Drink Dataset

Data Resource : https://github.com/fivethirtyeight/data/blob/master/alcohol-consumption/drinks.csv (https://github.com/fivethirtyeight/data/blob/master/alcohol-consumption/drinks.csv)

Story Behind : https://fivethirtyeight.com/features/dear-mona-followup-where-do-people-drink-the-most-beer-wine-and-spirits/ (https://fivethirtyeight.com/features/dear-mona-followup-where-do-people-drink-the-most-beer-wine-and-spirits/)

In [1]:

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

In [2]:

```
from sklearn.linear_model import LinearRegression
from sklearn.model_selection import train_test_split
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler,PolynomialFeatures
from sklearn.linear_model import Ridge
from sklearn.preprocessing import PolynomialFeatures
```

In [3]:

```
df= pd.read_csv('drinks.csv')
```

In [4]:

```
df.head()
```

Out[4]:

	country	beer_servings	spirit_servings	wine_servings	total_litres_of_pure_alcohol	continent
0	Afghanistan	0	0	0	0.0	Asia
1	Albania	89	132	54	4.9	Europe
2	Algeria	25	0	14	0.7	Africa
3	Andorra	245	138	312	12.4	Europe
4	Angola	217	57	45	5.9	Africa

In [5]:

```
df.dtypes
```

Out[5]:

```
country                          object
beer_servings                     int64
spirit_servings                   int64
wine_servings                     int64
total_litres_of_pure_alcohol    float64
continent                        object
dtype: object
```

Exploratory Data Analysis

In [6]:
```
df[['wine_servings','continent']].groupby('continent').sum()
```

Out[6]:

	wine_servings
continent	
Africa	862
Asia	399
Europe	6400
North America	564
Oceania	570
South America	749

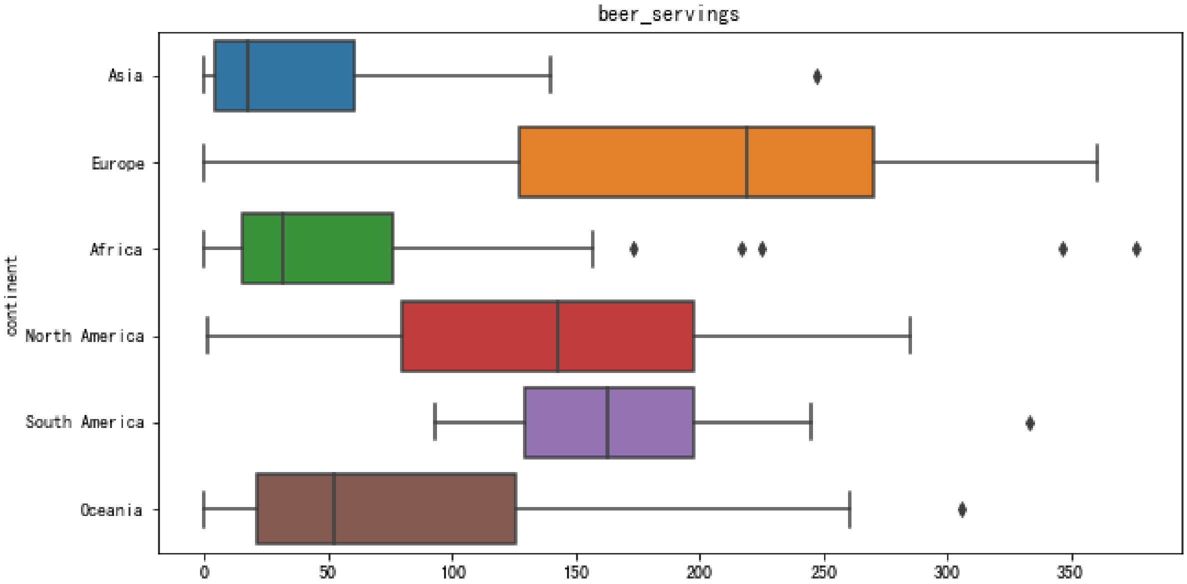
In [7]:
```
df[["beer_servings","continent"]].groupby(["continent"]).describe()
```

