

```

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

import os

os.listdir(r'C:\Users\rlith\OneDrive\Desktop\
BRAIN_WAVE_MATRIX_SOLUTION\sales_analysis_dataset')

['SuperMarket Analysis.csv']

sales = pd.read_csv(r'C:\Users\rlith\OneDrive\Desktop\
BRAIN_WAVE_MATRIX_SOLUTION\sales_analysis_dataset\SuperMarket
Analysis.csv')

sales.head()

```

	Invoice ID	Branch	City	Customer type	Gender	\
0	750-67-8428	Alex	Yangon	Member	Female	
1	226-31-3081	Giza	Naypyitaw	Normal	Female	
2	631-41-3108	Alex	Yangon	Normal	Female	
3	123-19-1176	Alex	Yangon	Member	Female	
4	373-73-7910	Alex	Yangon	Member	Female	

	Product line	Unit price	Quantity	Tax 5%	Total	\
0	Health and beauty	74.69	7	26.1415	548.9715	
1	Electronic accessories	15.28	5	3.8200	80.2200	
2	Home and lifestyle	46.33	7	16.2155	340.5255	
3	Health and beauty	58.22	8	23.2880	489.0480	
4	Sports and travel	86.31	7	30.2085	634.3785	

	Date	Time	Payment	cogs	gross margin	percentage \
0	01-05-2019	1:08:00 PM	Ewallet	522.83		
4.761905						
1	03-08-2019	10:29:00 AM	Cash	76.40		
4.761905						
2	03-03-2019	1:23:00 PM	Credit card	324.31		
4.761905						
3	1/27/2019	8:33:00 PM	Ewallet	465.76		
4.761905						
4	02-08-2019	10:37:00 AM	Ewallet	604.17		
4.761905						

	gross income	Rating
0	26.1415	9.1
1	3.8200	9.6
2	16.2155	7.4
3	23.2880	8.4
4	30.2085	5.3

```
sales.dtypes
```

```
Invoice ID      object
Branch          object
City            object
Customer type   object
Gender          object
Product line    object
Unit price      float64
Quantity        int64
Tax 5%          float64
Total           float64
Date            object
Time            object
Payment         object
cogs            float64
gross margin percentage float64
gross income    float64
Rating          float64
dtype: object
```

PERFORMING DATA PREPROCESSING

```
sales['Date'][0]
'01-05-2019'
```

DATE

```
type(sales['Date'][0])
str

from pandas import to_datetime
# sales['Date'] = to_datetime(sales['Date'])
sales['Date'] = pd.to_datetime(sales['Date'], format='mixed',
dayfirst=False, errors='coerce')

type(sales['Date'][0])
pandas._libs.tslibs.timestamps.Timestamp
sales['Date'].dtype
dtype('<M8[ns]')
```

TIME

```
sales['Time'] = to_datetime(sales['Time'])
```

```
C:\Users\rlith\AppData\Local\Temp\ipykernel_10200\50070907.py:1:
UserWarning: Could not infer format, so each element will be parsed
individually, falling back to `dateutil`. To ensure parsing is
consistent and as-expected, please specify a format.
```

```
sales['Time'] = to_datetime(sales['Time'])
```

```
sales['Time'].dtype
```

```
dtype('<M8[ns]')
```

FETCHING DERIVED ATTRIBUTES FROM DATA

1st WAY (EXTRACTION)

```
sales['Date']
```

```
0    2019-01-05
1    2019-03-08
2    2019-03-03
3    2019-01-27
4    2019-02-08
```

```
...
995  2019-01-29
996  2019-03-02
997  2019-02-09
998  2019-02-22
999  2019-02-18
```

```
Name: Date, Length: 1000, dtype: datetime64[ns]
```

```
def fetch_att(x):
    day = x.day
    month = x.month
    year = x.year
    return pd.Series([day, month, year])
```

```
sales[['day', 'month', 'year']] = sales['Date'].apply(fetch_att)
```

```
sales.head()
```

	Invoice ID	Branch	City	Customer type	Gender	\
0	750-67-8428	Alex	Yangon	Member	Female	
1	226-31-3081	Giza	Naypyitaw	Normal	Female	
2	631-41-3108	Alex	Yangon	Normal	Female	
3	123-19-1176	Alex	Yangon	Member	Female	
4	373-73-7910	Alex	Yangon	Member	Female	

	Product line	Unit price	Quantity	Tax 5%	Total
Date \					
0	Health and beauty	74.69	7	26.1415	548.9715
2019-01-05					
1	Electronic accessories	15.28	5	3.8200	80.2200

2019-03-08					
2	Home and lifestyle	46.33	7	16.2155	340.5255
2019-03-03					
3	Health and beauty	58.22	8	23.2880	489.0480
2019-01-27					
4	Sports and travel	86.31	7	30.2085	634.3785
2019-02-08					

		Time	Payment	cogs	gross margin percentage	\
0	2025-06-03	13:08:00	Ewallet	522.83		4.761905
1	2025-06-03	10:29:00	Cash	76.40		4.761905
2	2025-06-03	13:23:00	Credit card	324.31		4.761905
3	2025-06-03	20:33:00	Ewallet	465.76		4.761905
4	2025-06-03	10:37:00	Ewallet	604.17		4.761905

	gross income	Rating	day	month	year
0	26.1415	9.1	5	1	2019
1	3.8200	9.6	8	3	2019
2	16.2155	7.4	3	3	2019
3	23.2880	8.4	27	1	2019
4	30.2085	5.3	8	2	2019

2nd WAY (LAMBDA)

```
sales['Date'].apply(lambda x:x.day)
```

0	5
1	8
2	3
3	27
4	8
...	...
995	29
996	2
997	9
998	22
999	18

Name: Date, Length: 1000, dtype: int64

3rd WAY (DATE TIME)

```
sales['Date'].dt.month
#sales['Date'].dt.year
```

0	1
1	3
2	3
3	1
4	2

```

995    ..
996    1
997    3
998    2
999    2
Name: Date, Length: 1000, dtype: int32

sales.columns

Index(['Invoice ID', 'Branch', 'City', 'Customer type', 'Gender',
      'Product line', 'Unit price', 'Quantity', 'Tax 5%', 'Total',
      'Date',
      'Time', 'Payment', 'cogs', 'gross margin percentage', 'gross
income',
      'Rating', 'day', 'month', 'year'],
      dtype='object')

```

```
sales['hour'] = sales['Time'].apply(lambda x:x.hour)
```

```
sales.head()
```

	Invoice ID	Branch	City	Customer type	Gender	\
0	750-67-8428	Alex	Yangon	Member	Female	
1	226-31-3081	Giza	Naypyitaw	Normal	Female	
2	631-41-3108	Alex	Yangon	Normal	Female	
3	123-19-1176	Alex	Yangon	Member	Female	
4	373-73-7910	Alex	Yangon	Member	Female	

	Product line	Unit price	Quantity	Tax 5%
Total ... \				
0	Health and beauty	74.69	7	26.1415
548.9715 ...				
1	Electronic accessories	15.28	5	3.8200
80.2200 ...				
2	Home and lifestyle	46.33	7	16.2155
340.5255 ...				
3	Health and beauty	58.22	8	23.2880
489.0480 ...				
4	Sports and travel	86.31	7	30.2085
634.3785 ...				

	Time	Payment	cogs	gross margin percentage	\
0	2025-06-03 13:08:00	Ewallet	522.83	4.761905	
1	2025-06-03 10:29:00	Cash	76.40	4.761905	
2	2025-06-03 13:23:00	Credit card	324.31	4.761905	
3	2025-06-03 20:33:00	Ewallet	465.76	4.761905	
4	2025-06-03 10:37:00	Ewallet	604.17	4.761905	

	gross income	Rating	day	month	year	hour
0	26.1415	9.1	5	1	2019	13

1	3.8200	9.6	8	3	2019	10
2	16.2155	7.4	3	3	2019	13
3	23.2880	8.4	27	1	2019	20
4	30.2085	5.3	8	2	2019	10

[5 rows x 21 columns]

sales['Time']

0	2025-06-03 13:08:00
1	2025-06-03 10:29:00
2	2025-06-03 13:23:00
3	2025-06-03 20:33:00
4	2025-06-03 10:37:00

...

