Untitled

October 11, 2020

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
import sys
import os
```

[2]:
```
DF = pd.read_table('toefl.csv', header=0, sep=',')
DF
```

[2]:
```
     id  gender  listen  grammar  reading
0     1  FEMALE      40       50       56
1     2  FEMALE      33       44       46
2     3    MALE      39       44       47
3     4  FEMALE      44       55       66
4     5    MALE      43       56       53
..   …      …       …        …        …
95   96  FEMALE      43       48       56
96   97    MALE      50       54       60
97   98    MALE      55       50       67
98   99  FEMALE      53       61       66
99  100    MALE      43       44       43

[100 rows x 5 columns]
```

[3]:
```
DF.dtypes
```

[3]:
```
id          int64
gender     object
listen      int64
grammar     int64
reading     int64
dtype: object
```

[4]:
```
DF['gender'] = DF.gender.astype('category')
```

```
[5]: DF.dtypes
```

```
[5]: id             int64
     gender      category
     listen         int64
     grammar        int64
     reading        int64
     dtype: object
```

```
[6]: DF['gender'].cat.reorder_categories(['MALE', 'FEMALE'], inplace=True)
```

```
[7]: DF['gendernum'] = DF['gender'].cat.codes
```

```
[8]: DF.head()
```

```
[8]:    id  gender  listen  grammar  reading  gendernum
     0   1  FEMALE      40       50       56          1
     1   2  FEMALE      33       44       46          1
     2   3    MALE      39       44       47          0
     3   4  FEMALE      44       55       66          1
     4   5    MALE      43       56       53          0
```

```
[9]: DF['grade'] = np.round((DF['listen'] + DF['grammar'] + DF['reading']) / 3 * 10,␣
      ↪0)
```

```
[10]: DF.head()
```

```
[10]:    id  gender  listen  grammar  reading  gendernum  grade
      0   1  FEMALE      40       50       56          1  487.0
      1   2  FEMALE      33       44       46          1  410.0
      2   3    MALE      39       44       47          0  433.0
      3   4  FEMALE      44       55       66          1  550.0
      4   5    MALE      43       56       53          0  507.0
```

```
[11]: DF['grade'].describe()
```

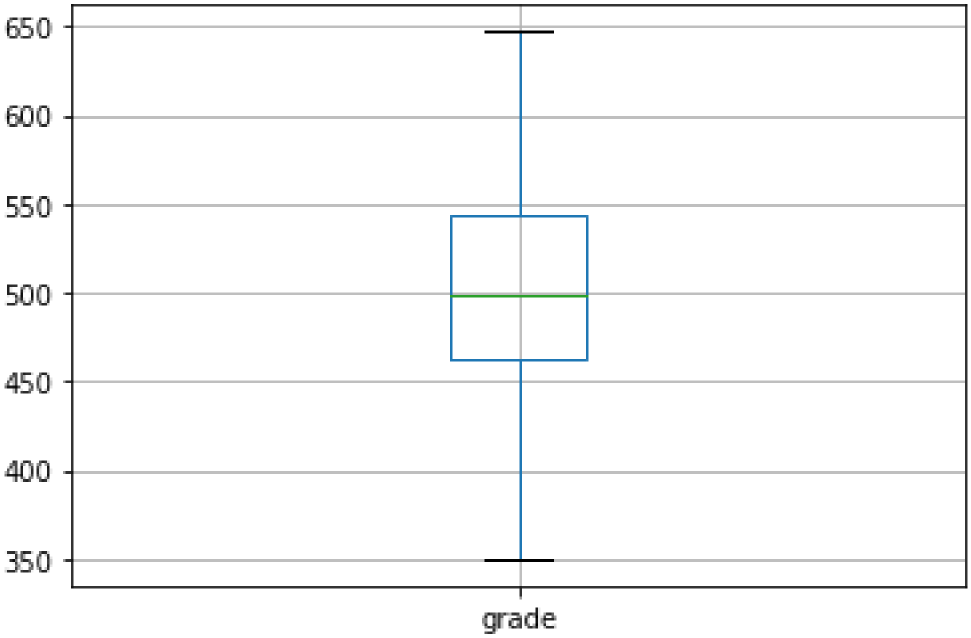
```
[11]: count    100.000000
      mean     504.760000
      std       63.272079
      min      350.000000
      25%      462.250000
      50%      498.500000
      75%      544.000000
      max      647.000000
      Name: grade, dtype: float64
```