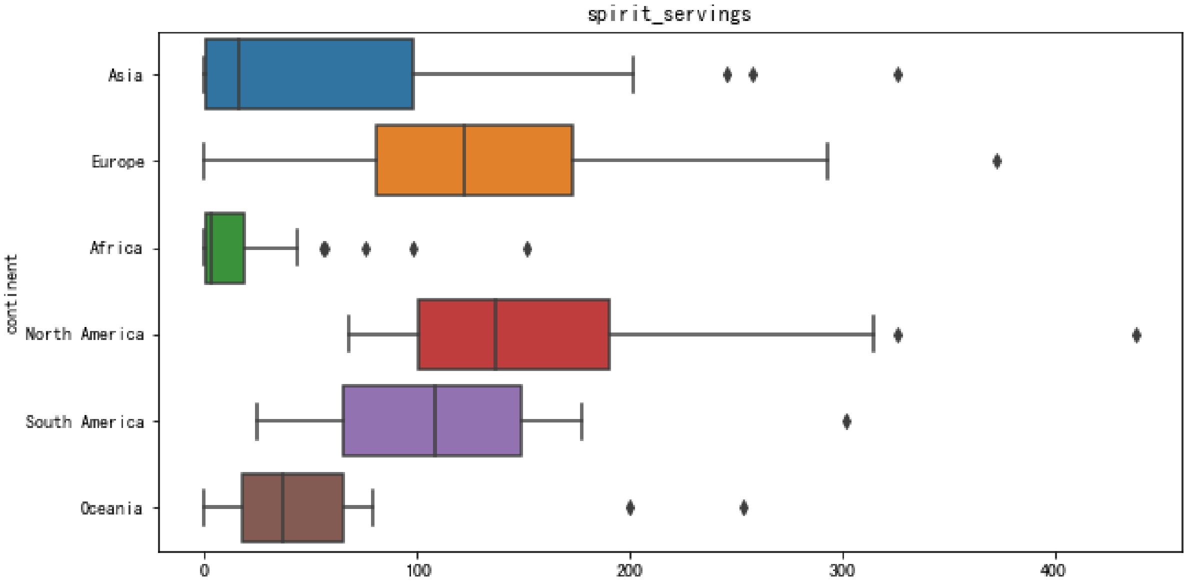
Out[7]:

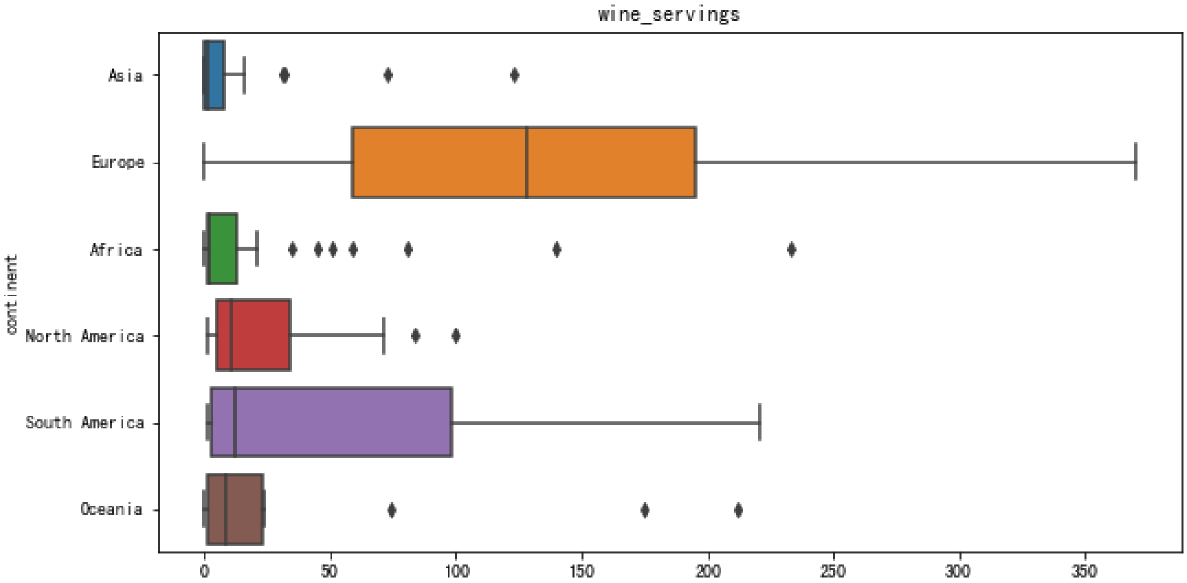
	beer_servings							
	count	**mean**	**std**	**min**	**25%**	**50%**	**75%**	**max**
continent								
Africa	53.0	61.471698	80.557816	0.0	15.00	32.0	76.00	376.0
Asia	44.0	37.045455	49.469725	0.0	4.25	17.5	60.50	247.0
Europe	45.0	193.777778	99.631569	0.0	127.00	219.0	270.00	361.0
North America	23.0	145.434783	79.621163	1.0	80.00	143.0	198.00	285.0
Oceania	16.0	89.687500	96.641412	0.0	21.00	52.5	125.75	306.0
South America	12.0	175.083333	65.242845	93.0	129.50	162.5	198.00	333.0

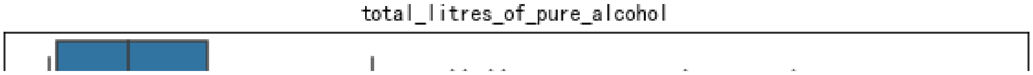
In [8]:

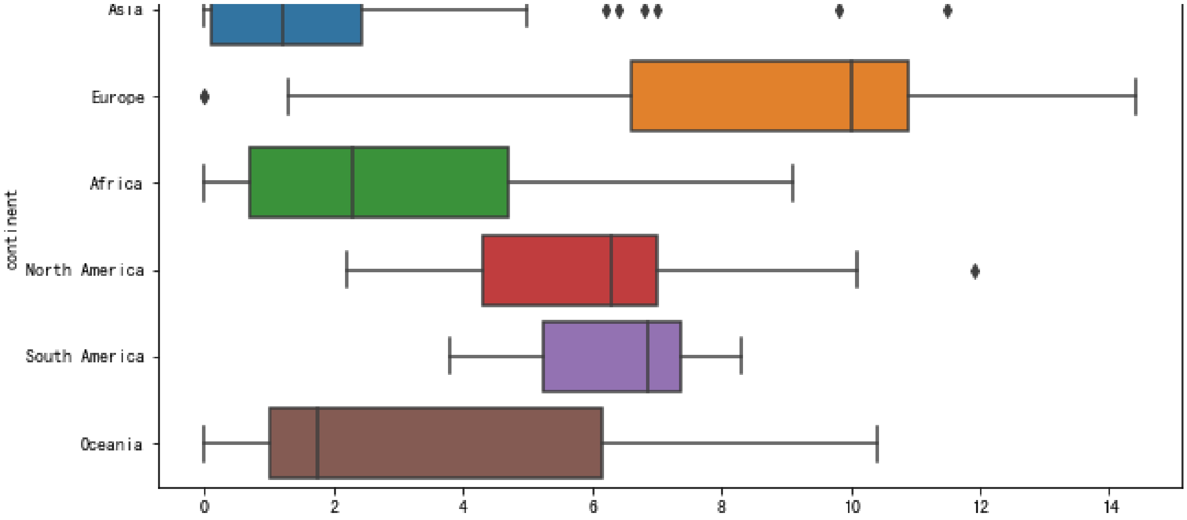
```
fig,  ax = plt.subplots(nrows=4, ncols=1, figsize=(10,24))

column = ['beer_servings','spirit_servings','wine_servings','total_litres_of_pure_alcohol']
category = [df[i].value_counts() for i in column]
r = 0
for j in range(4):

    axes = ax[j]

    sns.boxplot(x=column[r],y="continent",data=df,ax=axes)
    axes.set_xlabel('')
    axes.set_title(column[r])
    r+=1

plt.show()
```


beer_servings
continent
Asia
Europe
Africa
North America
South America
Oceania
0
50
100
150
200
250
300
350


spirit_servings
continent
Asia
Europe
Africa
North America
South America
Oceania
0
100
200
300
400

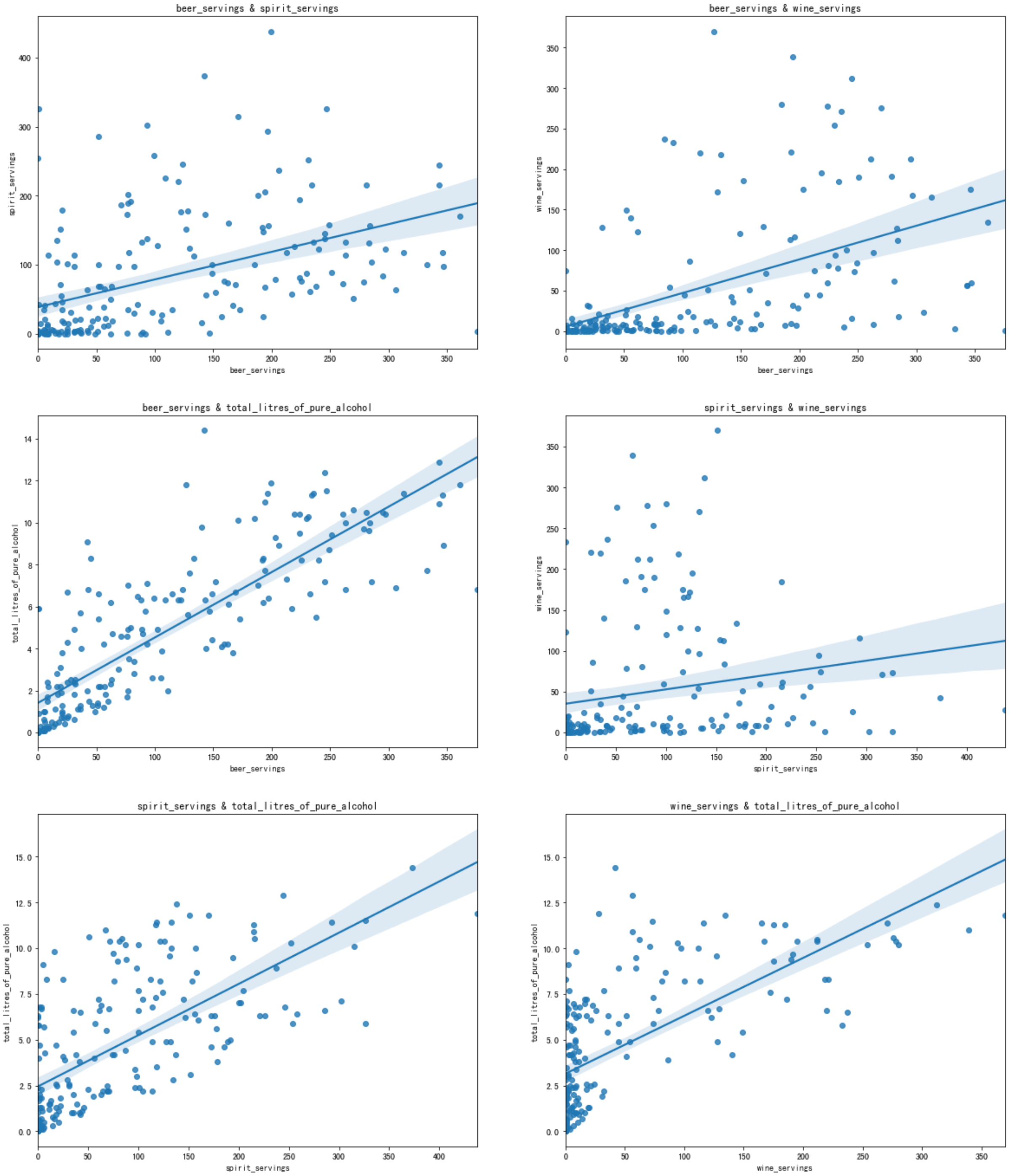

wine_servings
continent
Asia
Europe
Africa
North America
South America
Oceania
0
50
100
150
200
250
300
350


total_litres_of_pure_alcohol


Asia
Europe
Africa
North America
South America
Oceania
continent
0
2
4
6
8
10
12
14

In [9]:

```
fig,  ax = plt.subplots(nrows=3, ncols=2, figsize=(20,24))
column = ['beer_servings','spirit_servings','wine_servings','total_litres_of_pure_alcohol']
category = [df[i].value_counts() for i in column]
axe = [ax[i][j] for i in range(3) for j in range(2)]
r = 0

for i in range(3):
    for j in range(i+1,4):
        axes = axe[r]
        sns.regplot(x=column[i],y=column[j],data=df,ax=axes)
        axes.set_title(f'{column[i]} & {column[j]}')
        r+=1

plt.show()
```


beer_servings & spirit_servings
spirit_servings
beer_servings
0
100
200
300
400
0
50
100
150
200
250
300
350
beer_servings & wine_servings
wine_servings
beer_servings
0
50
100
150
200
250
300
350
beer_servings & total_litres_of_pure_alcohol
total_litres_of_pure_alcohol
beer_servings
0
2
4
6
8
10
12
14
spirit_servings & wine_servings
wine_servings
spirit_servings
400
spirit_servings & total_litres_of_pure_alcohol
total_litres_of_pure_alcohol
spirit_servings
0.0
2.5
5.0
7.5
10.0
12.5
15.0
wine_servings & total_litres_of_pure_alcohol
total_litres_of_pure_alcohol
wine_servings

Modeling

In [10]:

```
print('LinearRegression - Wine and Total')
print()
lm = LinearRegression()
x=df[['wine_servings']]
y=df[['total_litres_of_pure_alcohol']]
lm.fit(x,y)
lm.score(x,y)
print(f'Total = ({str(lm.coef_[0][0])[:6]} * Wine) + {str(lm.intercept_[0])[:6]}')
print('R^2 = ',lm.score(x,y))
```

```
LinearRegression - Wine and Total

Total = (0.0316 * Wine) + 3.1540
R^2 =  0.4456875459787605
```

In [11]:

```
print('LinearRegression - Beer and Total')
print()
lm = LinearRegression()
x=df[['beer_servings']]
y=df[['total_litres_of_pure_alcohol']]
lm.fit(x,y)
lm.score(x,y)
print(f'Total = ({str(lm.coef_[0][0])[:6]} * Beer) + {str(lm.intercept_[0])[:6]}')
print('R^2 = ',lm.score(x,y))
```

```
LinearRegression - Beer and Total

Total = (0.0311 * Beer) + 1.4067
R^2 =  0.6986262119487155
```

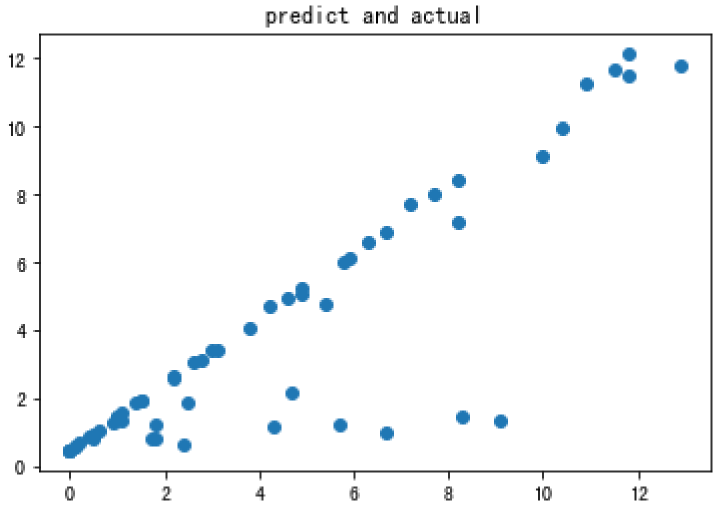
In [12]:

```
print('LinearRegression - Spirit and Total')
print()
lm = LinearRegression()
x=df[['spirit_servings']]
y=df[['total_litres_of_pure_alcohol']]
lm.fit(x,y)
lm.score(x,y)
print(f'Total = ({str(lm.coef_[0][0])[:6]} * Spirit) + {str(lm.intercept_[0])[:6]}')
print('R^2 = ',lm.score(x,y))
```

```
LinearRegression - Spirit and Total

Total = (0.0279 * Spirit) + 2.4497
R^2 =  0.4289833103726812
```

In [13]:
```
print('LinearRegression - Wine + Beer + Spirit and Total')
print()
Z=df[['wine_servings',"beer_servings", "spirit_servings" ]]
y=df[['total_litres_of_pure_alcohol']]

Z_train , Z_test , y_train, y_test = train_test_split(Z , y , test_size=
0.3, random_state=0)
lm1 = LinearRegression()
lm1.fit(Z_train , y_train)
print(f'Total = ({str(lm1.coef_[0][0])[:6]} * Wine) + ({str(lm1.coef_[0]
[1])[:6]} * Beer) + ({str(lm1.coef_[0][2])[:6]} * Spirit) + {str(lm1.int
ercept_[0])[:6]}')

print("R^2 = ",lm1.score(Z_test , y_test))

lm1.predict(Z_test)
plt.scatter(y_test,lm1.predict(Z_test))
plt.title('predict and actual')
plt.show()
```

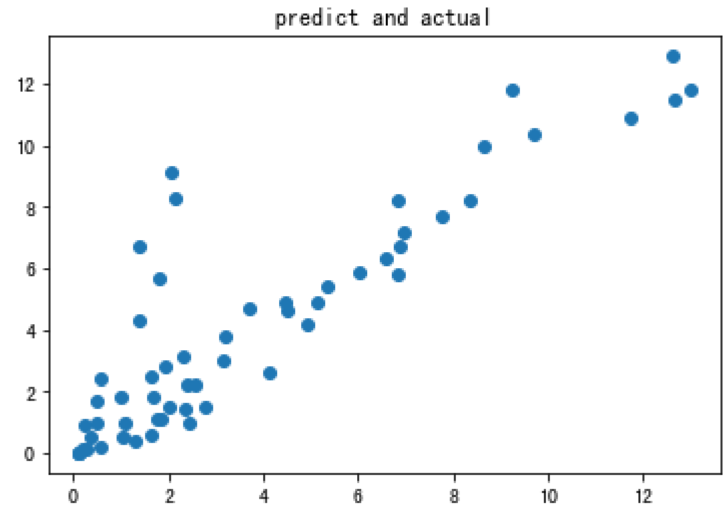
```
LinearRegression - Wine + Beer + Spirit and Total

Total = (0.0165 * Wine) + (0.0181 * Beer) + (0.0169 * Spirit) + 0.4779
R^2 =  0.7549608066333018
```



In [14]:

```
print('PipeLine - Standard , Polynomial(degree=3) , LinearRegression')
print()
Input = [('scale',StandardScaler()), ('polynomial', PolynomialFeatures(degree=3, include_bias=False)), ('model',LinearRegression())]
pipe = Pipeline(Input)

pipe.fit(Z_train,y_train)
print("R^2 = ",pipe.score(Z_test,y_test))
plt.scatter(pipe.predict(Z_test),y_test)
plt.title('predict and actual')
plt.show()
```

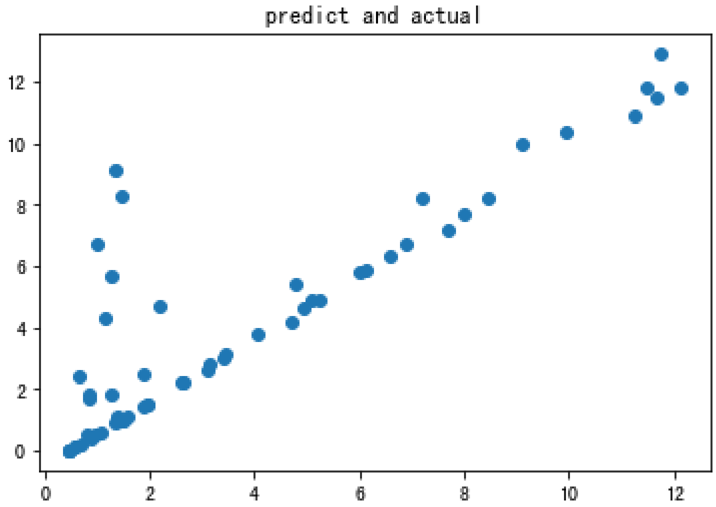
```
PipeLine - Standard , Polynomial(degree=3) , LinearRegression

R^2 =  0.7746820927843575
```



In [15]:

```
print('RidgeModel - alpha(0.1)')
print()
RidgeModel=Ridge(alpha=0.1)
RidgeModel.fit(Z_train,y_train)
print("R^2 = ",RidgeModel.score(Z_test,y_test))
print(f'Total = ({str(RidgeModel.coef_[0][0])[:6]} * Wine) + ({str(RidgeModel.coef_[0][1])[:6]} * Beer) + ({str(RidgeModel.coef_[0][2])[:6]} * Spirit) + {str(RidgeModel.intercept_[0])[:6]}')
plt.scatter(RidgeModel.predict(Z_test),y_test)
plt.title('predict and actual')
plt.show()


#Ridge(alpha=X) alpha越大懲罰越大
```

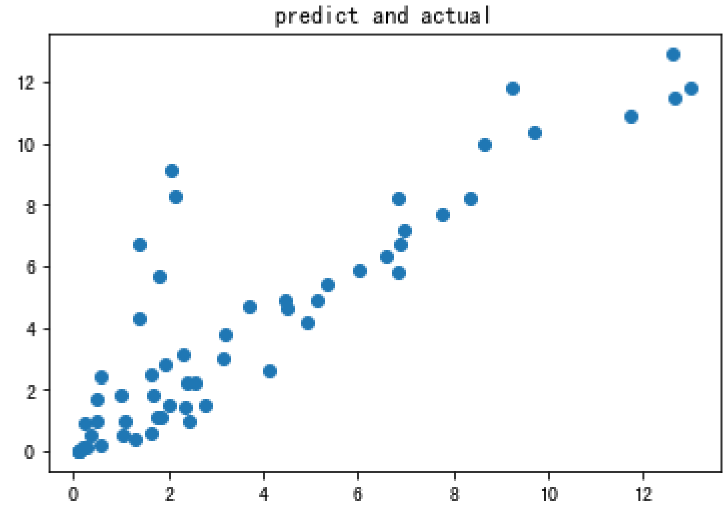
```
RidgeModel - alpha(0.1)

R^2 =  0.7549608184502712
Total = (0.0165 * Wine) + (0.0181 * Beer) + (0.0169 * Spirit) + 0.4779
```



In [16]:

```
print('Polynomial(degree=3) + RidgeModel - alpha(0.1) ')
print()
pr=PolynomialFeatures(degree=3)
Z_train_pr=pr.fit_transform(Z_train)
Z_test_pr=pr.fit_transform(Z_test)

RidgeModel=Ridge(alpha=0.2)
RidgeModel.fit(Z_train_pr,y_train)
print("R^2 = ",RidgeModel.score(Z_test_pr,y_test))

plt.scatter(RidgeModel.predict(Z_test_pr),y_test)
plt.title('predict and actual')
plt.show()
```

```
Polynomial(degree=3) + RidgeModel - alpha(0.1)

R^2 =  0.7746824248087052

/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
ckages/sklearn/linear_model/_ridge.py:147: LinAlgWarning: Ill-condition
ed matrix (rcond=6.84e-18): result may not be accurate.
  return linalg.solve(A, Xy, sym_pos=True,
```


predict and actual