995	2025-06-03 13:46:00
996	2025-06-03 17:16:00
997	2025-06-03 13:22:00
998	2025-06-03 15:33:00
999	2025-06-03 13:28:00

Name: Time, Length: 1000, dtype: datetime64[ns]

sales['Time'][0]

Timestamp('2025-06-03 13:08:00')

##string split

`int('2025-06-03 13:08:00'.split(' ')[1].split(':')[0])`

#the below will show error

#sales['Time'][0].split(' ')

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PERFORMING DESCRIPTIVE ANALYSIS OF DATA

sales.describe().T

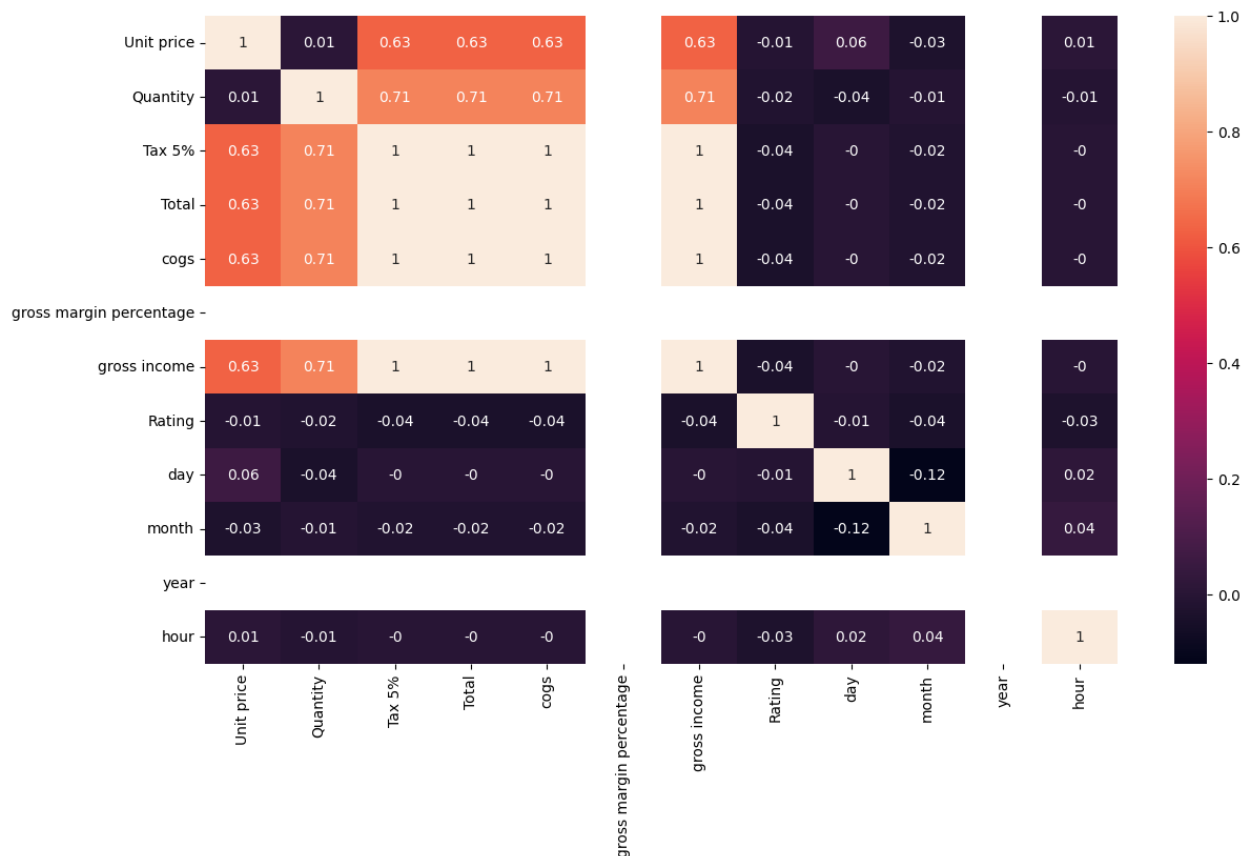
	count	mean	\
Unit price	1000.0	55.67213	
Quantity	1000.0	5.51	
Tax 5%	1000.0	15.379369	
Total	1000.0	322.966749	
Date	1000	2019-02-14 00:05:45.600000	
Time	1000	2025-06-03 15:24:41.880000	
cogs	1000.0	307.58738	
gross margin percentage	1000.0	4.761905	
gross income	1000.0	15.379369	
Rating	1000.0	6.9727	
day	1000.0	15.256	

month	1000.0	1.993
year	1000.0	2019.0
hour	1000.0	14.91
	min	25% \
Unit price	10.08	32.875
Quantity	1.0	3.0
Tax 5%	0.5085	5.924875
Total	10.6785	124.422375
Date	2019-01-01 00:00:00	2019-01-24 00:00:00
Time	2025-06-03 10:00:00	2025-06-03 12:43:00
cogs	10.17	118.4975
gross margin percentage	4.761905	4.761905
gross income	0.5085	5.924875
Rating	4.0	5.5
day	1.0	8.0
month	1.0	1.0
year	2019.0	2019.0
hour	10.0	12.0
	50%	75% \
Unit price	55.23	77.935
Quantity	5.0	8.0
Tax 5%	12.088	22.44525
Total	253.848	471.35025
Date	2019-02-13 00:00:00	2019-03-08 00:00:00
Time	2025-06-03 15:19:00	2025-06-03 18:15:00
cogs	241.76	448.905
gross margin percentage	4.761905	4.761905
gross income	12.088	22.44525
Rating	7.0	8.5
day	15.0	23.0
month	2.0	3.0
year	2019.0	2019.0
hour	15.0	18.0
	max	std
Unit price	99.96	26.494628
Quantity	10.0	2.923431
Tax 5%	49.65	11.708825
Total	1042.65	245.885335
Date	2019-03-30 00:00:00	NaN
Time	2025-06-03 20:59:00	NaN
cogs	993.0	234.17651
gross margin percentage	4.761905	0.0
gross income	49.65	11.708825
Rating	10.0	1.71858
day	31.0	8.693563
month	3.0	0.835254

```
year      2019.0      0.0
hour      20.0      3.186857
```

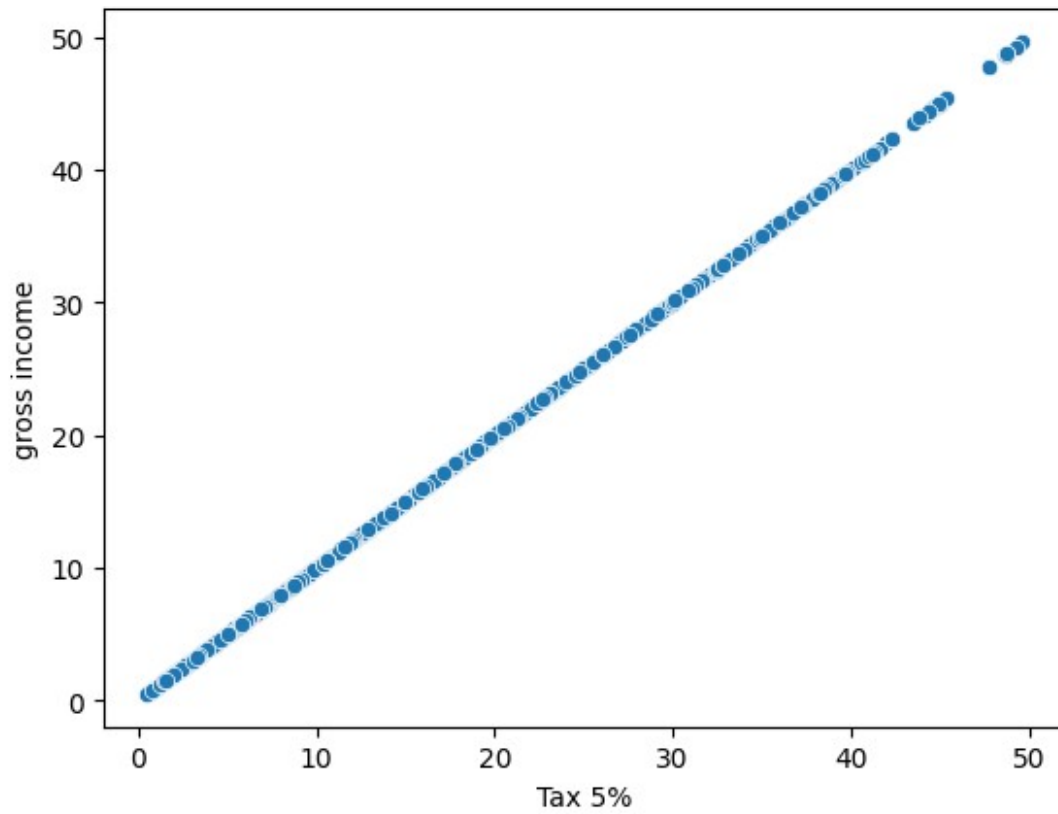
```
plt.figure(figsize=(14,8))
sns.heatmap(np.round(sales.corr(numeric_only=True),2),annot=True)
```

```
<Axes: >
```

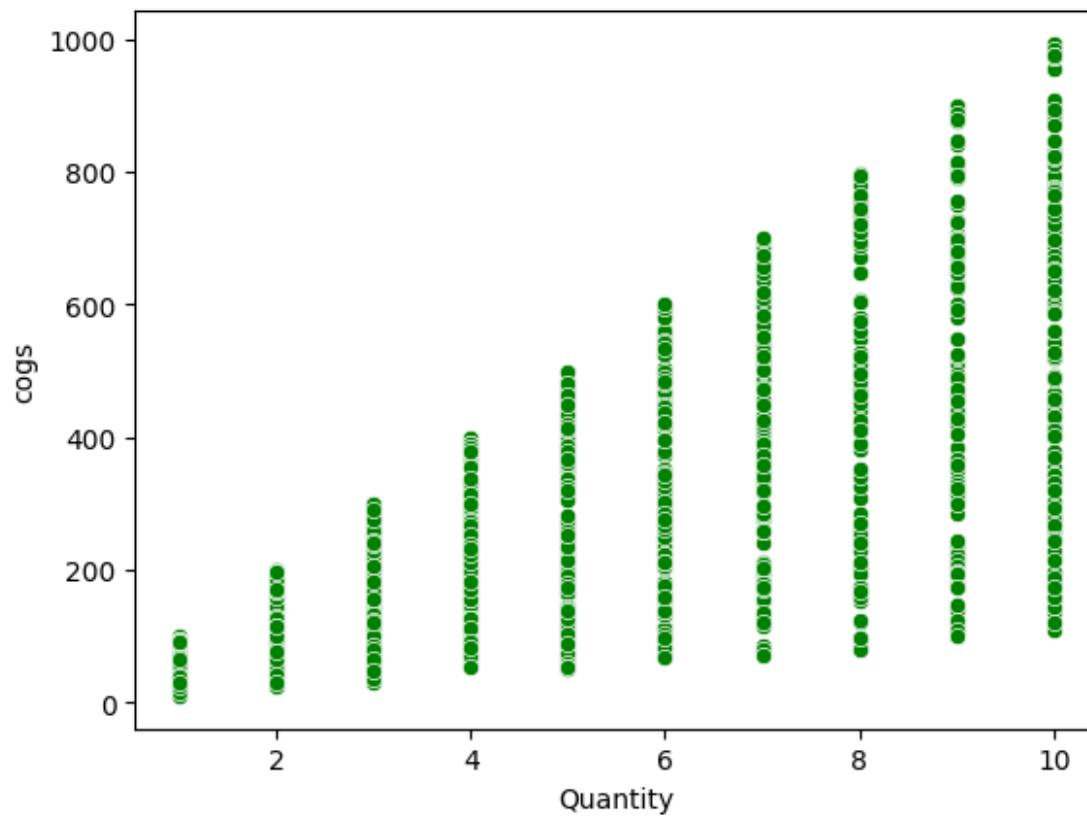


```
sns.scatterplot(x='Tax 5%', y = 'gross income', data = sales)
```

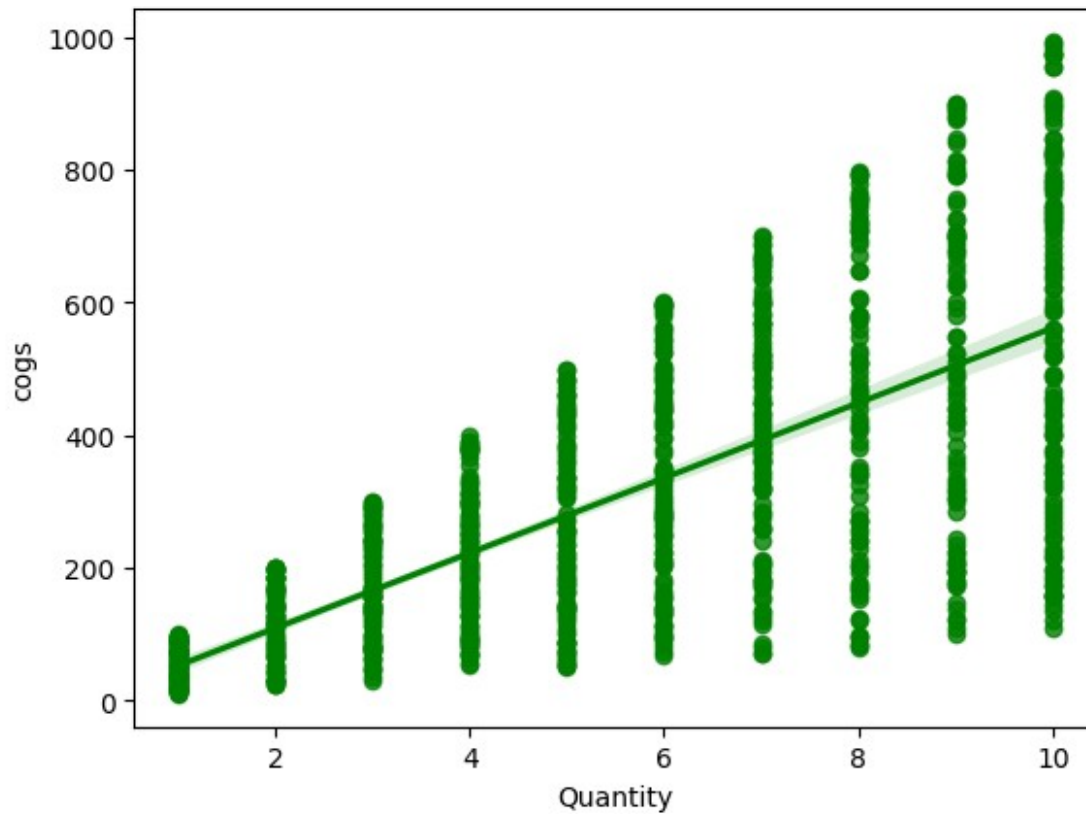
```
<Axes: xlabel='Tax 5%', ylabel='gross income'>
```

```
sns.scatterplot(x='Quantity', y = 'cogs', data = sales, color='green')  
<Axes: xlabel='Quantity', ylabel='cogs'>
```



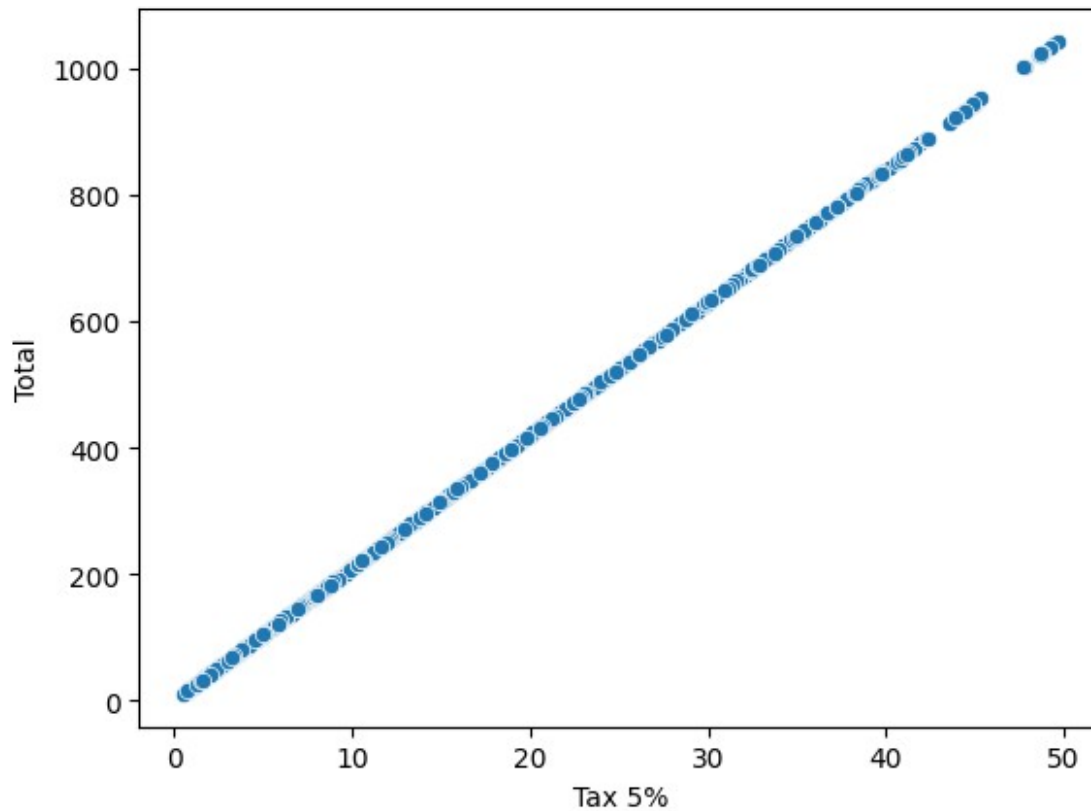
```
sns.regplot(x='Quantity', y = 'cogs', data = sales, color='green')  
<Axes: xlabel='Quantity', ylabel='cogs'>
```



1. Finding relationship between publish_display data
2. which city has more Gross Income
3. find mean rating & visualize it

```
sns.scatterplot(x='Tax 5%',y='Total', data=sales)
```

```
<Axes: xlabel='Tax 5%', ylabel='Total'>
```



```
sales['City']
```

```
0      Yangon
1    Naypyitaw
2      Yangon
3      Yangon
4      Yangon
...
995    Naypyitaw
996    Mandalay
997      Yangon
998      Yangon
999      Yangon
Name: City, Length: 1000, dtype: object
```

```
sales['City'].unique()
```

```
array(['Yangon', 'Naypyitaw', 'Mandalay'], dtype=object)
```

1. FILTER
2. GROUPBY

```
sales.groupby(['City'])['gross income'].median()
```

```
City
Mandalay      12.04200
Naypyitaw     12.92475
Yangon        11.46800
Name: gross income, dtype: float64
```

```
sales['Rating'].mean()
```

```
np.float64(6.9727)
```

```
np.mean(sales['Rating'])
```

```
np.float64(6.9727)
```

```
sns.distplot(sales['Rating'])
```

```
plt.axvline(x=np.mean(sales['Rating']),c='red',label='Avg rating')
```

```
C:\Users\rlith\AppData\Local\Temp\ipykernel_10200\1680473517.py:1:
UserWarning:
```

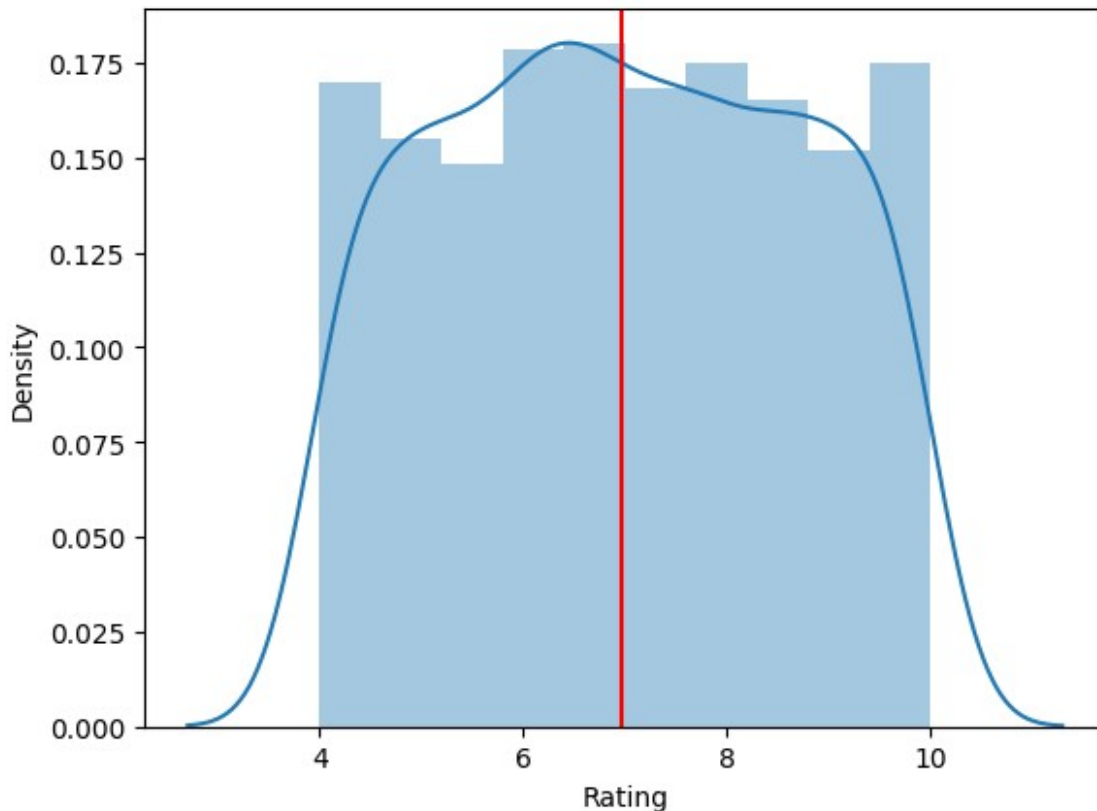
```
`distplot` is a deprecated function and will be removed in seaborn
v0.14.0.
```

Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see <https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

```
sns.distplot(sales['Rating'])
```

```
<matplotlib.lines.Line2D at 0x187a2643830>
```



```
sns.distplot(sales['Rating'],kde=False)
```

C:\Users\rlith\AppData\Local\Temp\ipykernel_10200\4206155404.py:1:
UserWarning:

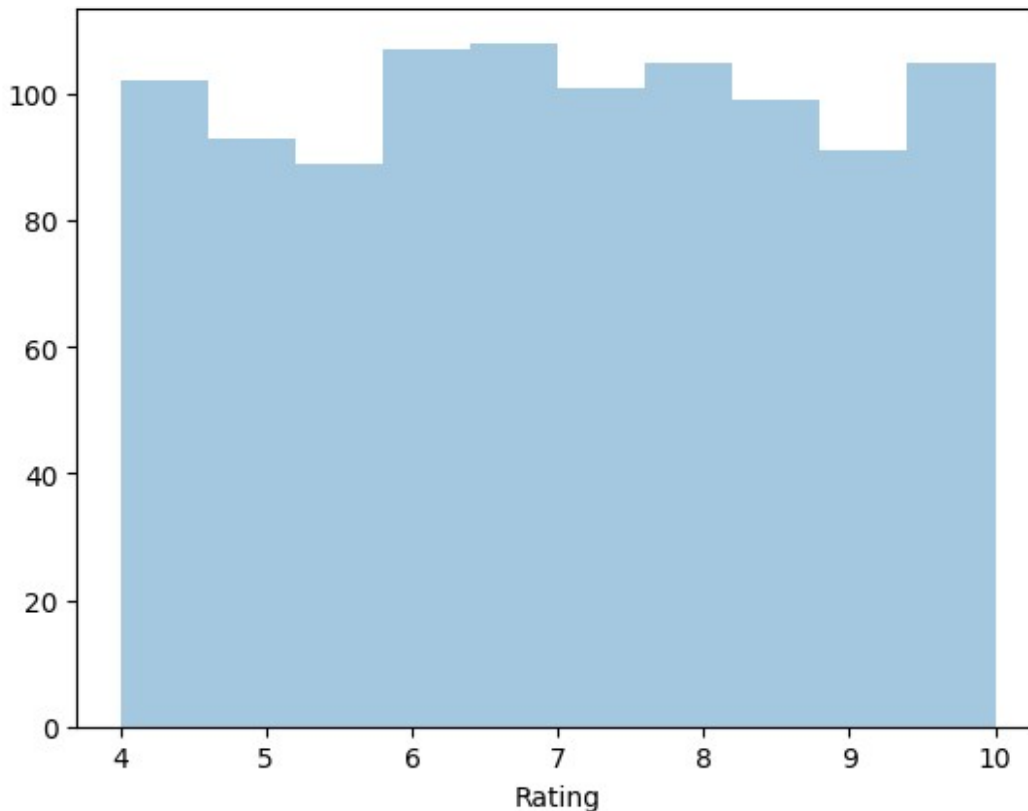
`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see <https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751>

```
sns.distplot(sales['Rating'],kde=False)
```