```
[12]: DF['grade'].describe()['std'] * DF['grade'].describe()['std']
```

```
[12]: 4003.3559595959596
```

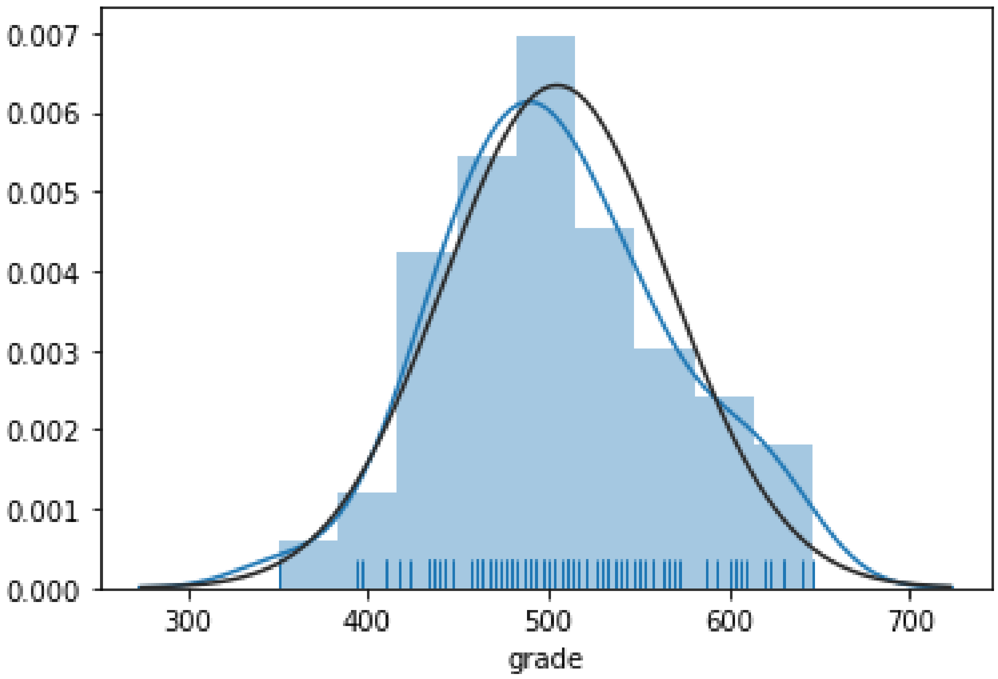
```
[13]: DF.plot(y='grade', kind='box', grid=True)
```

```
[13]: <matplotlib.axes._subplots.AxesSubplot at 0x16b9e055f88>
```



```
[14]: sns.distplot(DF.grade, rug = True, fit=stats.norm)
```

```
[14]: <matplotlib.axes._subplots.AxesSubplot at 0x16b9f446ec8>
```



[15]:

```
DF[['grade', 'gender']].groupby('gender').describe()
```

[15]:

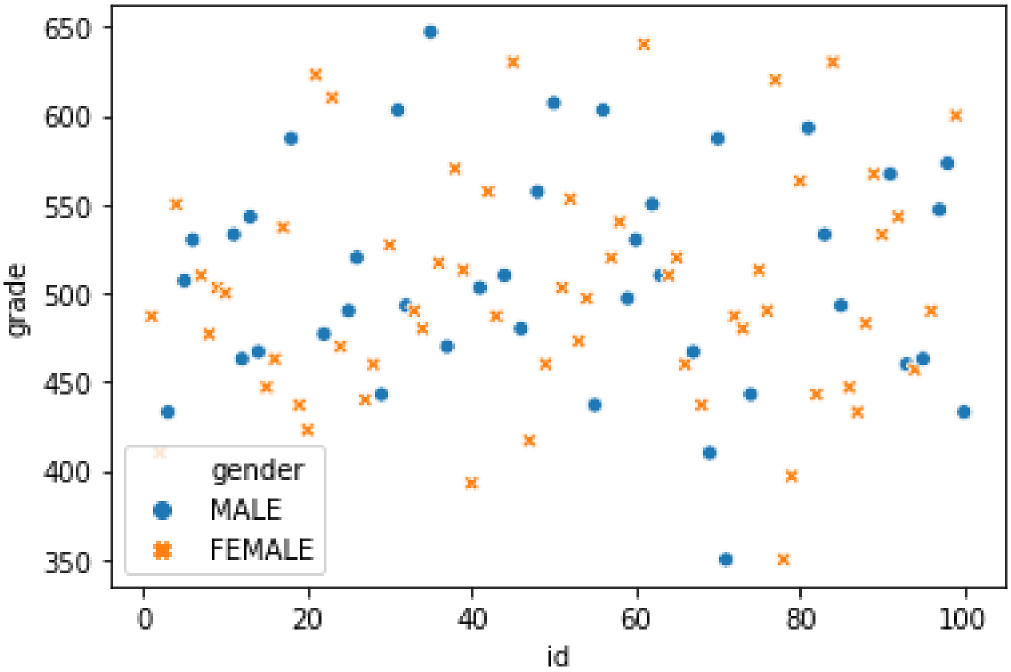
```
       grade
       count        mean        std    min    25%    50%    75%    max
gender
MALE    41.0  509.975610  62.618084  350.0  467.0  507.0  550.0  647.0
FEMALE  59.0  501.135593  64.004433  350.0  460.0  490.0  538.5  640.0
```

[16]:

```
sns.scatterplot(x='id', y='grade', hue='gender', style='gender', data=DF)
```

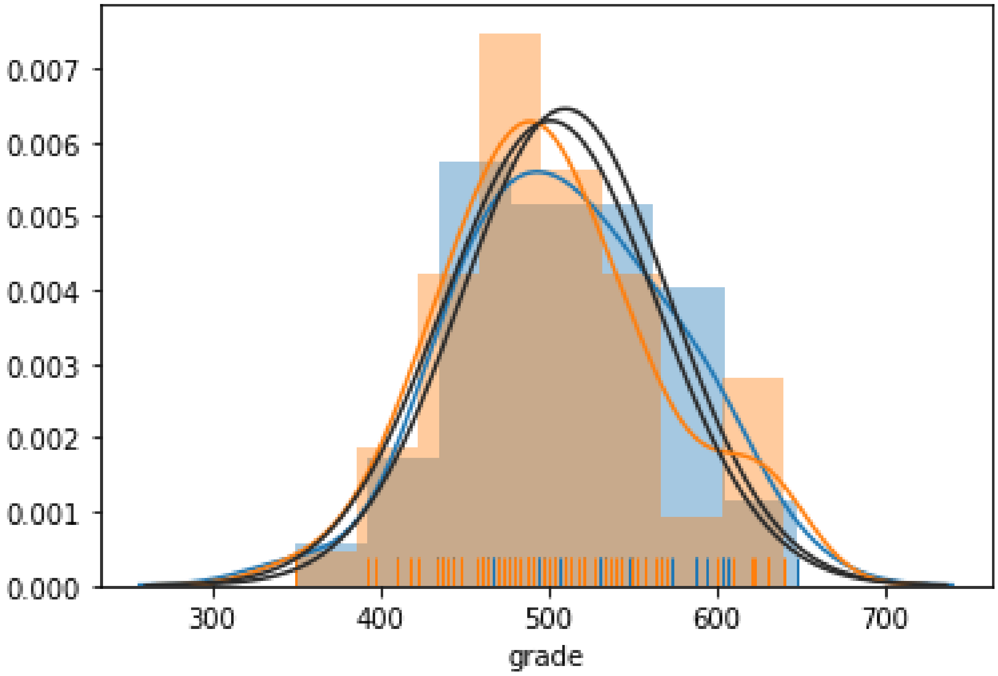
[16]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x16b9f446208>
```



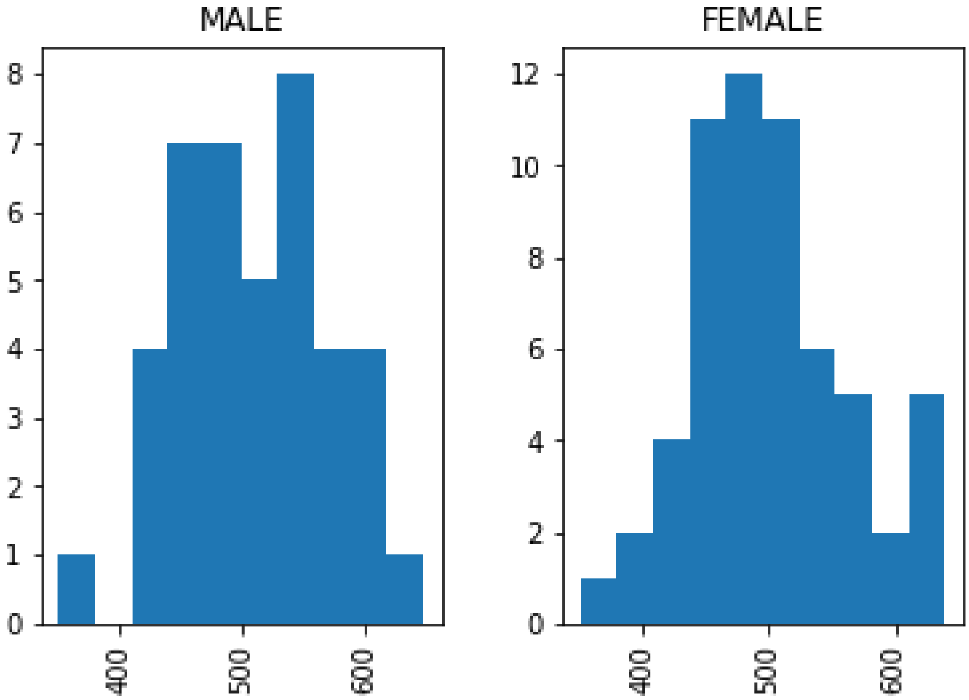
[17]:
```
sns.distplot(DF.grade[DF.gendernum==0], rug=True, fit=stats.norm)
sns.distplot(DF.grade[DF.gendernum==1], rug=True, fit=stats.norm)
```

[17]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x16ba15b9a88>
```



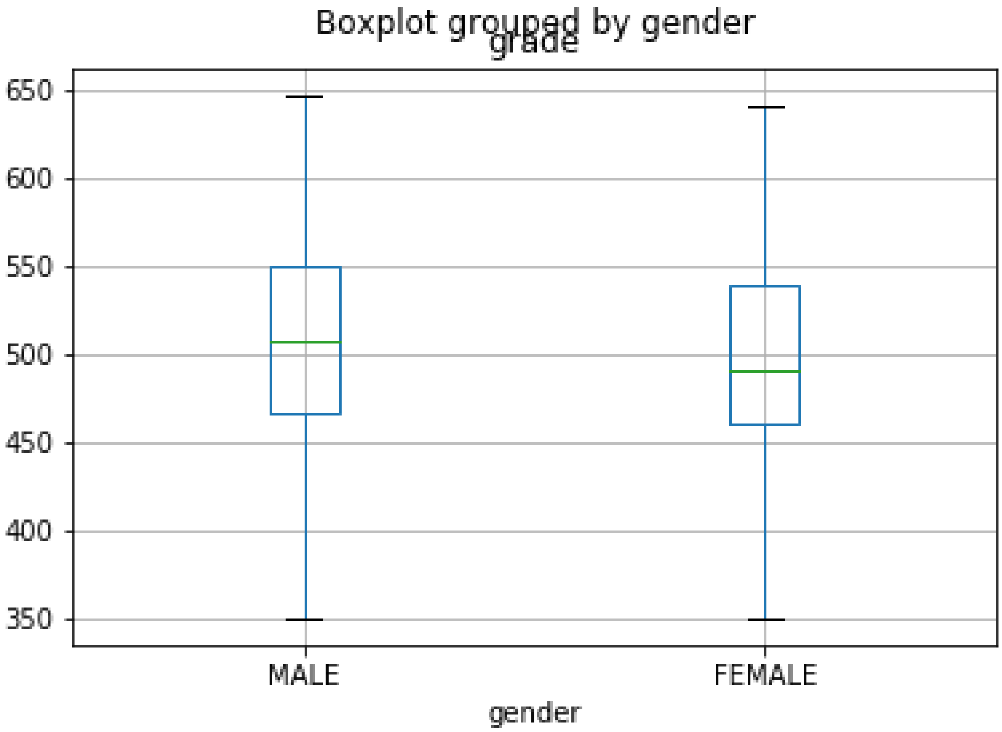
```
[18]: DF.hist(column='grade', by='gender')
```

