```
import numpy as np
import pandas as pd

import matplotlib.pyplot as plt

plt.style.use('default')
```

Problem 1 to 5:

Dataset link: https://tinyurl.com/2fe6vz4u

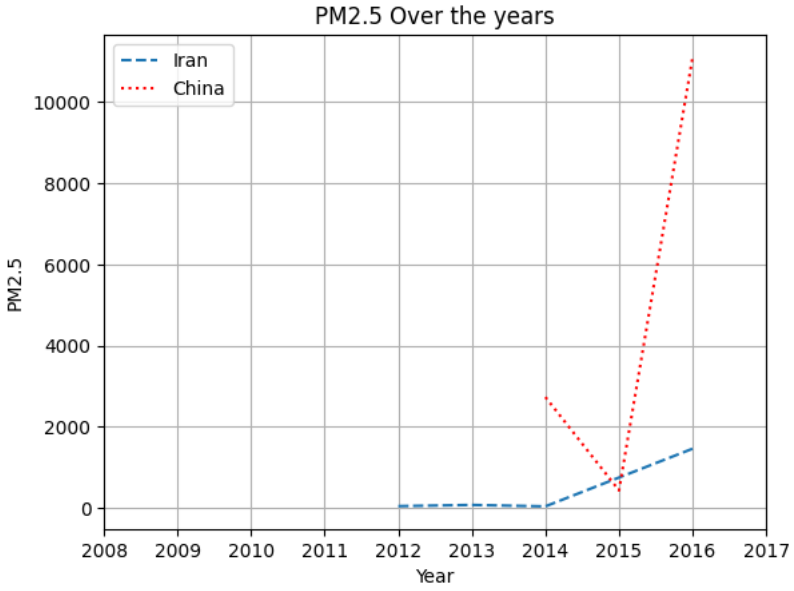
Add a label to every axis and add a proper title for the charts. Also add proper labels if there are multiple representations. Then, you can customize it as your wish.

Problem-1: Draw a line plot of which, the x-axis is the "Year" and the y-axis is sum of "PM2.5" of two countries Iran and China.

```
# code here
df = pd.read_csv('https://tinyurl.com/2fe6vz4u')
df.head()
```

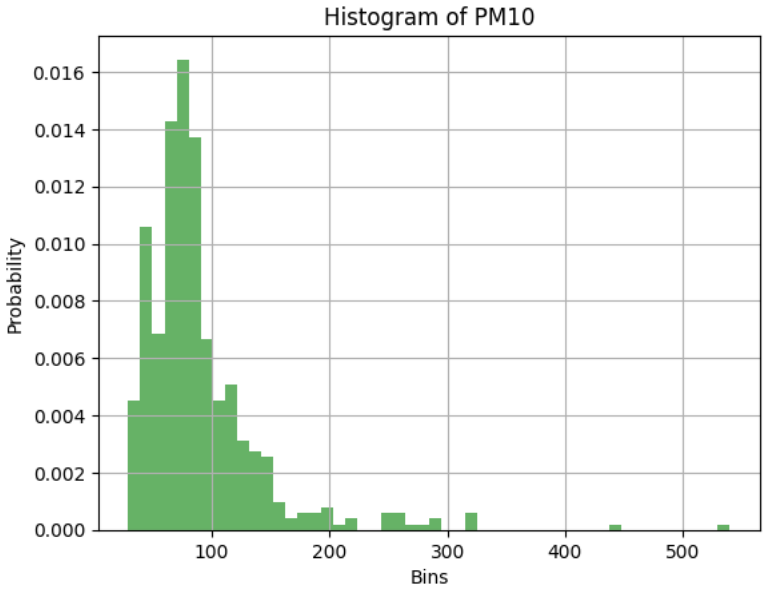
	Unnamed: 0	Position	Country	City/Town	Year	PM2.5	Temporal coverage	PM10	Temporal coverage.1	Database version (year)
0	0	1	India	Kanpur	2016	173	>75%	319	NaN	2018
1	1	2	India	Faridabad	2016	172	>75%	316	NaN	2018
2	2	3	India	Gaya	2016	149	50% -< 75%	275	NaN	2018
3	3	4	India	Varanasi	2016	146	>75%	260	NaN	2018
4	4	5	India	Patna	2016	144	>75%	266	NaN	2018

```
iran_series = df.query('Country == "Iran"').groupby('Year')['PM2.5'].sum()
china_series = df.query('Country == "China"').groupby('Year')['PM2.5'].sum()


plt.plot(iran_series.index,iran_series.values,label='Iran',linestyle='dashed')
plt.plot(china_series.index,china_series.values,label='China',linestyle='dotted',color='red')
plt.xlabel('Year')
plt.ylabel('PM2.5')
plt.title('PM2.5 Over the years')
plt.xticks(df['Year'].value_counts().index)
plt.legend()
plt.grid()
plt.show()
```



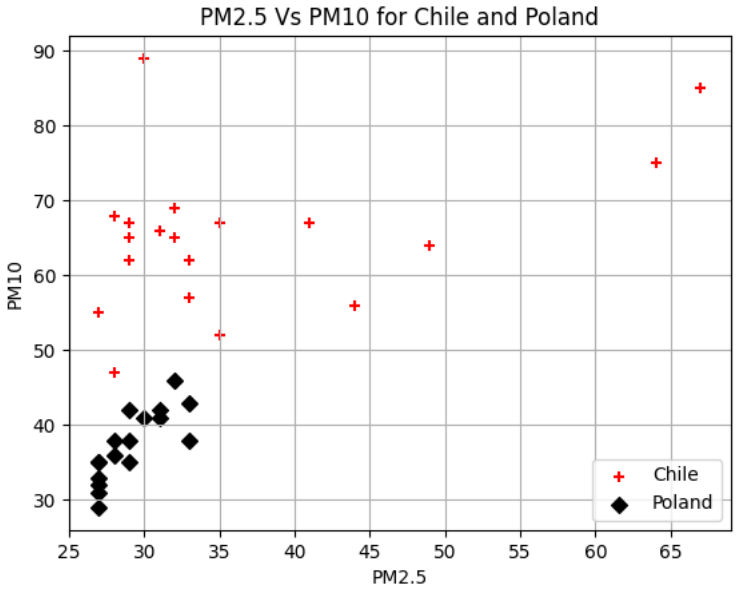
Problem-2: Draw a histogram of the column "PM10" of which the y-axis represents the probability (see the documentation how to draw the probability).

```
# code here
plt.hist(df['PM10'],density=True,bins=50,facecolor='green',alpha=0.6)
plt.xlabel('Bins')
plt.ylabel('Probability')
plt.title('Histogram of PM10')
plt.grid()
plt.show()
```



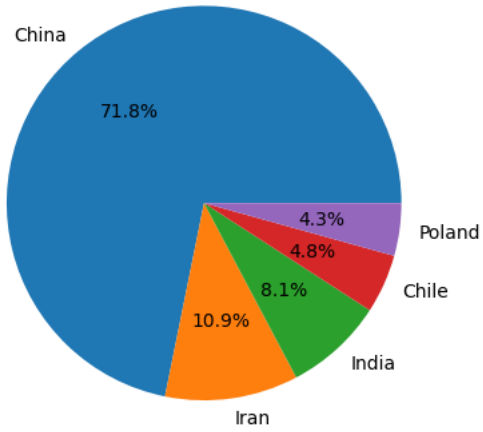
Problem-3: Draw a scatter plot where x-axis represents "PM2.5" and y-axis represents "PM10" for two countries Poland and Chile.

```
# code here
chile_df = df.query("Country == 'Chile'")
poland_df = df.query("Country == 'Poland'")


plt.scatter(chile_df['PM2.5'],chile_df['PM10'],marker="+",color='red',label='Chile')
plt.scatter(poland_df['PM2.5'],poland_df['PM10'],marker="D",color='black',label='Poland')
plt.xlabel('PM2.5')
plt.ylabel('PM10')
plt.title('PM2.5 Vs PM10 for Chile and Poland')
plt.legend()
plt.grid()
plt.show()
```



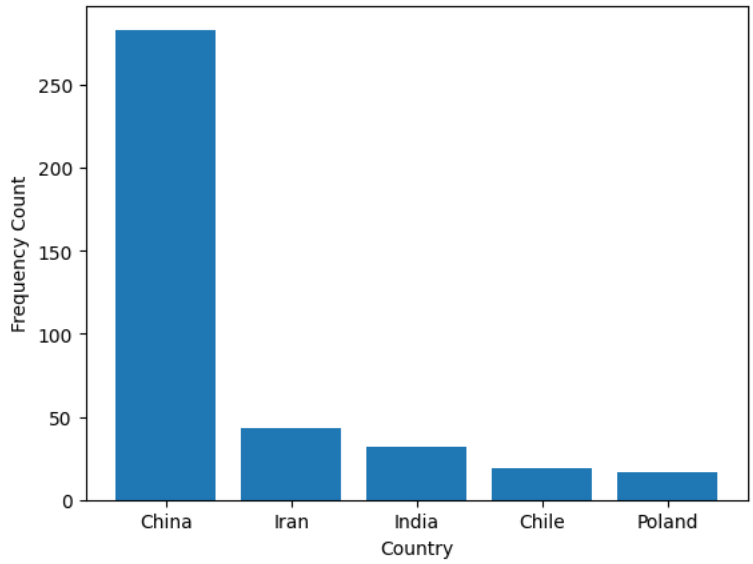
Problem-4: Draw a pie chart of top 5 most frequent countries.

```
# code here
freq_ser = df['Country'].value_counts().head()


plt.pie(freq_ser,labels=freq_ser.index,autopct='%0.1f%%')
plt.show()
```



Problem-5: Draw a bar chart which represents the counts of top 5 most frequent countries.

```
# code here
plt.bar(freq_ser.index,freq_ser)
plt.xlabel('Country')
plt.ylabel('Frequency Count')
plt.show()
```



Problem 6-10

Data Set - https://docs.google.com/spreadsheets/d/e/2PACX-1vTJh6X4_mqixWsfK9mgkllGQkKYW9Wj9kOIMGY2uYsWeS8n5np87DO-SDGQWJ1HXEnxiOVFVzYFYEcR/pub?gid=558678488&single=true&output=csv

This is a Sales data of any company in a Year.

Problem-6

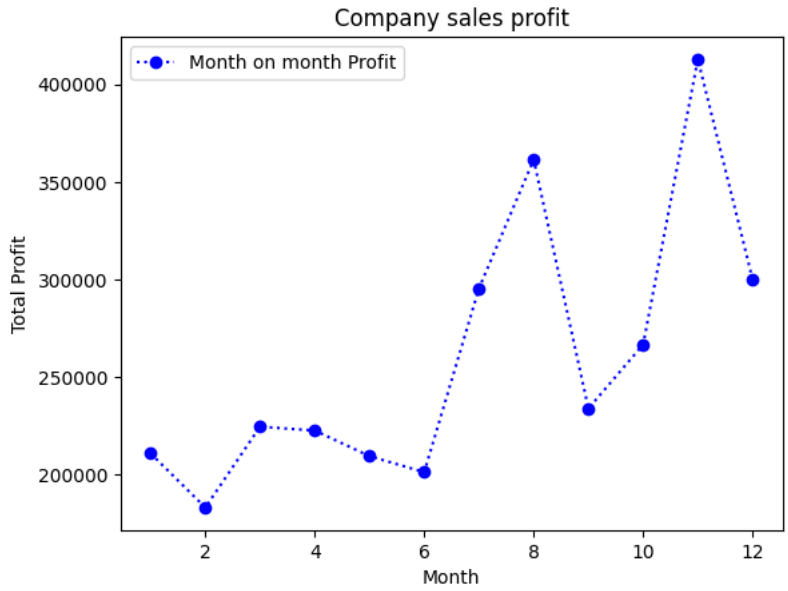
Show a line plot of Total Profit for each month with below styling.

- Dotted Line
- Line Color Blue
- Show Legend at top left
- Circle Marker

```
# code here
df = pd.read_csv('https://docs.google.com/spreadsheets/d/e/2PACX-1vTJh6X4_mqixWsfK9mgkllGQkKYW9Wj9kOIMGY2uYsWeS8n5np87DO-SDC
df
```

	month_number	facecream	facewash	toothpaste	bathingsoap	shampoo	moistu
0	1	2500	1500	5200	9200	1200	
1	2	2630	1200	5100	6100	2100	
2	3	2140	1340	4550	9550	3550	
3	4	3400	1130	5870	8870	1870	
4	5	3600	1740	4560	7760	1560	
5	6	2760	1555	4890	7490	1890	
6	7	2980	1120	4780	8980	1780	
7	8	3700	1400	5860	9960	2860	
8	9	3540	1780	6100	8100	2100	
9	10	1990	1890	8300	10300	2300	
10	11	2340	2100	7300	13300	2400	
11	12	2900	1760	7400	14400	1800	

```
plt.plot(df['month_number'],df['total_profit'],label='Month on month Profit',color='b',marker='o',linestyle='dotted')
plt.xlabel('Month')
plt.ylabel('Total Profit')
plt.title('Company sales profit')
plt.legend(loc="upper left")
plt.show()
```



Problem-7

Show sales of each product in march month as pie chart.

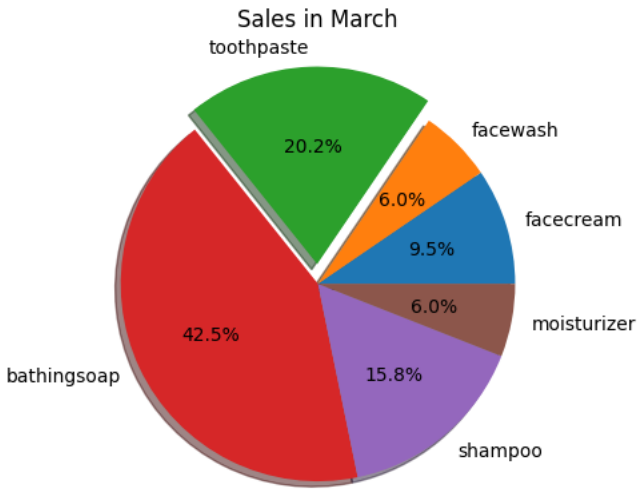
- Show Percentage value
- Give Title "Sales in March"
- Explode ToothPaste with shadow

```
# code here
labels = df[df['month_number'] == 3].iloc[:,1:7].stack().index.get_level_values(1)
values = df[df['month_number'] == 3].iloc[:,1:7].stack().values
```

```
labels
```

```
Index(['facecream', 'facewash', 'toothpaste', 'bathingsoap', 'shampoo',
       'moisturizer'],
      dtype='object')
```

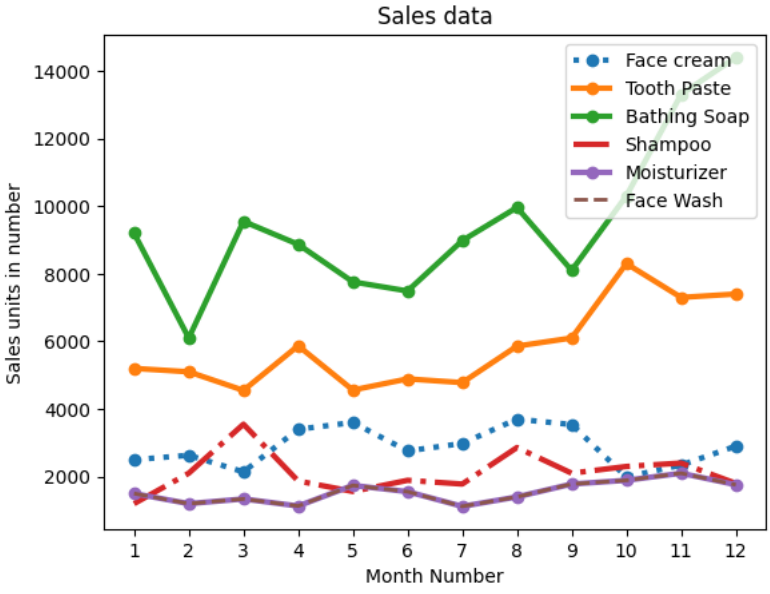
```
plt.pie(values,labels=labels,autopct='%0.1f%%',explode=[0,0,0.1,0,0,0],shadow=True)
plt.title("Sales in March")
plt.show()
```



Problem–8 Multiline Plot of all products sales.

- Give different styes for each products
- Add legend at top right

```
# code here
monthList  = df['month_number'].tolist()

plt.plot(monthList, df['facecream'],   label = 'Face cream', linestyle='dotted', marker='o', linewidth=3)
plt.plot(monthList, df['toothpaste'], label = 'Tooth Paste', marker='o', linewidth=3)
plt.plot(monthList, df['bathingsoap'], label = 'Bathing Soap', marker='o', linewidth=3)
plt.plot(monthList, df['shampoo'], label = 'Shampoo', linestyle='dashdot', linewidth=3)
plt.plot(monthList, df['moisturizer'], label = 'Moisturizer', marker='o', linewidth=3)
plt.plot(monthList, df['facewash'],   label = 'Face Wash',  linestyle='dashed', linewidth=2)


plt.xlabel('Month Number')
plt.ylabel('Sales units in number')
plt.legend(loc='upper right')
plt.xticks(monthList)
plt.title('Sales data')
plt.show()
```

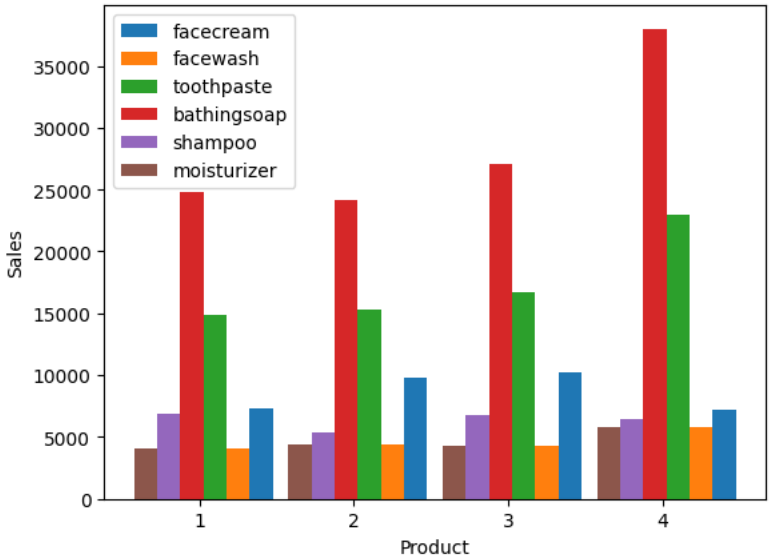


Problem–9 Show Quarter wise Sales data for all products as multi Bar chart.

```
# code here
df['date'] = pd.to_datetime(['2020-{}-01'.format(month) for month in df['month_number']])


final_df = df.groupby(df['date'].dt.quarter).sum()


final_df
```

date	month_number	facecream	facewash	toothpaste	bathingsoap	shampoo	moisturizer	total_units	total_profit
1	6	7270	4040	14850	24850	6850	4040	61900	619000
2	15	9760	4425	15320	24120	5320	4425	63370	633700
3	24	10220	4300	16740	27040	6740	4300	89090	890900
4	33	7230	5750	23000	38000	6500	5750	97970	979700

```
i = -1
for col in final_df.columns[1:7]:
  plt.bar(final_df.index + i,final_df[col],width=0.15,label=col)
  i = i - 0.15

plt.xticks(final_df.index-1.4,final_df.index)
plt.xlabel('Product')
plt.ylabel('Sales')
plt.legend()
plt.show()
```




```
final_df.iloc[:,1:7]
```

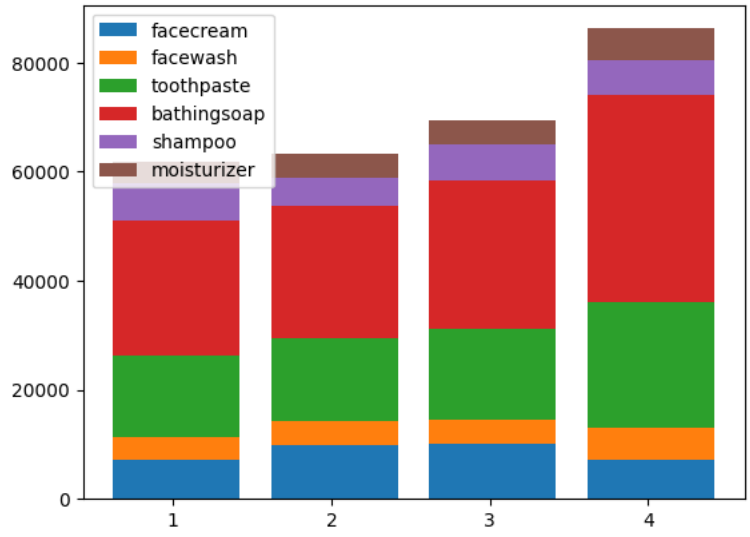
date	facecream	facewash	toothpaste	bathingsoap	shampoo	moisturizer
1	7270	4040	14850	24850	6850	4040
2	9760	4425	15320	24120	5320	4425
3	10220	4300	16740	27040	6740	4300
4	7230	5750	23000	38000	6500	5750

Problem-10 Plot Stacked Bar chart quarter wise for each product.

```
# code here
final_df
```

date	month_number	facecream	facewash	toothpaste	bathingsoap	shampoo	moisturizer	total_units	total_profit
1	6	7270	4040	14850	24850	6850	4040	61900	619000
2	15	9760	4425	15320	24120	5320	4425	63370	633700
3	24	10220	4300	16740	27040	6740	4300	89090	890900
4	33	7230	5750	23000	38000	6500	5750	97970	979700

```
all_cols = []

for col in final_df.columns[1:7]:
  if len(all_cols) == 0:
    plt.bar(final_df.index,final_df[col],label=col)
  else:
    plt.bar(final_df.index,final_df[col],bottom=sum(all_cols),label=col)
  all_cols.append(final_df[col])

plt.xticks(final_df.index - 0.02, final_df.index)
plt.legend()
plt.show()
```




```
sum(all_cols)
```

```
date
1    61900
2    63370
3    69340
4    86230
dtype: int64
```