<Axes: xlabel='Rating'>



DEFINING OWN CUSTOM FUNCTIONS

```
def return_countplot(column, hue_name=None):
    return sns.countplot(x=column, data=sales, hue=hue_name)

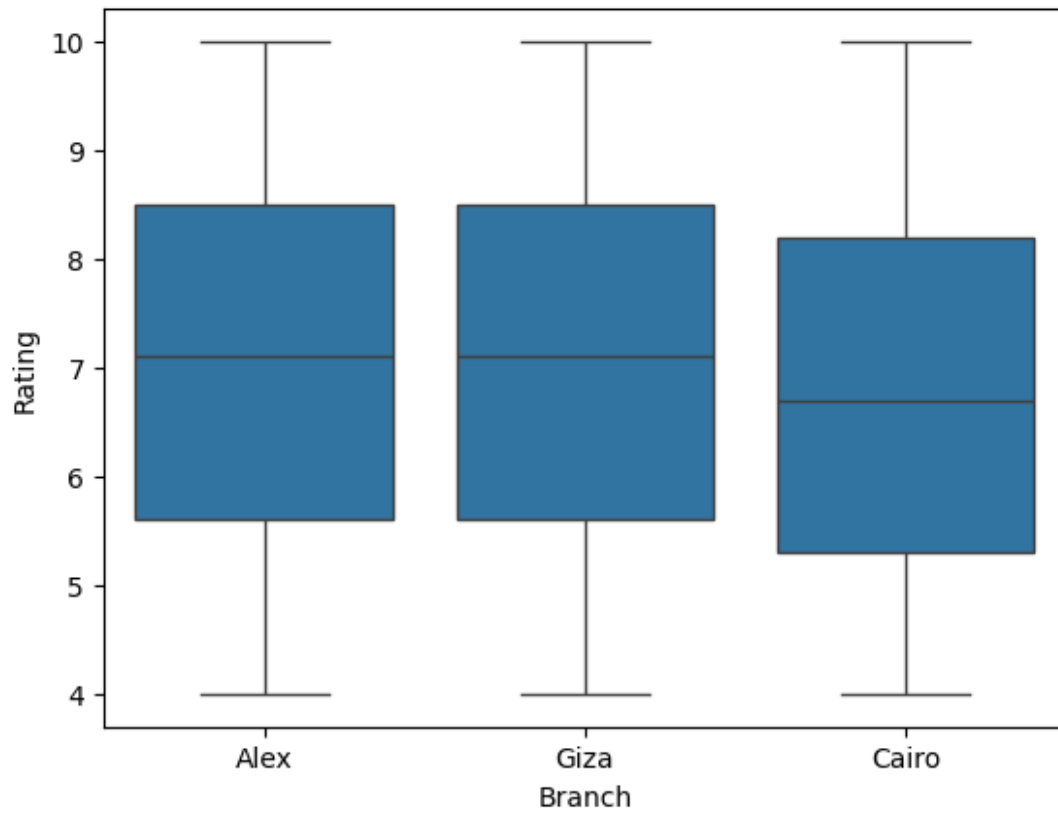
def return_boxplot(x_column, y_column):
    return sns.boxplot(x=x_column, y=y_column, data=sales)

def return_lineplot(x_column, y_column):
    return sns.lineplot(x=x_column, y=y_column, data=sales)

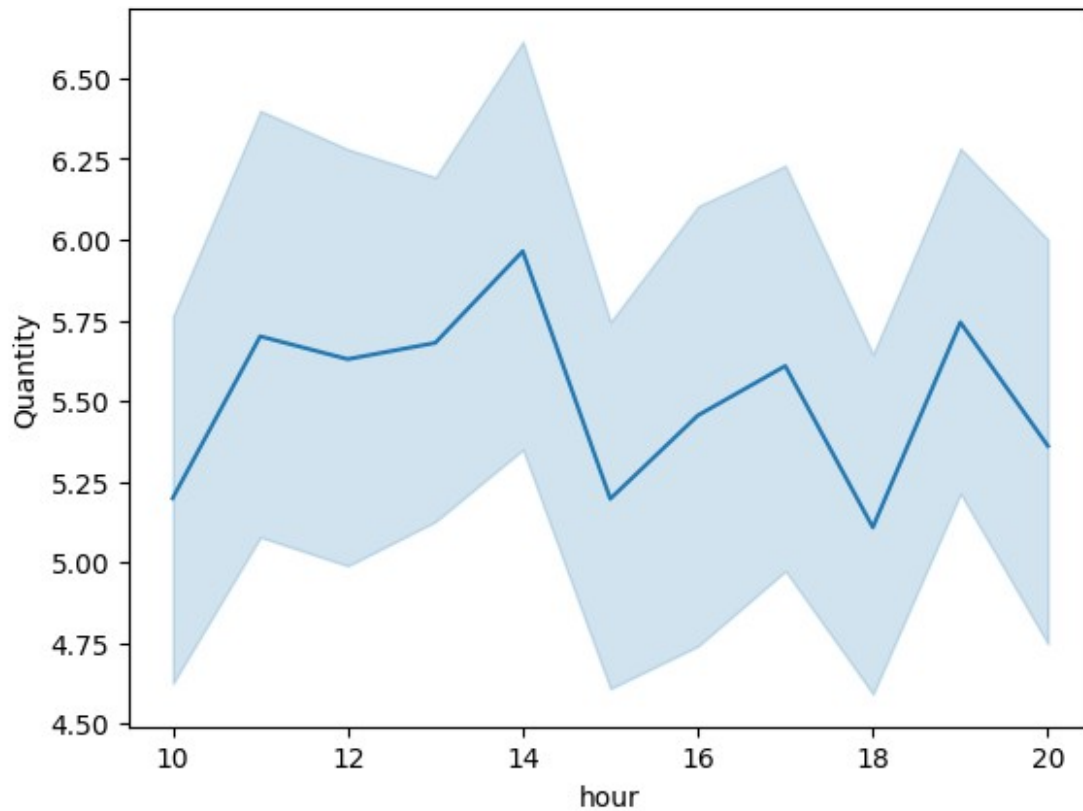
def return_relplot(x_col, y_col, col_name=None,
row_name=None, rel_type=None, hue_name=None, style_name=None):
    return sns.relplot(x=x_col, y=y_col, col=col_name,
row=row_name, kind=rel_type, hue=hue_name, style=style_name,
data=sales)
```

1. ANALYSING DIATRIBUTION OF VARIOUS BRANCEHES
2. ANALYSIS TREND OF SALES
3. HOW MUCH SALES OCCURS IN EACH & EVERY BRANCH WITH RESPECT TO EACH & EVERY MONTH

```
return_boxplot('Branch', 'Rating')
<Axes: xlabel='Branch', ylabel='Rating'>
```



```
return_lineplot('hour','Quantity')  
<Axes: xlabel='hour', ylabel='Quantity'>
```

```
return_relplot(x_col='hour',y_col='Quantity',  
col_name='month',row_name='Branch', rel_type='line',hue_name='Gender',  
style_name='Gender')
```

```
<seaborn.axisgrid.FacetGrid at 0x187a632a4b0>
```



1. ANALYSING BRANCH TOTAL SALES PER HOUR IN A MONTHLY FASHION
2. WHEN CUSTOMERS BUY CERTAIN PRODUCTS IN THE VARIOUS BRANCHES
3. PERFORMING PRODUCT ANALYSIS

```
sales.columns
```

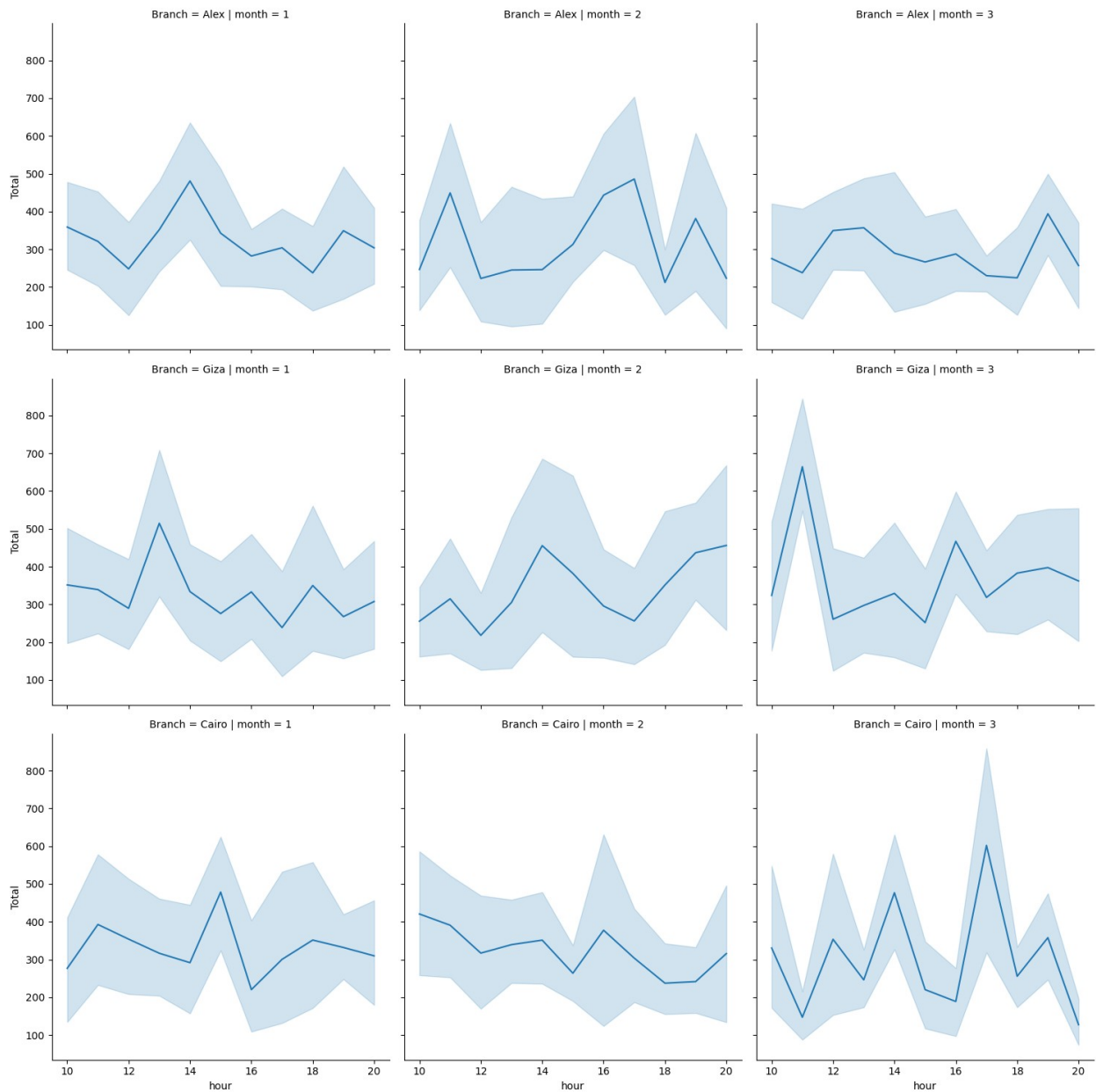
```
Index(['Invoice ID', 'Branch', 'City', 'Customer type', 'Gender',
      'Product line', 'Unit price', 'Quantity', 'Tax 5%', 'Total',
      'Date',
      'Time', 'Payment', 'cogs', 'gross margin percentage', 'gross
income',
      'Rating', 'day', 'month', 'year', 'hour'],
      dtype='object')
```

```
len(sales['Product line'].unique())
```

6

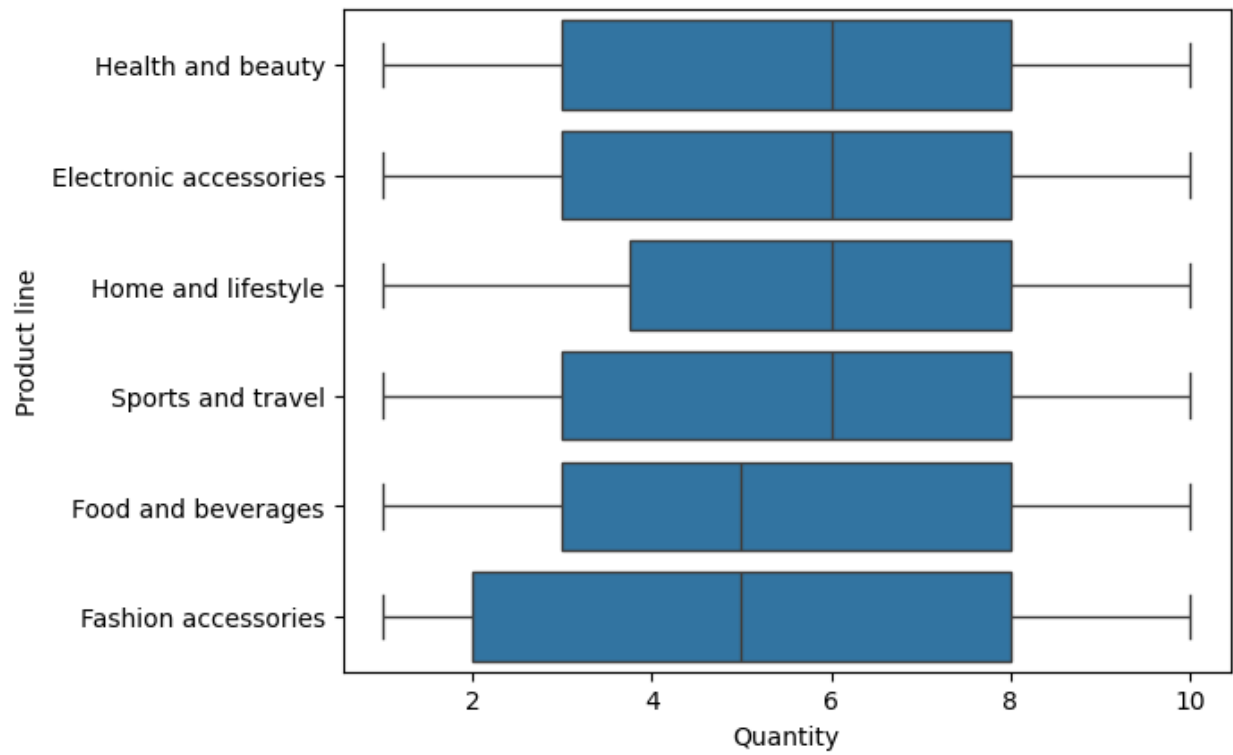
```
return_relplot(x_col='hour',y_col='Total',
col_name='month',row_name='Branch',rel_type='line')
```

<seaborn.axisgrid.FacetGrid at 0x187a62a8ad0>

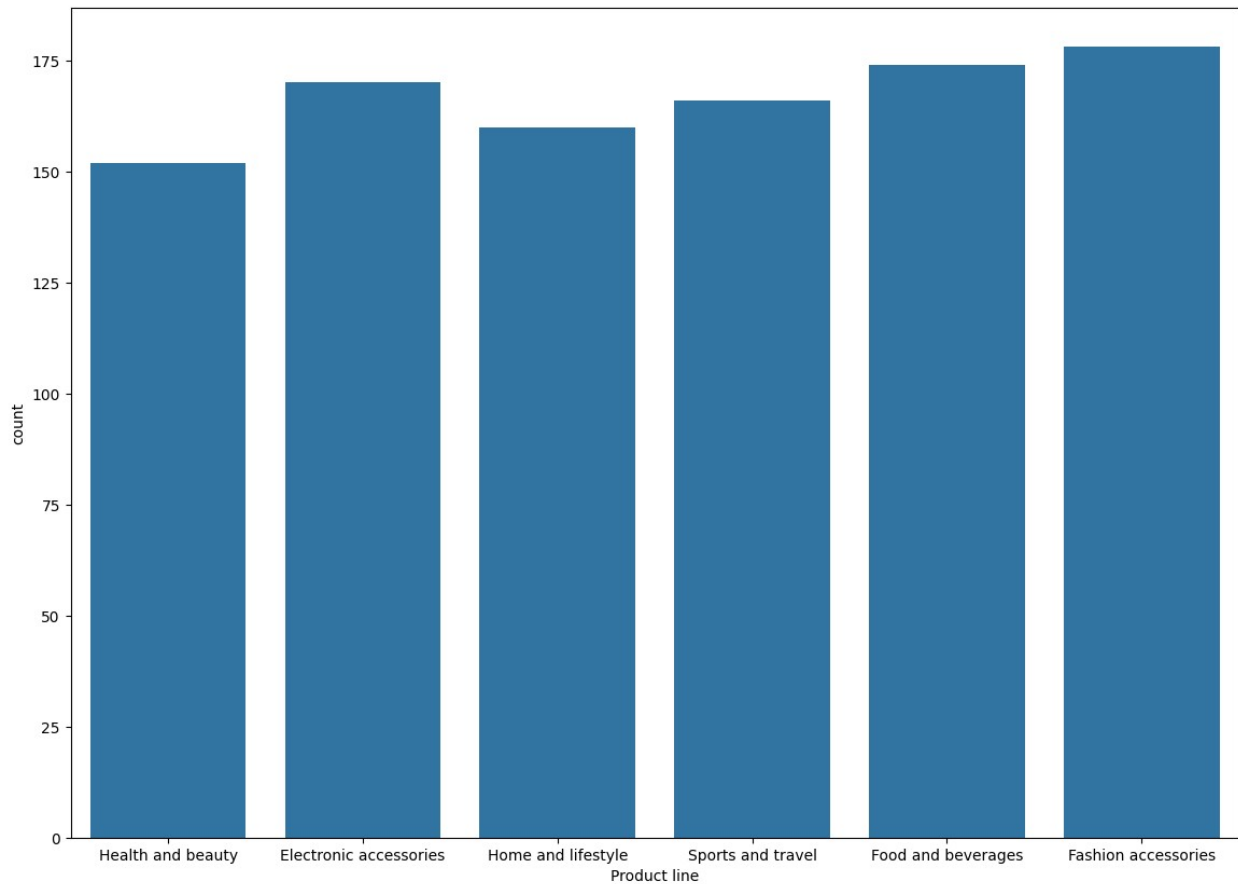


```
return_boxplot('Quantity','Product line')
```

<Axes: xlabel='Quantity', ylabel='Product line'>

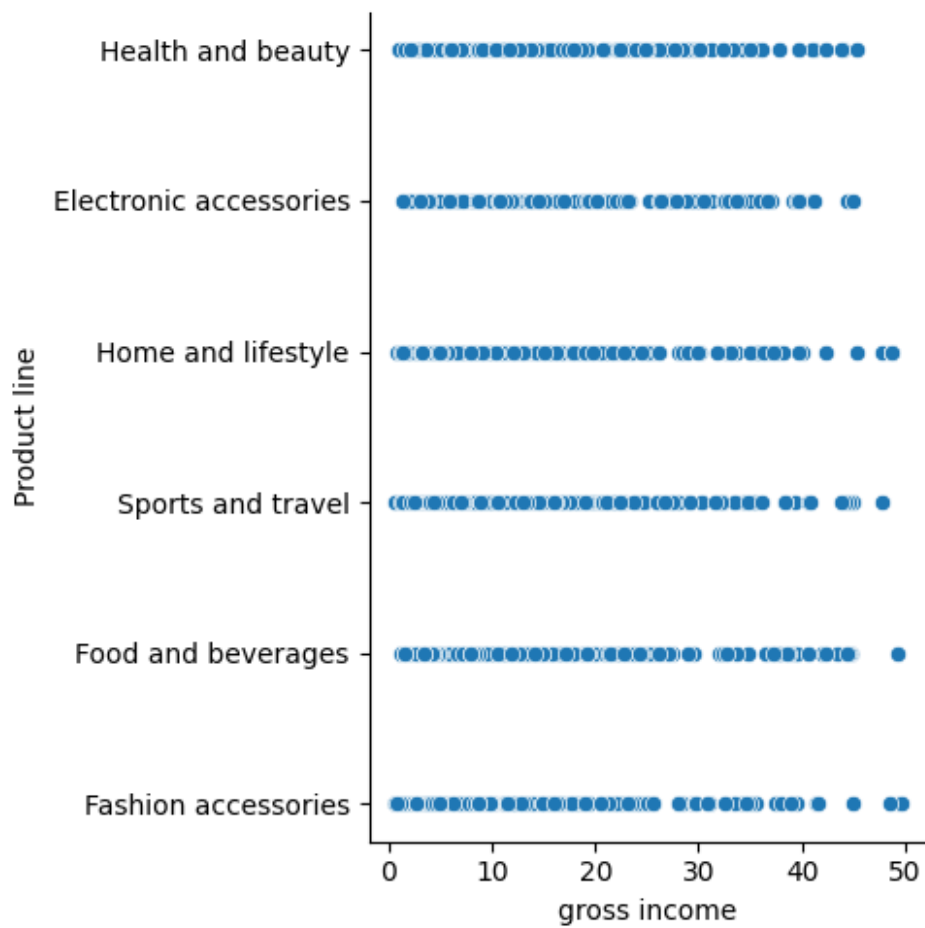


```
plt.figure(figsize=(14,10))  
return_countplot('Product line')  
<Axes: xlabel='Product line', ylabel='count'>
```



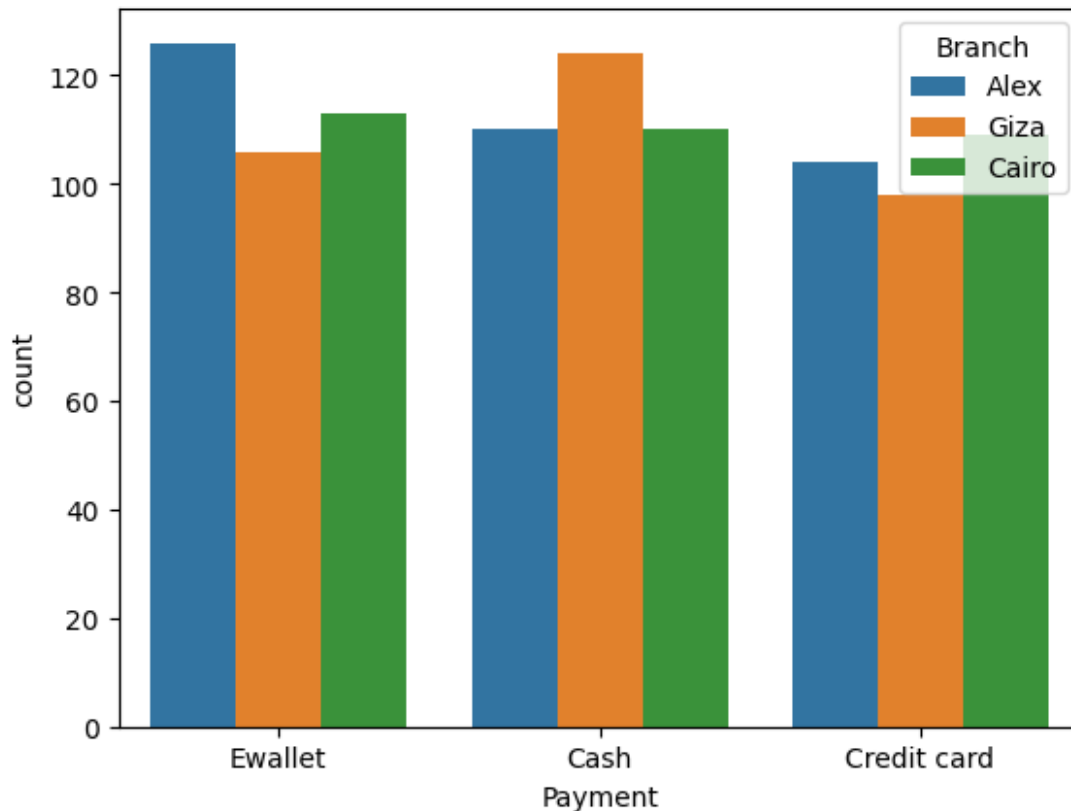
1. relationship between gross_income & product_line
2. how customers make payment in this businesss
3. does customer type influences the sales?

```
return_relplot('gross income', 'Product line', rel_type='scatter')  
<seaborn.axisgrid.FacetGrid at 0x187a8255850>
```



```
return_countplot('Payment', hue_name='Branch')
```

```
<Axes: xlabel='Payment', ylabel='count'>
```



```
sales.groupby('Customer type')['Total'].sum()
```

```
Customer type
Member    189694.764
Normal    133271.985
Name: Total, dtype: float64
```

```
type(sales.groupby('Customer type')['Total'].sum())
```

```
pandas.core.series.Series
```

```
sales.groupby('Customer type').agg({'Total': 'sum'})
```

```

              Total
Customer type
Member    189694.764
Normal    133271.985

```

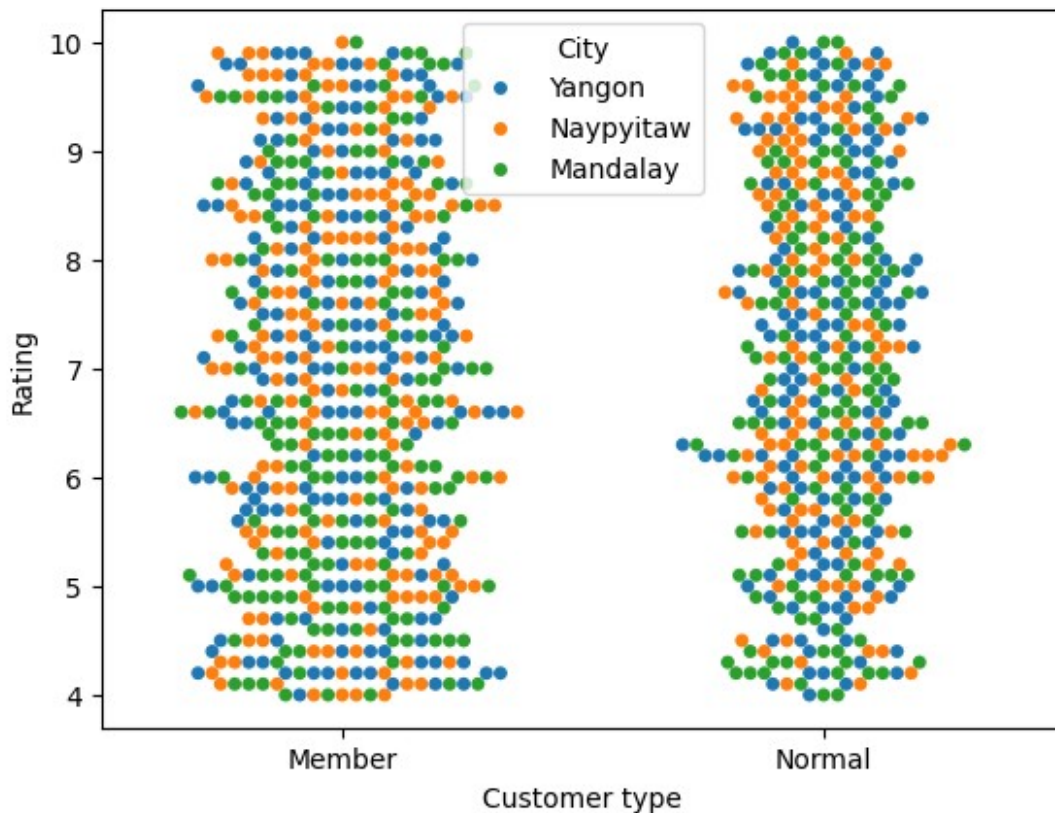
```
type(sales.groupby('Customer type').agg({'Total': 'sum'}))
```

```
pandas.core.frame.DataFrame
```

1. DO THE CUSTOMER TYPE INFLUENCE CUSTOMER RATING?
2. MOST FAVOURITE PRODUCTS OF USERS

```
sns.swarmplot(x='Customer type', y = 'Rating', data=sales, hue='City')
```

```
<Axes: xlabel='Customer type', ylabel='Rating'>
```



```
pip install wordcloud
```

```
Collecting wordcloud
```

```
Obtaining dependency information for wordcloud from  
https://files.pythonhosted.org/packages/b9/74/6a15f68f59bc90032bfcf62eca796a5675be95e1aaf84f7861e1bfcfa8e5/wordcloud-1.9.4-cp312-cp312-win\_amd64.whl.metadata
```

```
Downloading wordcloud-1.9.4-cp312-cp312-win_amd64.whl.metadata (3.5 kB)
```

```
Requirement already satisfied: numpy>=1.6.1 in c:\users\rlith\appdata\local\programs\python\python312\lib\site-packages (from wordcloud) (2.1.3)
```

```
Requirement already satisfied: pillow in c:\users\rlith\appdata\local\programs\python\python312\lib\site-packages (from wordcloud) (11.1.0)
```

```
Requirement already satisfied: matplotlib in c:\users\rlith\appdata\local\programs\python\python312\lib\site-packages (from wordcloud) (3.10.1)
```

```
Requirement already satisfied: contourpy>=1.0.1 in c:\users\rlith\appdata\local\programs\python\python312\lib\site-packages (from matplotlib->wordcloud) (1.3.1)
```

```
Requirement already satisfied: cyclor>=0.10 in c:\users\rlith\appdata\local\programs\python\python312\lib\site-packages (from matplotlib-
```



```

>wordcloud) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\rlith\
appdata\local\programs\python\python312\lib\site-packages (from
matplotlib->wordcloud) (4.57.0)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\rlith\
appdata\local\programs\python\python312\lib\site-packages (from
matplotlib->wordcloud) (1.4.8)
Requirement already satisfied: packaging>=20.0 in c:\users\rlith\
appdata\roaming\python\python312\site-packages (from matplotlib-
>wordcloud) (24.2)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\rlith\
appdata\local\programs\python\python312\lib\site-packages (from
matplotlib->wordcloud) (3.2.3)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\rlith\
appdata\roaming\python\python312\site-packages (from matplotlib-
>wordcloud) (2.9.0.post0)
Requirement already satisfied: six>=1.5 in c:\users\rlith\appdata\
roaming\python\python312\site-packages (from python-dateutil>=2.7-
>matplotlib->wordcloud) (1.17.0)
Downloading wordcloud-1.9.4-cp312-cp312-win_amd64.whl (301 kB)
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----- 301.2/301.2 kB 433.0 kB/s
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Installing collected packages: wordcloud
Successfully installed wordcloud-1.9.4
Note: you may need to restart the kernel to use updated packages.
```

```
[notice] A new release of pip is available: 23.2.1 -> 25.1.1
[notice] To update, run: python.exe -m pip install --upgrade pip
```

```
from wordcloud import WordCloud
```

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' '.join(sales['Product line'])
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'Health and beauty Electronic accessories Home and lifestyle Health
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```
plt.figure(figsize=(12,8))  
wordcloud = WordCloud(width=1920,height=1080).generate('  
'.'.join(sales['Product line'])))  
plt.imshow(wordcloud)  
plt.axis('off')  
  
(np.float64(-0.5), np.float64(1919.5), np.float64(1079.5),  
np.float64(-0.5))
```