```
[18]: array([<matplotlib.axes._subplots.AxesSubplot object at 0x0000016BA15CA048>,
             <matplotlib.axes._subplots.AxesSubplot object at 0x0000016BA169BFC8>],
            dtype=object)
```



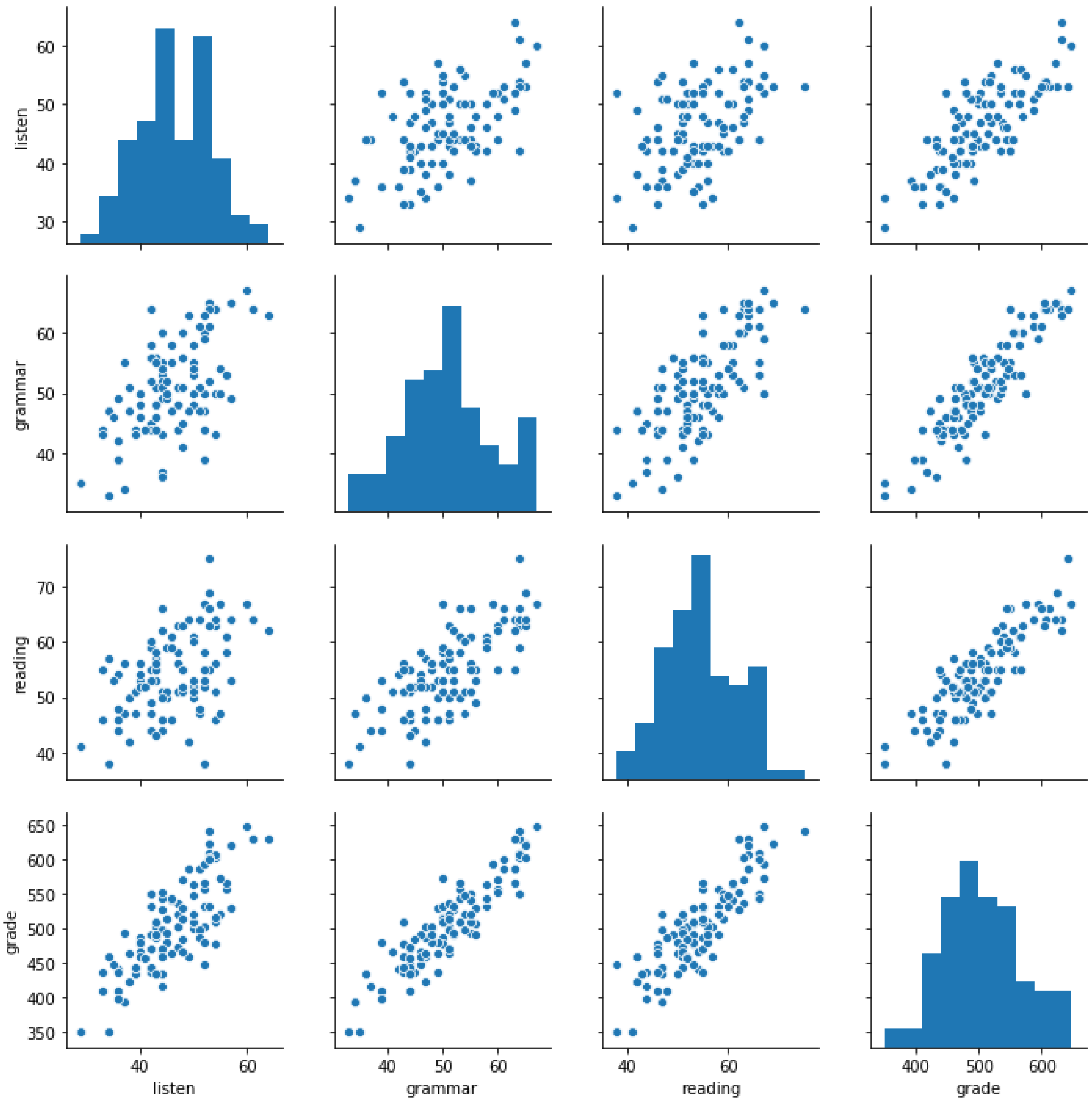
```
[19]: DF.boxplot(column='grade', by='gender')
```

```
[19]: <matplotlib.axes._subplots.AxesSubplot at 0x16ba1769048>
```



[20]:

```
sns.pairplot(DF, vars=['listen', 'grammar', 'reading', 'grade'],␣
 ↪diag_kind='hist')
plt.show()
```



[21]:
```
DF['support'] = np.where(DF['grade'] >= 500, 1,
                         np.where(DF['grade'] >= 450, 2,
                         np.where(DF['grade'] >= 400, 3, 4)))
```

[22]:
```
DF.head()
```

[22]:
```
   id  gender  listen  grammar  reading  gendernum  grade  support
0   1  FEMALE      40       50       56          1  487.0        2
1   2  FEMALE      33       44       46          1  410.0        3
2   3    MALE      39       44       47          0  433.0        3
3   4  FEMALE      44       55       66          1  550.0        1
4   5    MALE      43       56       53          0  507.0        1
```

[23]:

```
DF['exemption'] = np.where(DF['support'] <= 2, 1, 0)
```

[24]:

```
DF.head()
```

[24]:

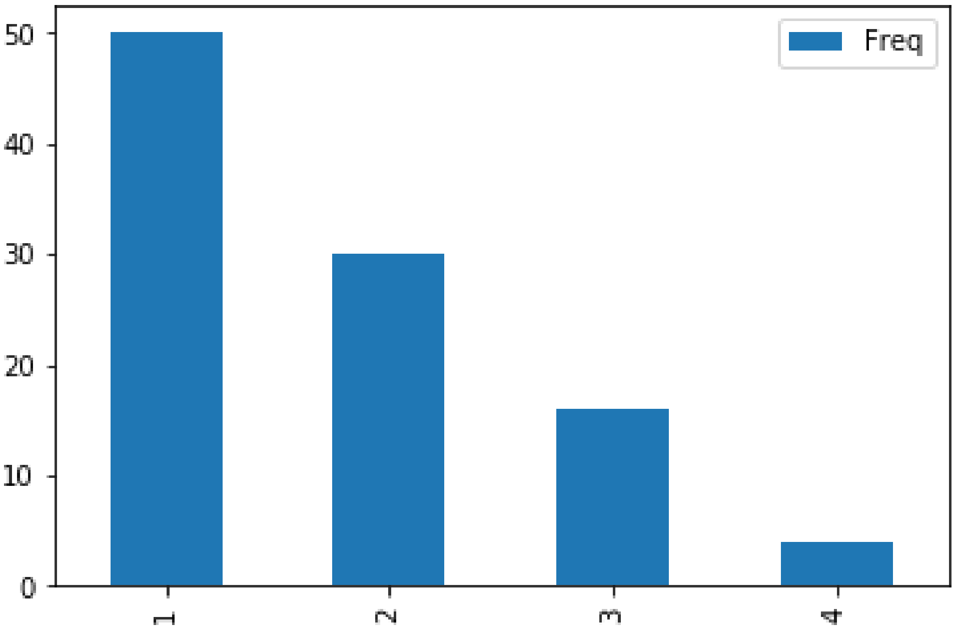
```
   id  gender  listen  grammar  reading  gendernum  grade  support  exemption
0   1  FEMALE      40       50       56          1  487.0        2          1
1   2  FEMALE      33       44       46          1  410.0        3          0
2   3    MALE      39       44       47          0  433.0        3          0
3   4  FEMALE      44       55       66          1  550.0        1          1
4   5    MALE      43       56       53          0  507.0        1          1
```

[25]:

```
sufreq = DF.support.value_counts()
suprop = sufreq / sum(sufreq)
sutbl = pd.concat([sufreq, suprop], axis=1)
sutbl.columns = ['Freq', 'Prop']
sutbl
sutbl.plot.bar(y='Freq')
```

[25]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x16ba20c3948>
```



[26]:

```
sutbl
```

[26]:

```
   Freq  Prop
1    50  0.50
2    30  0.30
3    16  0.16
```

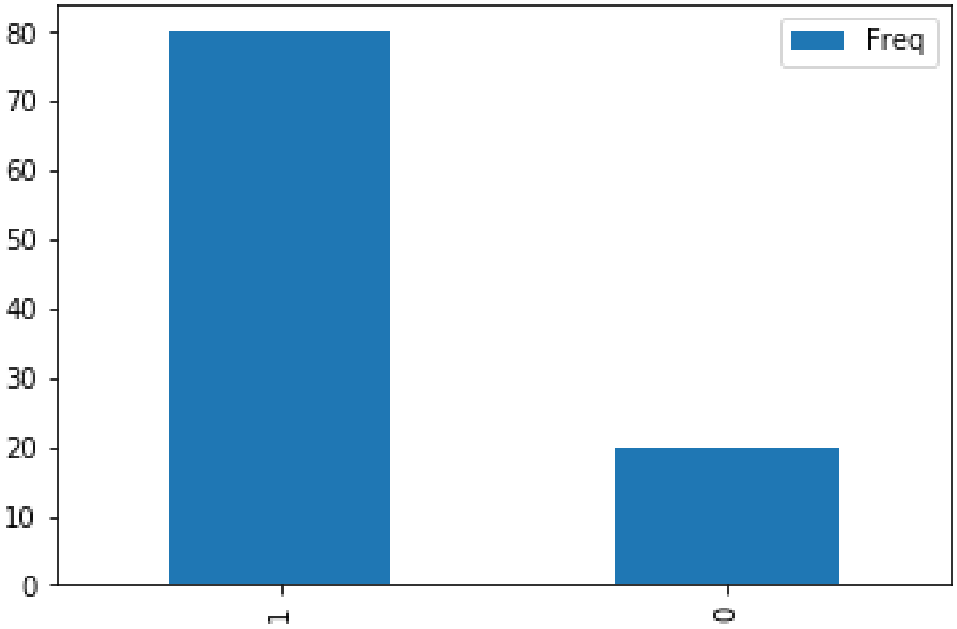
```
4      4  0.04
```

[27]:

```
exfreq = DF.exemption.value_counts()
exprop = exfreq / sum(exfreq)
extbl = pd.concat([exfreq, exprop], axis=1)
extbl.columns = ['Freq', 'Prop']
extbl
extbl.plot.bar(y='Freq')
```

[27]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x16ba232b888>
```



[28]:

```
extbl
```

[28]:

```
   Freq  Prop
1    80   0.8
0    20   0.2
```

[29]:

```
sutbl = pd.crosstab(index=DF.support, columns=DF.exemption, margins=True)
sutbl
```

[29]:

```
exemption   0   1  All
support
1           0  50   50
2           0  30   30
3          16   0   16
4           4   0    4
```

```
All         20  80  100
```

[ ]: