Wine Reviews 数据集

该数据集有129971条数据，13个属性标签，分别为

country：产出国

description：描述

designation：葡萄酒名称

points：度数

price：价格

province：产出省

region_1：产出区域1

region_2：产出区域2

taster_name：品鉴师

taster_twitter_handle：品鉴师推特号

title：品鉴师所获荣誉

variety：品种

winery：酒厂

In [61]:

```
import os
import sys
import math
import pandas as pd
import numpy as np
import csv
import json
import pickle
import matplotlib.pyplot as plt
from scipy import stats
import statsmodels.api as sm
%matplotlib inline
```

In [4]:

```
wine1_data = pd.read_csv('.\data\Wine Reviews\winemag-data-130k-v2.csv',index_col = 0)
wine1_data.head()
```

Out[4]:

	country	description	designation	points	price	province	region_1	region_2	taster_name	taster_twitter_handle	title	variety	winery
0	Italy	Aromas include tropical fruit, broom, brimston...	Vulkà Bianco	87	NaN	Sicily & Sardinia	Etna	NaN	Kerin O’Keefe	@kerinokeefe	Nicosia 2013 Vulkà Bianco (Etna)	White Blend	Nicosia
1	Portugal	This is ripe and fruity, a wine that is smooth...	Avidagos	87	15.0	Douro	NaN	NaN	Roger Voss	@vossroger	Quinta dos Avidagos 2011 Avidagos Red (Douro)	Portuguese Red	Quinta dos Avidagos
2	US	Tart and snappy, the flavors of lime flesh and...	NaN	87	14.0	Oregon	Willamette Valley	Willamette Valley	Paul Gregutt	@paulgwine	Rainstorm 2013 Pinot Gris (Willamette Valley)	Pinot Gris	Rainstorm
3	US	Pineapple rind, lemon pith and orange blossom ...	Reserve Late Harvest	87	13.0	Michigan	Lake Michigan Shore	NaN	Alexander Peartree	NaN	St. Julian 2013 Reserve Late Harvest Riesling ...	Riesling	St. Julian
4	US	Much like the regular bottling from 2012, this...	Vintner's Reserve Wild Child Block	87	65.0	Oregon	Willamette Valley	Willamette Valley	Paul Gregutt	@paulgwine	Sweet Cheeks 2012 Vintner's Reserve Wild Child...	Pinot Noir	Sweet Cheeks

In [15]:

```
wine1_data.shape
```

Out[15]:

```
(129971, 13)
```

In [14]:

```
cols = list(wine1_data)
cols
```

Out[14]:

```
['country',
 'description',
 'designation',
 'points',
 'price',
 'province',
 'region_1',
 'region_2',
 'taster_name',
 'taster_twitter_handle',
 'title',
 'variety',
 'winery']
```

数据摘要

对标称数据计算频数

标称属性包括：'country' , 'designation', 'province', 'region_1', 'region_2', 'taster_name' , 'taster_twitter_handle', 'variety', 'winery',分别计算它们的频数

