to_datetime(df1['Date'], format='%d-%m-%Y')
df1.set_index('Date', inplace=True)

products = ['Q-P1', 'Q-P2', 'Q-P3', 'Q-P4']
for product in products:
    product_data = df1[product]['2018']

    moving_average = product_data.rolling(window=100).mean()
```

```python
# Create a clearer plot of the smoothed data
plt.figure(figsize=(12, 6))
plt.plot(product_data.index, moving_average, label=f'{product} - Moving Average
plt.xlabel('Date')
plt.ylabel('Smoothed Unit Sales')
plt.title(f'Smoothed Unit Sales Over Time for {product} (Year 2018)')
plt.grid(True)
plt.legend()
plt.show()
```






Smoothed Unit Sales Over Time for Q-P3 (Year 2018)
Q-P3 - Moving Average
Smoothed Unit Sales
3300
3200
3100
3000
2900
2018-04
2018-05
2018-06
2018-07
2018-08
2018-09
2018-10
2018-11
2018-12
2019-01
Date


Smoothed Unit Sales Over Time for Q-P4 (Year 2018)
Q-P4 - Moving Average
Smoothed Unit Sales
1140
1120
1100
1080
1060
1040
2018-04
2018-05
2018-06
2018-07
2018-08
2018-09
2018-10
2018-11
2018-12
2019-01
Date

In [ ]: