In [1]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import datetime as dt
import matplotlib.ticker as mtick
import numpy as np
```

In [2]:
```
df=pd.read_excel(r"C:\Users\berid\OneDrive\Desktop\mydata\Car Sales.xlsx")
```

In [3]:
```
pd.set_option("display.max_columns",100)
df.columns=df.columns.str.strip().str.lower().str.replace(" |_","",regex=True)
```

In [4]:
```
df["date"]=pd.to_datetime(df["date"])
df["year"]=df["date"].dt.year
df["month"]=df["date"].dt.month_name()
df["monthnum"]=df["date"].dt.month
df["priceinthousands"]=df["priceinthousands"]*10**3
```

In [5]:
```
df
```

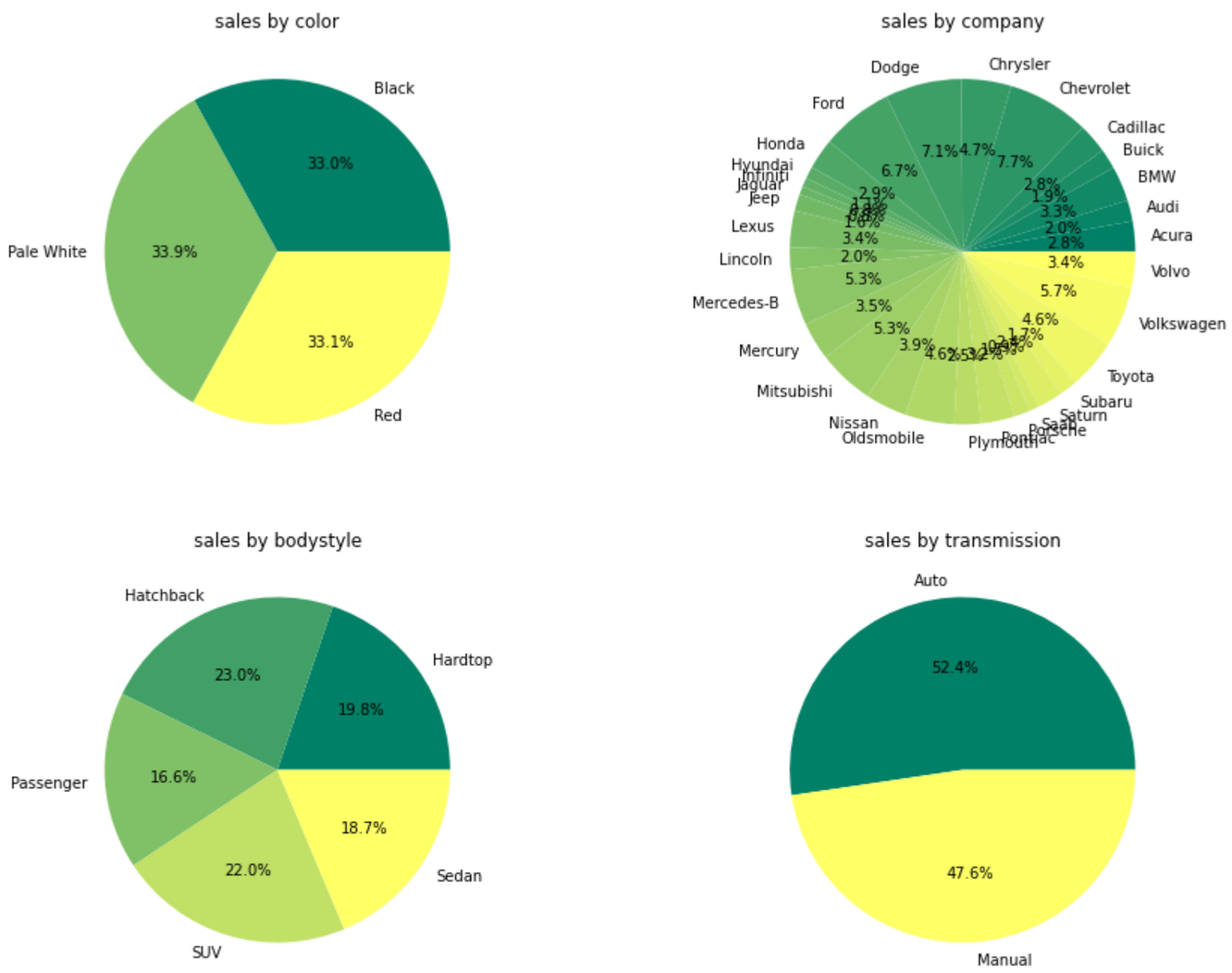
Out[5]:

	date	customername	dealername	company	model	year	bodystyle	engine	transmission	color	priceinthousands	dealeradd	customeraddress	councilarea	phone	gender	annualincome	dealerlc
0	2016-03-09	Geraldine	Buddy Storbeck's Diesel Service Inc	Ford	Expedition	2016	SUV	DoubleÂ Overhead Camshaft	Auto	Black	26000	44 Walnut St	68 Studley St	Yarra City Council	8264678	Male	13500	44 W
1	2016-03-12	Gia	C & M Motors Inc	Dodge	Durango	2016	SUV	DoubleÂ Overhead Camshaft	Auto	Black	19000	4333 Ogden Ave	85 Turner St	Yarra City Council	6848189	Male	1480000	4333
2	2016-04-02	Gianna	Capitol KIA	Cadillac	Eldorado	2016	Passenger	Overhead Camshaft	Manual	Red	31000	3 Green Tree Trl	25 Bloomburg St	Yarra City Council	7298798	Male	1035000	3 Gree
3	2016-04-02	Giselle	Chrysler of Tri-Cities	Toyota	Celica	2016	SUV	Overhead Camshaft	Manual	Pale White	14000	3203 W Marie St	18/659 Victoria St	Yarra City Council	6257557	Male	13500	3203 W
4	2017-04-03	Grace	Chrysler Plymouth	Acura	TL	2017	Hatchback	DoubleÂ Overhead Camshaft	Auto	Red	24000	6137 S Us-51	5 Charles St	Yarra City Council	7081483	Male	1465000	6137 S
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
34727	2018-02-24	Thomas	Chrysler Plymouth	Ford	Explorer	2018	Hatchback	DoubleÂ Overhead Camshaft	Auto	Pale White	18000	6942 E McDowell Rd	13 Burns St	Maribyrnong City Council	6905977	Male	1480000	6137 S
34728	2018-02-24	Amelie	Capitol KIA	Nissan	Quest	2018	SUV	Overhead Camshaft	Manual	Black	12000	8803 Research Blvd	29A Murray St	Maribyrnong City Council	6009564	Male	888000	3 Gree
34729	2018-02-24	Loan	Chrysler of Tri-Cities	Chevrolet	Corvette	2018	SUV	DoubleÂ Overhead Camshaft	Auto	Pale White	46000	347 Walnut St	147A Severn St	Maribyrnong City Council	8340959	Male	705000	3203 W
34730	2018-02-24	Romane	Chrysler Plymouth	Oldsmobile	Silhouette	2018	Sedan	Overhead Camshaft	Manual	Pale White	15000	4636 Ogden Ave	12/37 Stephen St	Maribyrnong City Council	6312272	Female	1140000	6137 S
34731	2018-02-24	Manon	Capitol KIA	Toyota	Celica	2018	SUV	Overhead Camshaft	Manual	Pale White	14000	306 Green Tree Trl	3 Tarrengower St	Maribyrnong City Council	6558902	Male	1020000	3 Gree

34732 rows × 22 columns

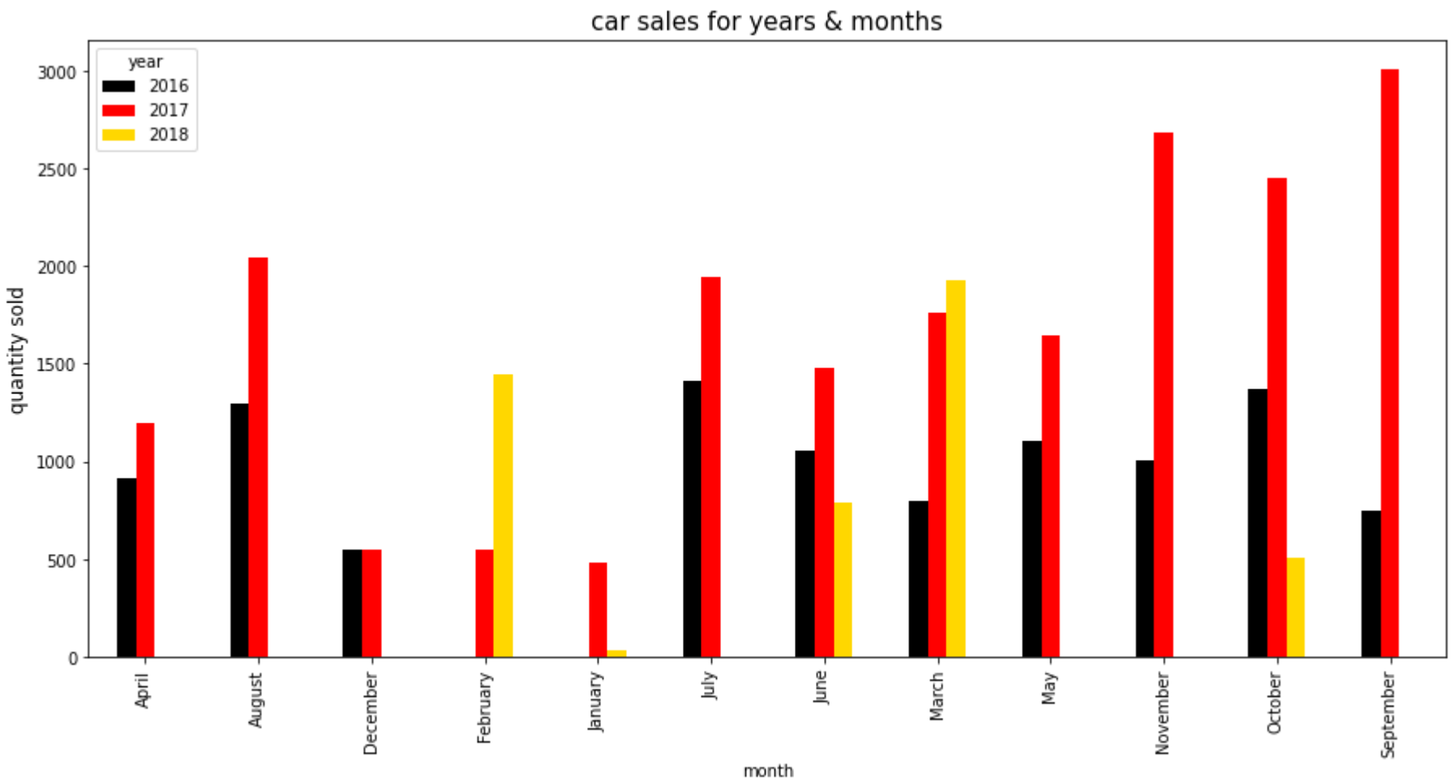
plot car sales by car color,company,car bodystyle,transmission,customer gender and dealerregion

In [6]:
```
fig,axes=plt.subplots(3,2,figsize=(15,18))
arguments=["color","company","bodystyle","transmission","gender","dealerregion"]
for ax,arg in zip(axes.ravel(),arguments):
    cmap = plt.get_cmap('summer')
    colors = list(cmap(np.linspace(0, 1, len(df[arg].unique()))))
    df.groupby(arg)["customername"].count().reset_index()\
    .plot(kind="pie",y="customername",labels=df.groupby(arg)["customername"].count().reset_index()[arg],\
          autopct="%1.1f%%",ax=ax,legend=False,ylabel="",title="sales by "+arg,colors=colors)
```



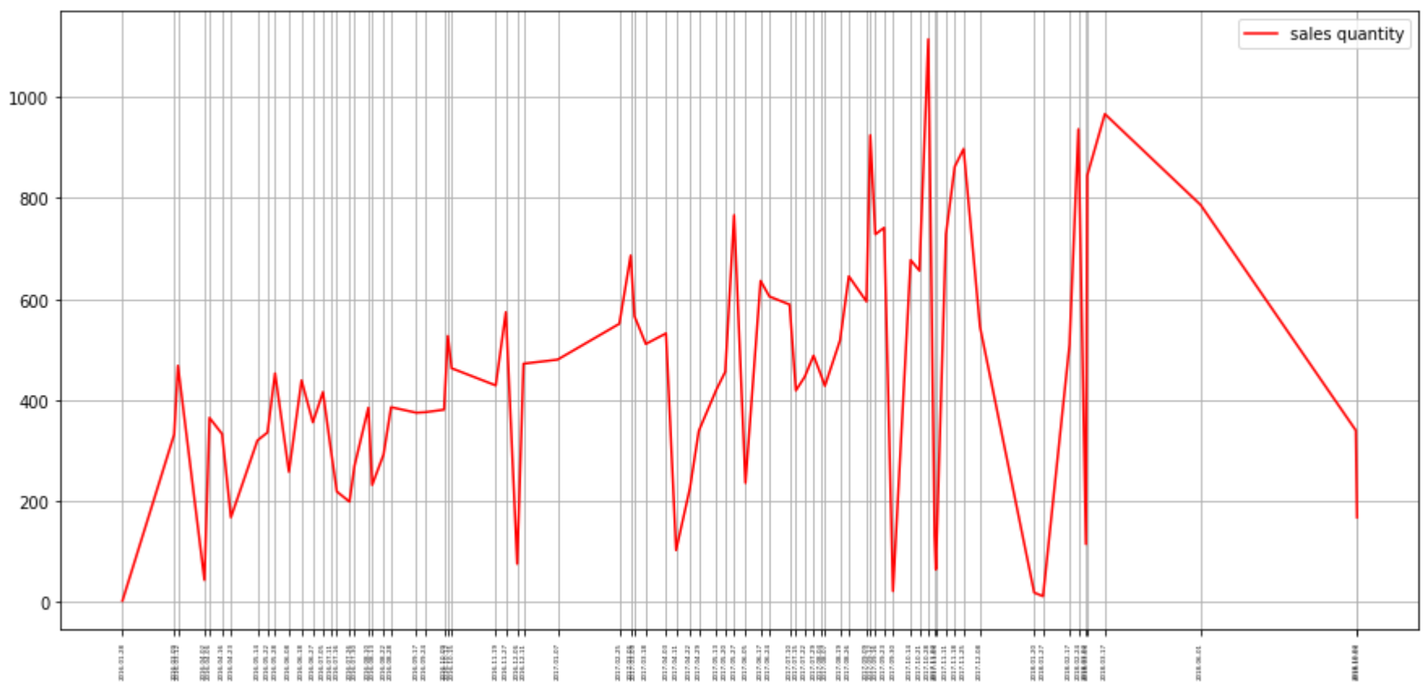
plot car sales by years and months

In [7]:
```
g=df.groupby(["year","month","monthnum"])["customername"].count().reset_index().sort_values(["year","monthnum"],ascending=[True,True])
g["year"]=g["year"].astype(str)
p=g.pivot("month","year","customername").reset_index()
#.merge(g,on="month").sort_values("monthnum").drop_duplicates(subset=["month"])
p.plot(kind="bar",x="month",y=["2016","2017","2018"],figsize=(15,7),color=["k","r","gold"])
plt.title("car sales for years & months",size=15)
plt.ylabel("quantity sold",size=12)
plt.show()
```



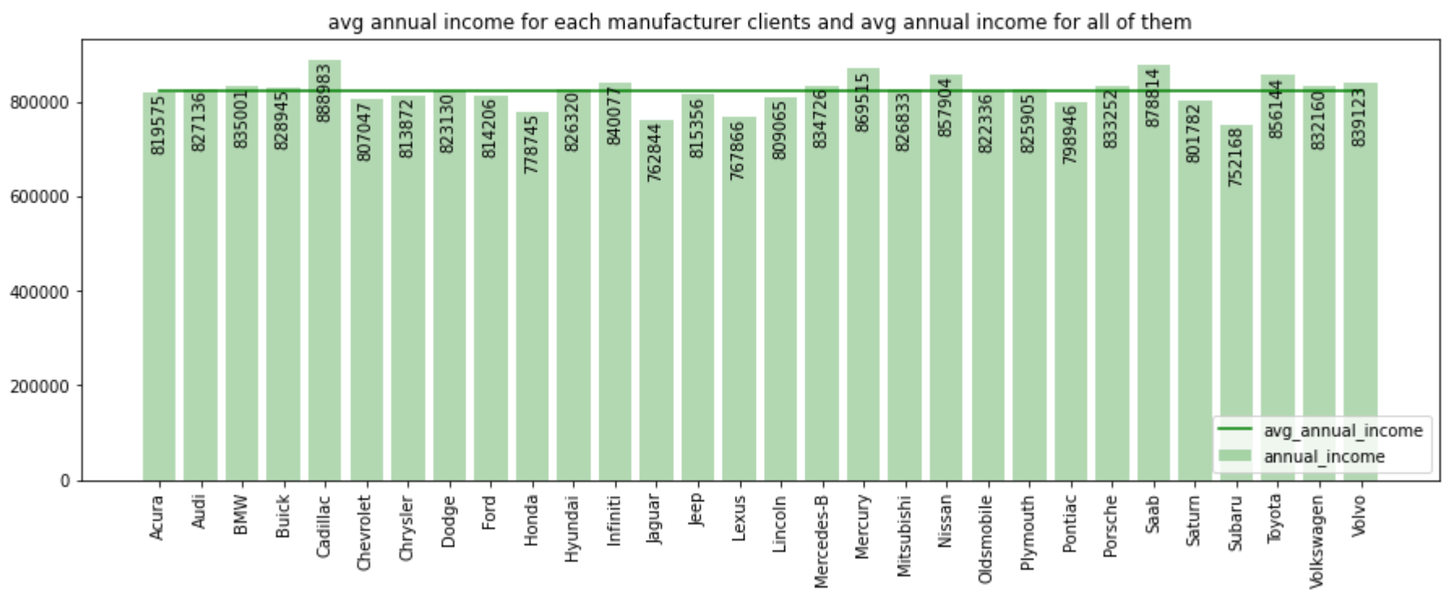
plot number of sales by date

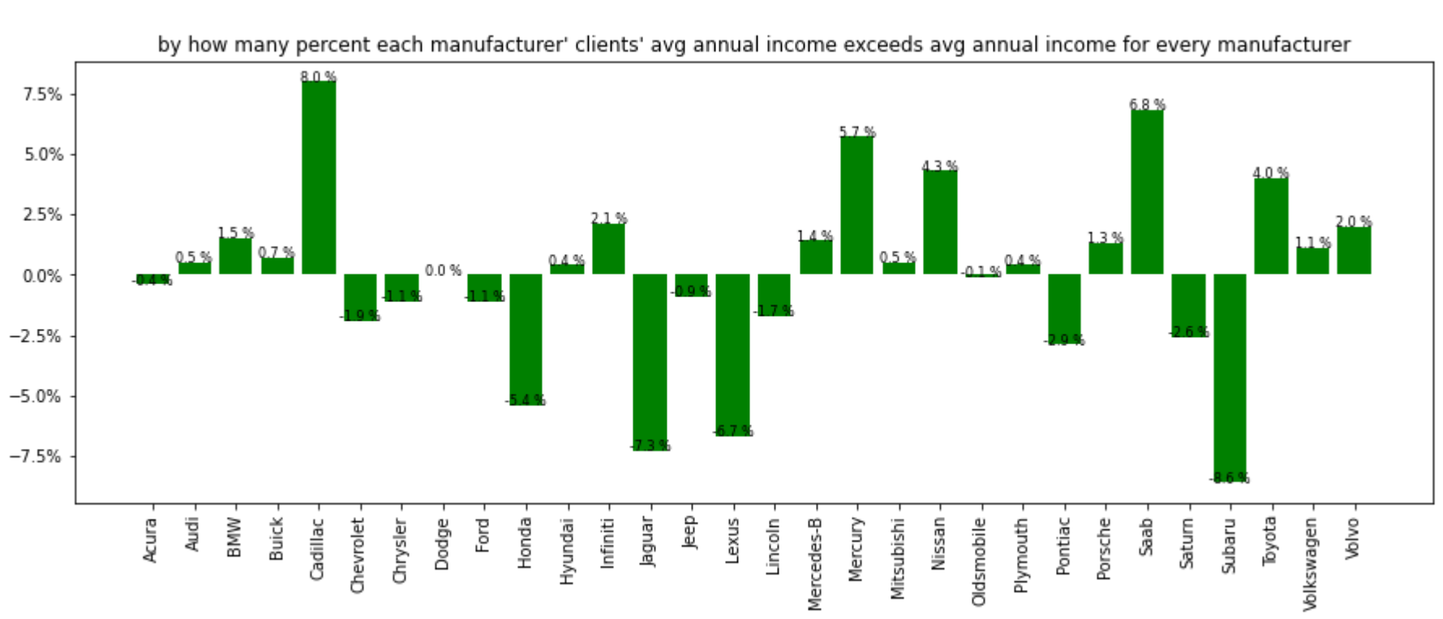
In [8]:
```
g=df.groupby("date")["customername"].count().reset_index().sort_values("date")
plt.figure(figsize=(15,7))
plt.plot(g.date,g.customername,c="r",label="sales quantity")
plt.xticks(g.date,rotation=90,size=4)
plt.grid(axis="both")
plt.legend()
plt.show()
```



plot clients avg annual income by car manufacturer and avg annual income for all car manufacturer(in a nutshell wich manufacturer has the richest clients)

In [9]:
```
g=df.groupby("company")["annualincome"].mean().reset_index()
g["avg"]=g.annualincome.mean()
g["vs_avg"]=(g.annualincome/g.avg*100-100).round(1)

plt.figure(figsize=(15,5))
plt.bar(g.company,g.annualincome,color="g",alpha=0.3,label="annual_income")
plt.plot(g.company,g["avg"],color="g",label="avg_annual_income")
plt.xticks(rotation=90)
plt.legend(loc="lower right")
plt.title("avg annual income for each manufacturer clients and avg annual income for all of them")

def value_label(x,y):
    for i in range(len(x)):
        plt.text(i,round(y[i]),round(y[i]),size=10,ha="center",va="top",rotation=90)

value_label(g.company,g.annualincome)
plt.show()

plt.figure(figsize=(15,5))
plt.bar(g.company,g.vs_avg,color="g")
plt.xticks(rotation=90)
plt.gca().yaxis.set_major_formatter(mtick.PercentFormatter(100))
plt.title("by how many percent each manufacturer' clients' avg annual income exceeds avg annual income for every manufacturer")
def value_label(x,y):
    for i in range(len(x)):
        plt.text(i,round(y[i],1),str(round(y[i],1))+" %",size=8,ha="center")
value_label(g.company,g.vs_avg)

plt.show()
```





How car sales increased compared to previous month in 2017. In each month by how many percent car sales

exceeded the average sales of 2017 .

In [12]:
```
g=df[df.year==2017].groupby(["monthnum","month"])["customername"].count().reset_index()
g["previous_year"]=g.customername.shift(1)
g["increase"]=((g.customername-g.previous_year)/g.previous_year*100).round()
g["avg"]=g.customername.mean()
g["percent_of_avg"]=((g.customername/g.avg-1)*100).round()
fig,ax=plt.subplots(1,2,figsize=(20,7))
plt.subplot(1,2,1)
plt.bar(g.month,g.increase,color="b",alpha=.75)
plt.title("increase of sales compared to previous month",size=15)
plt.xticks(rotation=90)
plt.gca().yaxis.set_major_formatter(mtick.PercentFormatter(100))
plt.subplot(1,2,2)
plt.bar(g.month,g.percent_of_avg,color="g",alpha=0.75)
plt.xticks(rotation=90)
plt.title("monthly sales compared to average monthly sales",size=15)
plt.gca().yaxis.set_major_formatter(mtick.PercentFormatter(100))
plt.show()
```