In [25]:

```
nominal_attribute = ['country','designation','province','region_1','region_2','taster_name','taster_twitter_handle','variety','winery
for tmp in nominal_attribute:
    print(wine1_data[tmp].value_counts())
    print('-' * 60)
```

```
US                        54504
France                    22093
Italy                     19540
Spain                      6645
Portugal                   5691
Chile                      4472
Argentina                  3800
Austria                    3345
Australia                  2329
Germany                    2165
New Zealand                1419
```

```
South Africa              1401
Israel                     505
Greece                     466
Canada                     257
Hungary                    146
Bulgaria                   141
Romania                    120
Uruguay                    109
Turkey                      90
Slovenia                    87
Georgia                     86
England                     74
Croatia                     73
Mexico                      70
Moldova                     59
Brazil                      52
Lebanon                     35
Morocco                     28
Peru                        16
Ukraine                     14
Macedonia                   12
Serbia                      12
Czech Republic              12
Cyprus                      11
India                        9
Switzerland                  7
Luxembourg                   6
Bosnia and Herzegovina       2
Armenia                      2
Egypt                        1
Slovakia                     1
China                        1
Name: country, dtype: int64
------------------------------------------------------------
Reserve                               2009
Estate                                1322
Reserva                               1259
Riserva                                698
Estate Grown                           621
                                      ... 
Private Stash #10                        1
Ten Degrees Vineyard                     1
CLB Reserve                              1
Million Dollar Beach                     1
Faiv Brut Rosé Metodo Classico           1
Name: designation, Length: 37979, dtype: int64
------------------------------------------------------------
```

```
California            36247
Washington             8639
Bordeaux               5941
Tuscany                5897
Oregon                 5373
                      ...  
Pitsilia Mountains        1
Markopoulo                1
Elazığ-Diyarbakir         1
China                     1
Krk                       1
Name: province, Length: 425, dtype: int64
------------------------------------------------------------
Napa Valley             4480
Columbia Valley (WA)    4124
Russian River Valley    3091
California              2629
Paso Robles             2350
                        ... 
Cabernet de Saumur         1
Riverland                  1
Mâcon-Mancey               1
Jujuy                      1
Gippsland                  1
Name: region_1, Length: 1229, dtype: int64
------------------------------------------------------------
Central Coast        11065
Sonoma                9028
Columbia Valley       8103
Napa                  6814
Willamette Valley     3423
California Other      2663
Finger Lakes          1777
Sierra Foothills      1462
Napa-Sonoma           1169
Central Valley        1062
Southern Oregon        917
Oregon Other           727
Long Island            680
North Coast            584
Washington Other       534
South Coast            272
New York Other         231
Name: region_2, dtype: int64
------------------------------------------------------------
Roger Voss            25514
Michael Schachner     15134
```

```
Kerin O’Keefe         10776
Virginie Boone         9537
Paul Gregutt           9532
Matt Kettmann          6332
Joe Czerwinski         5147
Sean P. Sullivan       4966
Anna Lee C. Iijima     4415
Jim Gordon             4177
Anne Krebiehl  MW      3685
Lauren Buzzeo          1835
Susan Kostrzewa        1085
Mike DeSimone           514
Jeff Jenssen            491
Alexander Peartree      415
Carrie Dykes            139
Fiona Adams              27
Christina Pickard         6
Name: taster_name, dtype: int64
------------------------------------------------------------
@vossroger          25514
@wineschach         15134
@kerinokeefe        10776
@vboone              9537
@paulgwine           9532
@mattkettmann        6332
@JoeCz               5147
@wawinereport        4966
@gordone_cellars     4177
@AnneInVino          3685
@laurbuzz            1835
@suskostrzewa        1085
@worldwineguys       1005
@bkfiona               27
@winewchristina         6
Name: taster_twitter_handle, dtype: int64
------------------------------------------------------------
Pinot Noir                  13272
Chardonnay                  11753
Cabernet Sauvignon           9472
Red Blend                    8946
Bordeaux-style Red Blend     6915
                            ...  
Moschofilero-Chardonnay         1
Francisa                        1
Sercial                         1
Ondenc                          1
Merlot-Argaman                  1
```

```
Name: variety, Length: 707, dtype: int64
------------------------------------------------------------
Wines & Winemakers           222
Testarossa                   218
DFJ Vinhos                   215
Williams Selyem              211
Louis Latour                 199
                            ...
Château La Croix Lartigue      1
Geode                          1
Patrick M. Paul                1
Heredad Soliterra              1
Once Upon a Vine               1
Name: winery, Length: 16757, dtype: int64
------------------------------------------------------------
```

- 从数据中发现，美国为最大产出国
- California是最大的产出州
- 名字为Roger Voss的品鉴师，品鉴次数最多，他的推特号为@vossroger
- Pinot Noir种类最多

对数值数据计算五数概括以及缺失值

In [27]:

```
number_data = ['points','price']
wine1_data[number_data].describe()
```

Out[27]:

	points	price
count	129971.000000	120975.000000
mean	88.447138	35.363389
std	3.039730	41.022218
min	80.000000	4.000000
25%	86.000000	17.000000
50%	88.000000	25.000000
75%	91.000000	42.000000
max	100.000000	3300.000000

In [41]:
```
wine1_data.isnull()[number_data].sum()
```

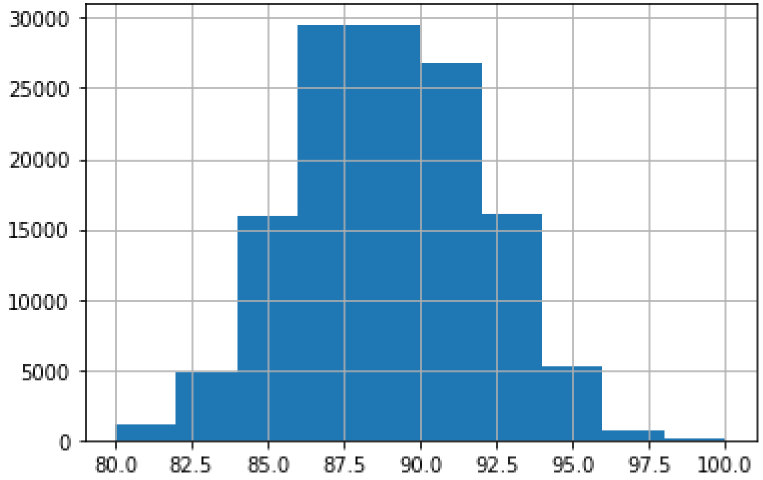
Out[41]:
```
points       0
price     8996
dtype: int64
```

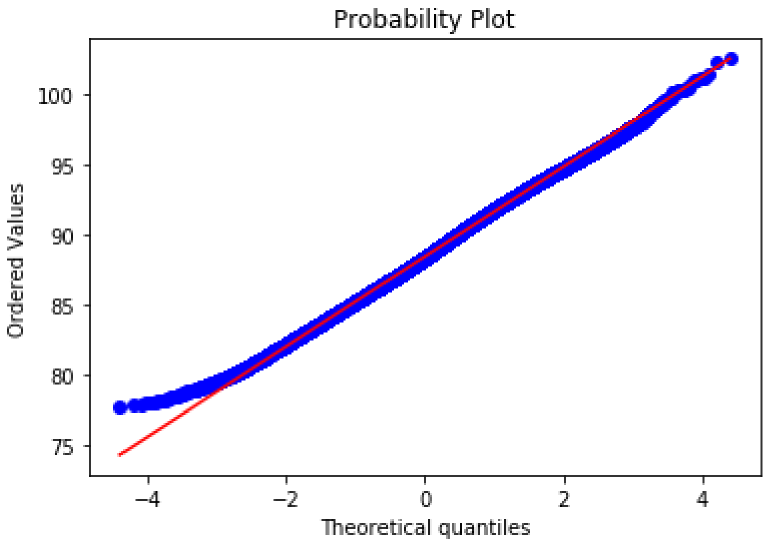
数值数据包括'point' 和 'price'

- point：最大100、最小80、Q1值86、中位数88、Q3值91，缺失值个数为0
- price：最大3300、最小4、Q1值17、中位数25、Q3值42，缺失值个数为0

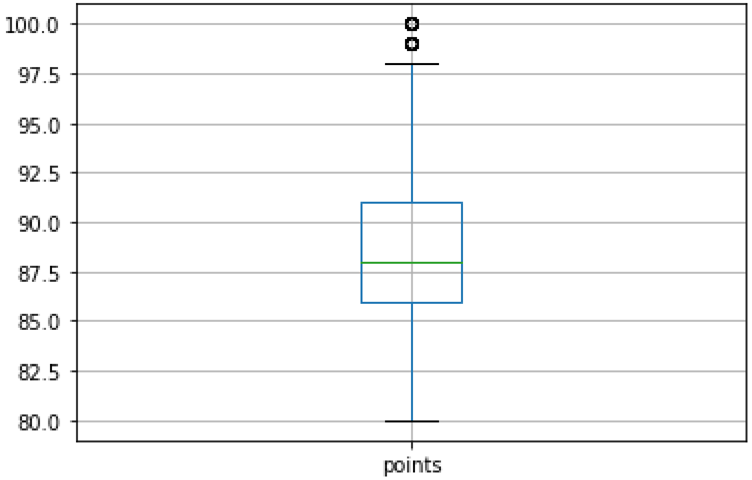
数据可视化

In [10…
```
wine1_data['points'].hist()

points = wine1_data['points'].dropna()
points = points.apply(lambda x: x + np.random.normal())

fig = plt.figure()
res = stats.probplot(points, plot=plt)
plt.show()

wine1_data.boxplot(column=['points'])
```





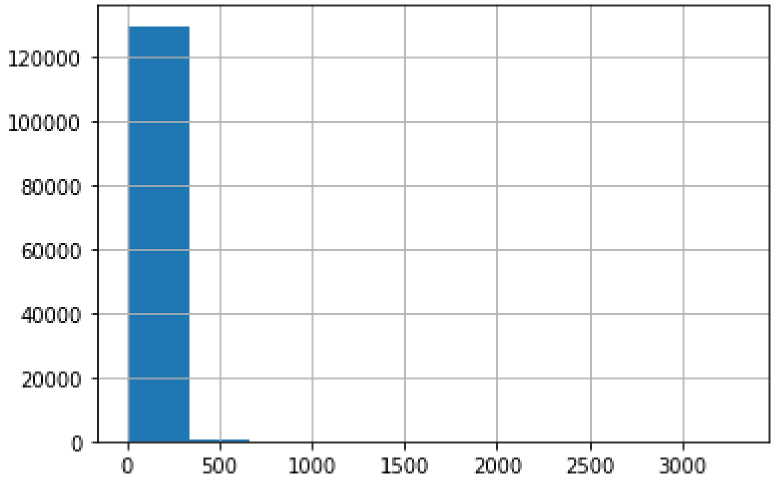
```
Out[105]: <matplotlib.axes._subplots.AxesSubplot at 0x25823452048>
```

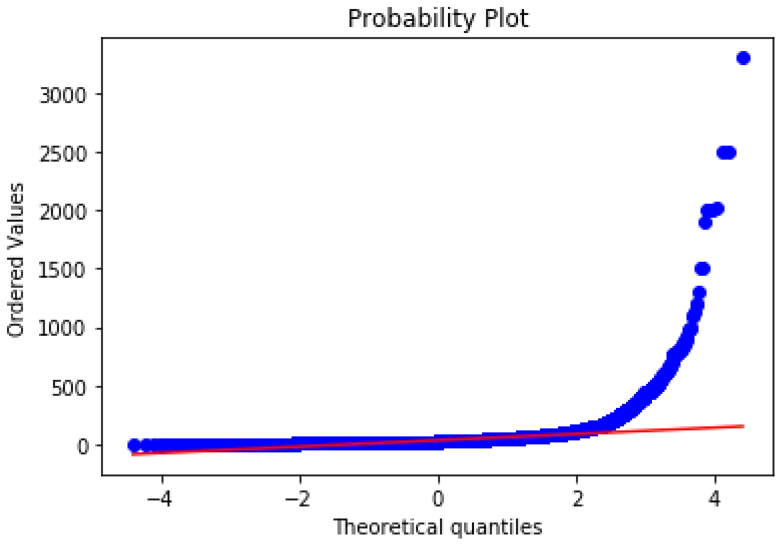


我们可以发现'points'数据符合正态分布

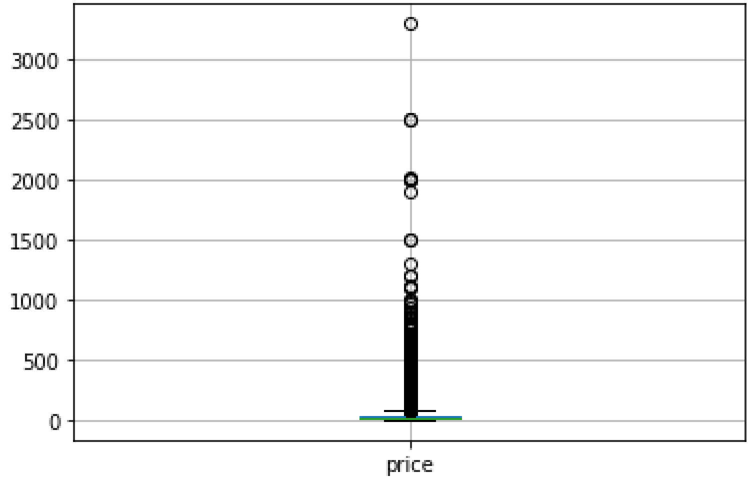
```
In [10…  wine1_data['price'].hist()

         price = wine1_data['price'].dropna()
         price = price.apply(lambda x: x + np.random.normal())

         fig = plt.figure()
```

```
res = stats.probplot(price, plot=plt)
plt.show()

wine1_data.boxplot(column=['price'])
```





```
Out[106]: <matplotlib.axes._subplots.AxesSubplot at 0x258234f9188>
```



'price' 数据符合正态分布，高价的酒较少，价格主要集中在中低价位

数据缺失的处理

In [43]:
```
wine1_data.isnull()[cols].sum()
```

Out[43]:
```
country                     63
description                  0
designation              37465
points                       0
price                     8996
province                    63
region_1                 21247
region_2                 79460
taster_name              26244
taster_twitter_handle    31213
title                        0
variety                      1
winery                       0
dtype: int64
```

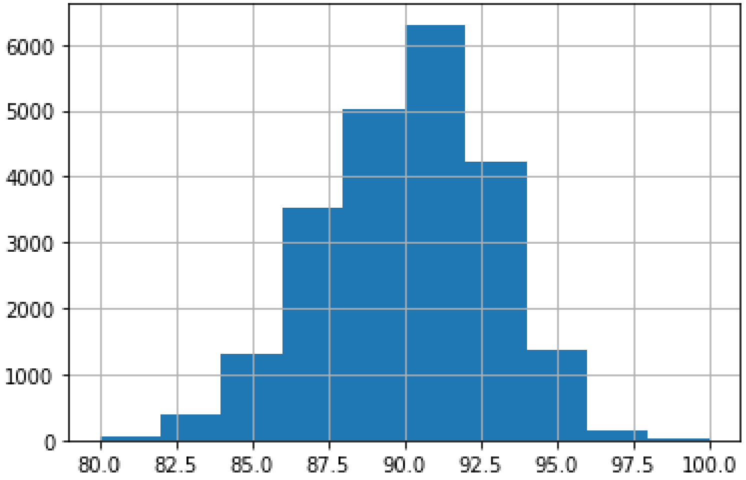
- 对于country和province的缺失，可能无法确定该葡萄酒的产出国
- taster_name缺失可能说明该葡萄酒没有品酒师去品鉴
- taster_twitter_handle缺失说明品酒师没有获得任何荣誉称号

将缺失部分剔除

```
In  [44]:  delete_wine1 = wine1_data.dropna()
```

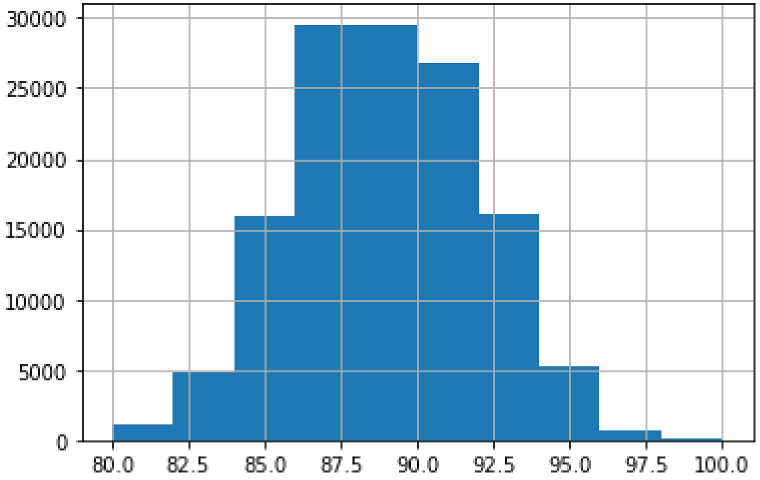
```
In  [47]:  delete_wine1['points'].hist()
```

```
Out[47]:  <matplotlib.axes._subplots.AxesSubplot at 0x2581ae56208>
```



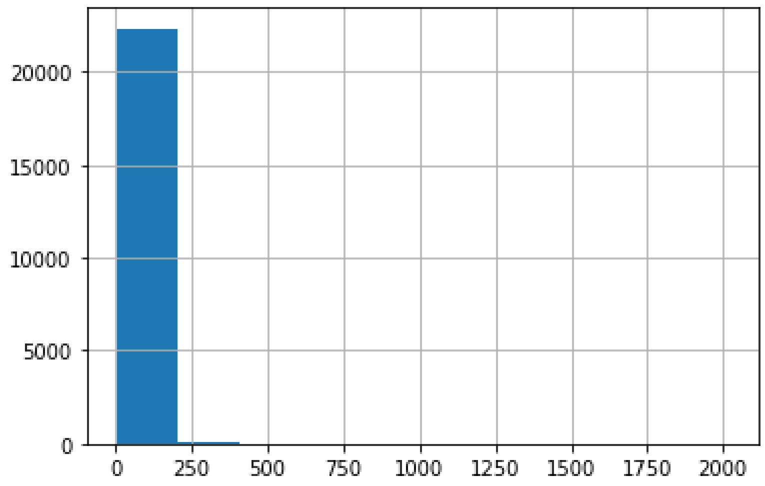
```
In  [48]:  wine1_data['points'].hist()
```

```
Out[48]:  <matplotlib.axes._subplots.AxesSubplot at 0x2581ae95388>
```



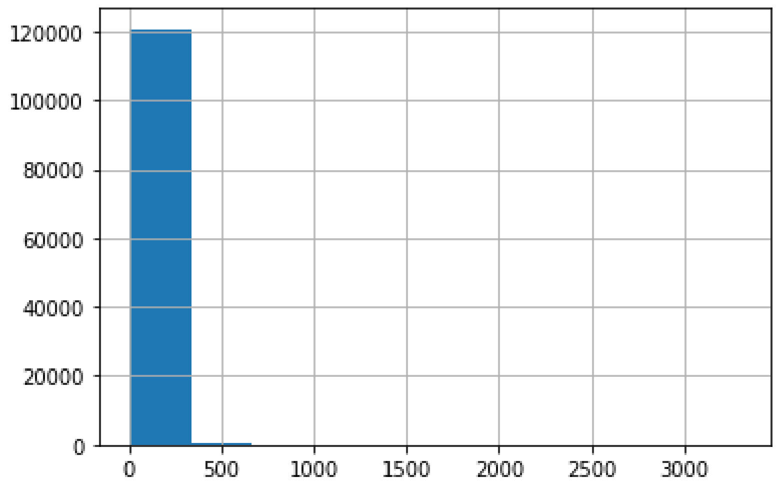
```
In [49]: delete_wine1['price'].hist()
```

```
Out[49]: <matplotlib.axes._subplots.AxesSubplot at 0x2581af9f048>
```



```
In [50]: wine1_data['price'].hist()
```

```
Out[50]: <matplotlib.axes._subplots.AxesSubplot at 0x2581afc9188>
```



剔除缺失值后，prices的分布没有太多改变

用最高频率值来填补缺失值

In [52]:

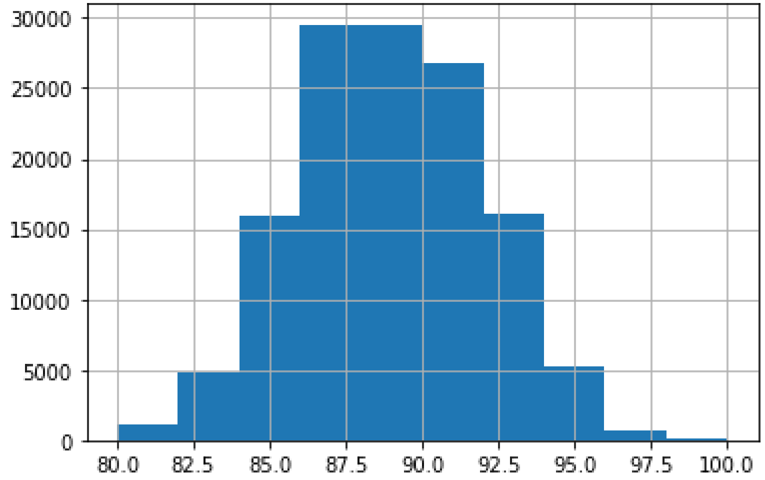
```
fill_max = wine1_data.fillna({'points': wine1_data['points'].mode().item(), 'price': wine1_data['price'].mode().item()})
```

In [53]:

```
fill_max['points'].hist()
```

Out[53]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x2581bc8f448>
```

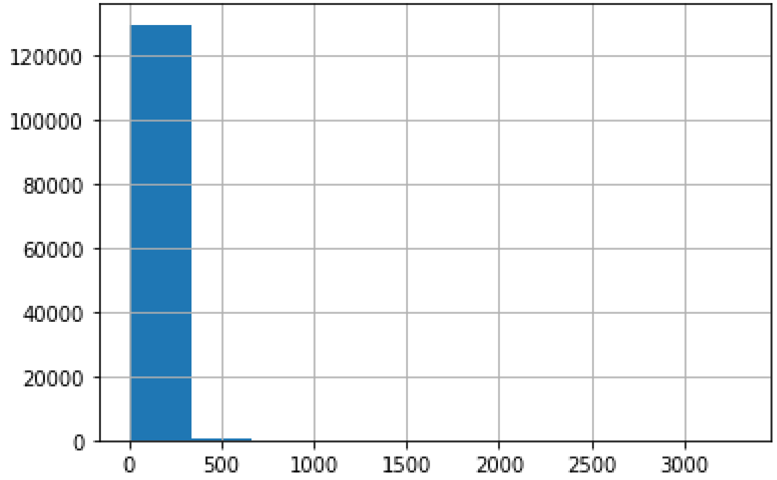


In [54]:

```
fill_max['price'].hist()
```

Out[54]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x2581bd85948>
```



通过属性的相关关系来填补缺失值

首先计算属性之间的相关系数

In [59]:

```
x = wine1_data.corr()
print(x)
```

```
          points     price
points  1.000000  0.416167
price   0.416167  1.000000
```

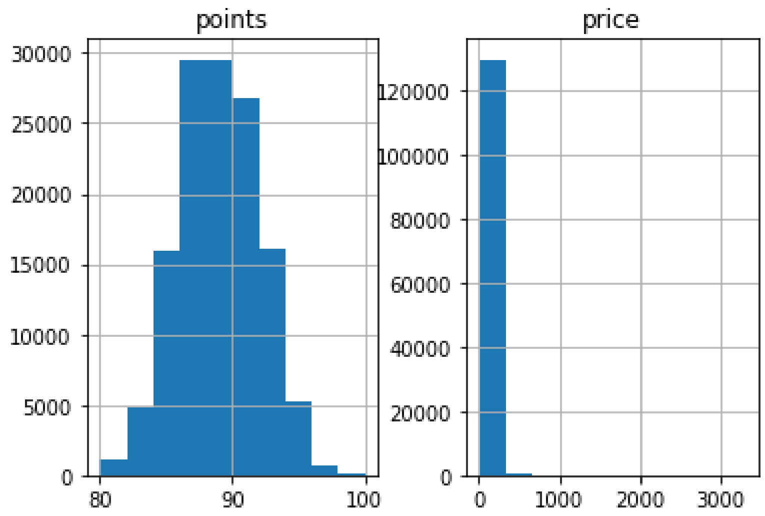
只有price和points为数值属性，虽然相关性为中，但是points没有缺失数据，可以根据已有的points和price数据，得到它们的回归方程，利用回归方程计算缺失值

In [10…

```
# 进行回归
points = wine1_data['points']
price = wine1_data['price']
model = sm.OLS(price,points).fit()
new_data = wine1_data
for i in range(len(new_data)):
    if(np.isnan(new_data['price'][i])):
        new_data.loc[i,'price'] = model.predict(new_data['points'][i])
number_data = ['points','price']
new_data.hist()
```

Out[108]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x00000258234C2888>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x0000025823CD6F48>]],
      dtype=object)
```



```
In  [10⋯  new_data[number_data].describe()
```

```
Out[109]:
                points          price
count    129971.000000  129970.000000
 mean        88.447138      35.447080
  std         3.039730      41.080914
  min        80.000000       4.000000
  25%        86.000000      17.000000
  50%        88.000000      25.000000
  75%        91.000000      42.000000
  max       100.000000    3300.000000
```

填充后，price只有均值和标准差发生变化，均值减小。

通过数据对象之间的相似性来填补缺失值

根据对象之间ponits的相似性，填充缺失的price

In [ ]:

```
df_sim = wine1_data[['price','points']]
p = {}
for row in df_sim.iterrows():
    if p.get(row[1]['points'], None):
        if not np.isnan(row[1]['price']):
            p[row[1]['points']][0] += row[1]['price']
            p[row[1]['points']][1] += 1
    else:
        if not np.isnan(row[1]['price']):
            p[row[1]['points']] = [row[1]['price'], 1]
for k in p.keys():
    p[k][0] = round(p[k][0] / p[k][1], 4)
for i in range(len(df_sim['price'])):
    if (np.isnan(df_sim['price'][i])):
        da = p[df_sim.loc[i, 'points']][0]
        df_sim.loc[i, 'price']  = da
```

In [10…

```
number_data = ['points','price']
df_sim[number_data].describe()
```

Out[104]:

	points	price
count	129971.000000	129971.000000
mean	88.447138	35.446999
std	3.039730	41.080766
min	80.000000	4.000000
25%	86.000000	17.000000
50%	88.000000	25.000000
75%	91.000000	42.000000
max	100.000000	3300.000000

填充后，price只有均值和标准差发生变化，均值增大。