NAME : ARYAN SIRDESAI ROLL No. : TACO20175 Lab Assignment 2 : Data Wrangling II

Problem Statement : Create an “Academic performance” dataset of students and perform the following operations using Python.

1. Scan all variables for missing values and inconsistencies. If there are missing values and/or inconsistencies, use any of the suitable techniques to deal with them.
2. Scan all numeric variables for outliers. If there are outliers, use any of the suitable techniques to deal with them.
3. Apply data transformations on at least one of the variables. The purpose of this transformation should be one of the following reasons: to change the scale for better understanding of the variable, to convert a non□linear relation into a linear one, or to decrease the skewness and convert the distribution into a normal distribution.

In [1]:

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

Getting dataset - Student Performance

In [2]:

```
df = pd.read_csv("StudentsPerformance.csv")
```

In [3]:

```
df
```

Out[3]:

	gender	race/ethnicity	parental level of education	lunch	test preparation course	math score	reading score	writing score
0	female	group B	bachelor's degree	standard	none	72.0	72.0	74.0
1	female	group C	some college	standard	completed	69.0	90.0	88.0
2	female	group B	master's degree	standard	none	90.0	95.0	93.0
3	male	group A	associate's degree	free/reduced	none	47.0	57.0	NaN
4	male	group C	some college	standard	none	76.0	78.0	75.0
...	...	...	...	...	...	...	...	...
995	female	group E	master's degree	standard	completed	88.0	99.0	95.0
996	male	group C	high school	free/reduced	none	62.0	55.0	55.0
997	female	group C	high school	free/reduced	completed	59.0	71.0	65.0
998	female	group D	some college	standard	completed	68.0	78.0	77.0
999	female	group D	some college	free/reduced	none	77.0	86.0	86.0

1000 rows × 8 columns

In [4]:

```
df.shape
```

Out[4]:

```
(1000, 8)
```

In [5]:

```
df.columns
```

Out[5]:

```
Index(['gender', 'race/ethnicity', 'parental level of education', 'lunch',
       'test preparation course', 'math score', 'reading score',
       'writing score'],
      dtype='object')
```

In [6]:

```
df.dtypes
```

Out[6]:

```
gender                          object
race/ethnicity                  object
parental level of education     object
lunch                           object
test preparation course         object
math score                     float64
reading score                  float64
writing score                  float64
dtype: object
```

In [7]:

```
df.isnull().sum()
```

Out[7]:

```
gender                         0
race/ethnicity                 0
parental level of education    0
lunch                          0
test preparation course        0
math score                     6
reading score                  6
writing score                  3
dtype: int64
```

In [8]:

```
df['math score'].fillna(value=df['math score'].mean(),inplace=True)
df['writing score'].fillna(value=df['writing score'].mean(),inplace=True)
df['reading score'].fillna(value=df['reading score'].mean(),inplace=True)



df.isnull().sum()
```

Out[8]:

```
gender                         0
race/ethnicity                 0
parental level of education    0
lunch                          0
test preparation course        0
math score                     0
reading score                  0
writing score                  0
dtype: int64
```

In [9]:

```
outliers = []
def detect(df):
    threshold = 3
    mean = np.mean(df)
    std = np.std(df)

    for d in df:
        z_score = (d-mean)/std
        if np.abs(z_score) > threshold:
            outliers.append(d)
    return outliers
```

In [10]:

```
var='math score'
# var='reading score'
# var='writing score'
```

In [11]:

```
z_scores=detect(df[var])
```

In [12]:

```
outliers=df[df[var].isin(z_scores)]
```

In [13]:

```
outliers
```

Out[13]:

	gender	race/ethnicity	parental level of education	lunch	test preparation course	math score	reading score	writing score
7	male	group B	some college	free/reduced	none	120.0	43.0	39.0
17	female	group B	some high school	free/reduced	none	18.0	32.0	28.0
39	male	group B	associate's degree	free/reduced	none	10.0	56.0	57.0
59	female	group C	some high school	free/reduced	none	0.0	17.0	10.0
113	female	group D	some college	standard	none	1.0	58.0	54.0
139	male	group D	some college	standard	completed	200.0	61.0	69.0
980	female	group B	high school	free/reduced	none	8.0	24.0	23.0

In [14]:

```
dfs = df[~df.index.isin(outliers.index)]
```

In [15]:

```
#df2=df[var].drop(df[var][df[var].isin(z_scores)])
```

In [16]:

```
dfs
```

Out[16]:

	gender	race/ethnicity	parental level of education	lunch	test preparation course	math score	reading score	writing score
0	female	group B	bachelor's degree	standard	none	72.0	72.0	74.000000
1	female	group C	some college	standard	completed	69.0	90.0	88.000000
2	female	group B	master's degree	standard	none	90.0	95.0	93.000000
3	male	group A	associate's degree	free/reduced	none	47.0	57.0	68.402207
4	male	group C	some college	standard	none	76.0	78.0	75.000000
...	...	...	...	...	...	...	...	...
995	female	group E	master's degree	standard	completed	88.0	99.0	95.000000
996	male	group C	high school	free/reduced	none	62.0	55.0	55.000000
997	female	group C	high school	free/reduced	completed	59.0	71.0	65.000000
998	female	group D	some college	standard	completed	68.0	78.0	77.000000
999	female	group D	some college	free/reduced	none	77.0	86.0	86.000000

993 rows × 8 columns

In [17]:

```
dfs.skew(axis =0)
```

```
/var/folders/q4/v4fv5t6d4kndspky2m0bvynw0000gn/T/ipykernel_5412/4029879126.py:1: F
utureWarning: Dropping of nuisance columns in DataFrame reductions (with 'numeric_
only=None') is deprecated; in a future version this will raise TypeError.  Select
only valid columns before calling the reduction.
  dfs.skew(axis =0)
```

Out[17]:

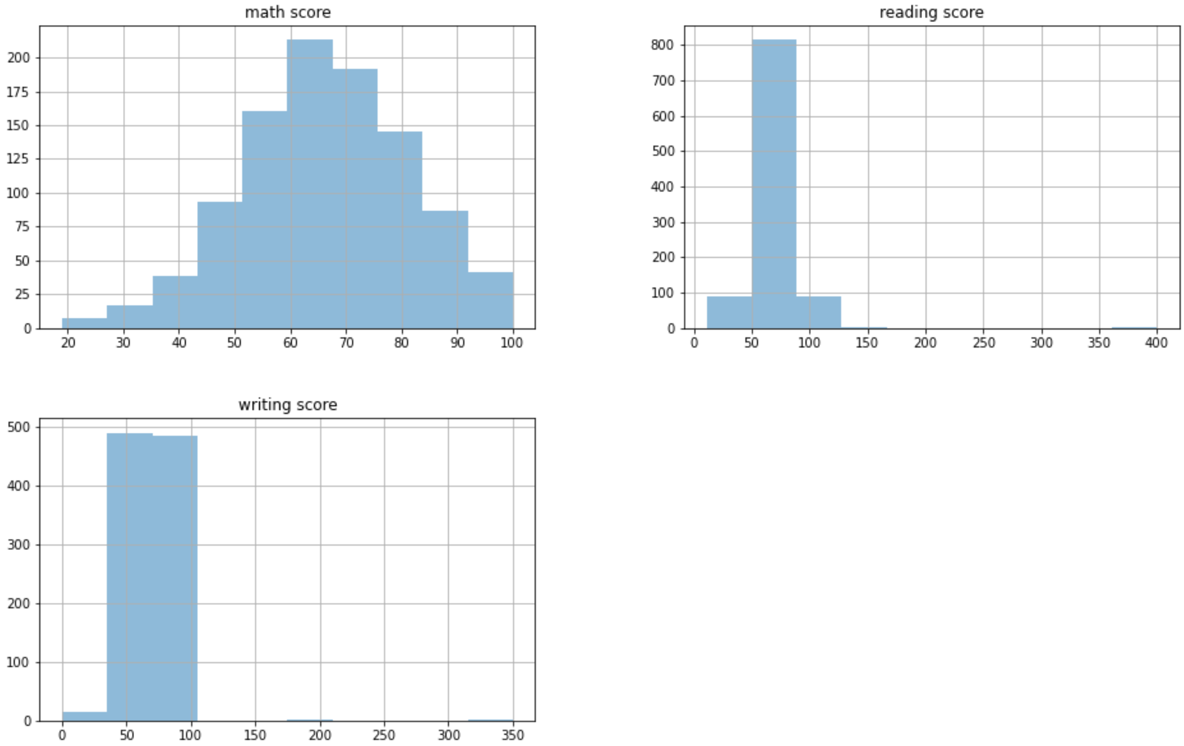
```
math score      -0.156469
reading score    6.006394
writing score    3.999959
dtype: float64
```

In [18]:

```
dfs.hist(alpha=0.5, figsize=(16, 10))
```

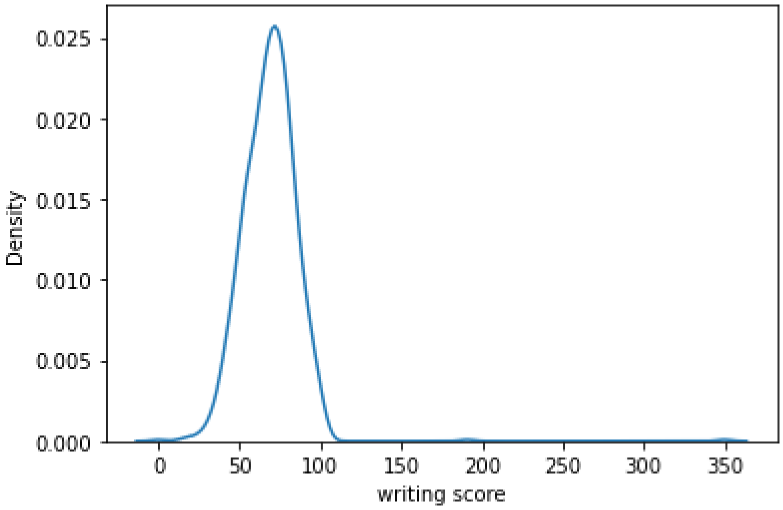
Out[18]:

```
array([[<AxesSubplot:title={'center':'math score'}>,
        <AxesSubplot:title={'center':'reading score'}>],
       [<AxesSubplot:title={'center':'writing score'}>, <AxesSubplot:>]],
      dtype=object)
```



In [19]:
```
sns.kdeplot(dfs['writing score'])
```

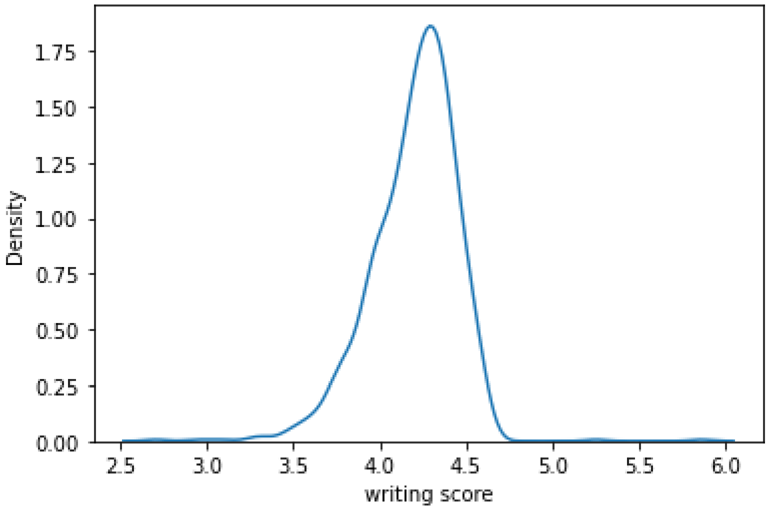
Out[19]:
```
<AxesSubplot:xlabel='writing score', ylabel='Density'>
```



In [20]:
```
a = np.log(dfs['writing score'])

a.skew(axis=0)

sns.kdeplot(a)
```

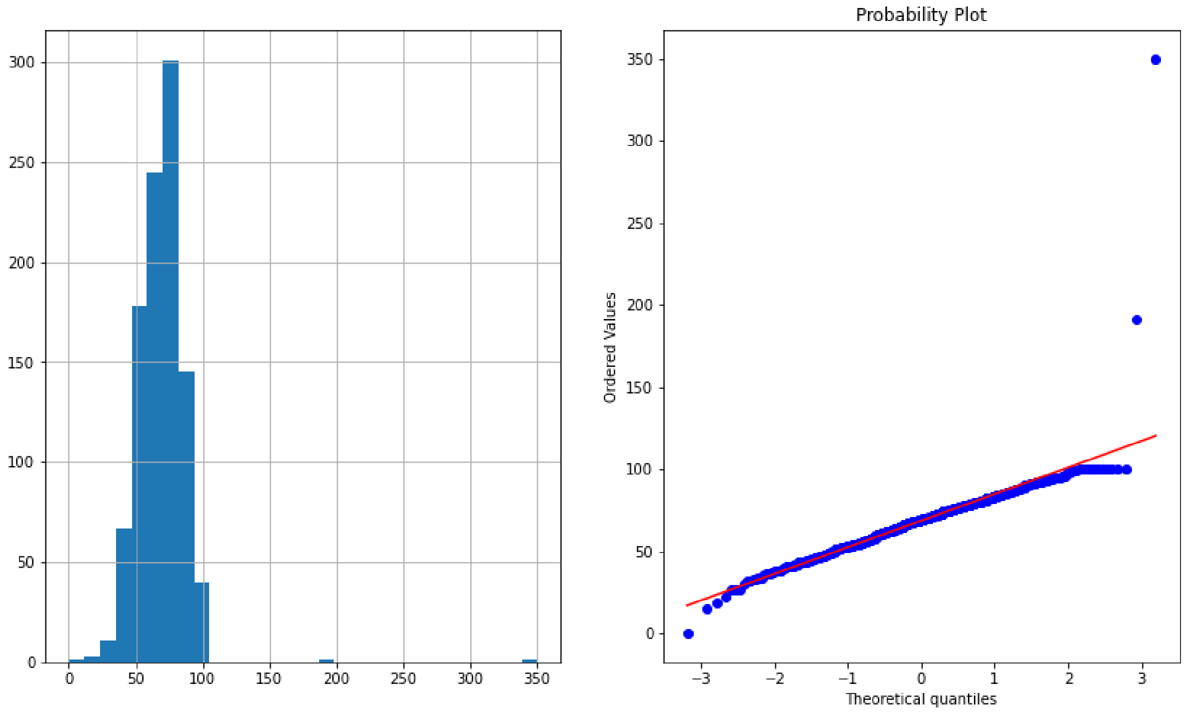
```
/Users/apple/opt/anaconda3/lib/python3.9/site-packages/pandas/core/arraylike.py:36
4: RuntimeWarning: divide by zero encountered in log
  result = getattr(ufunc, method)(*inputs, **kwargs)
```

Out[20]:
```
<AxesSubplot:xlabel='writing score', ylabel='Density'>
```



In [21]:

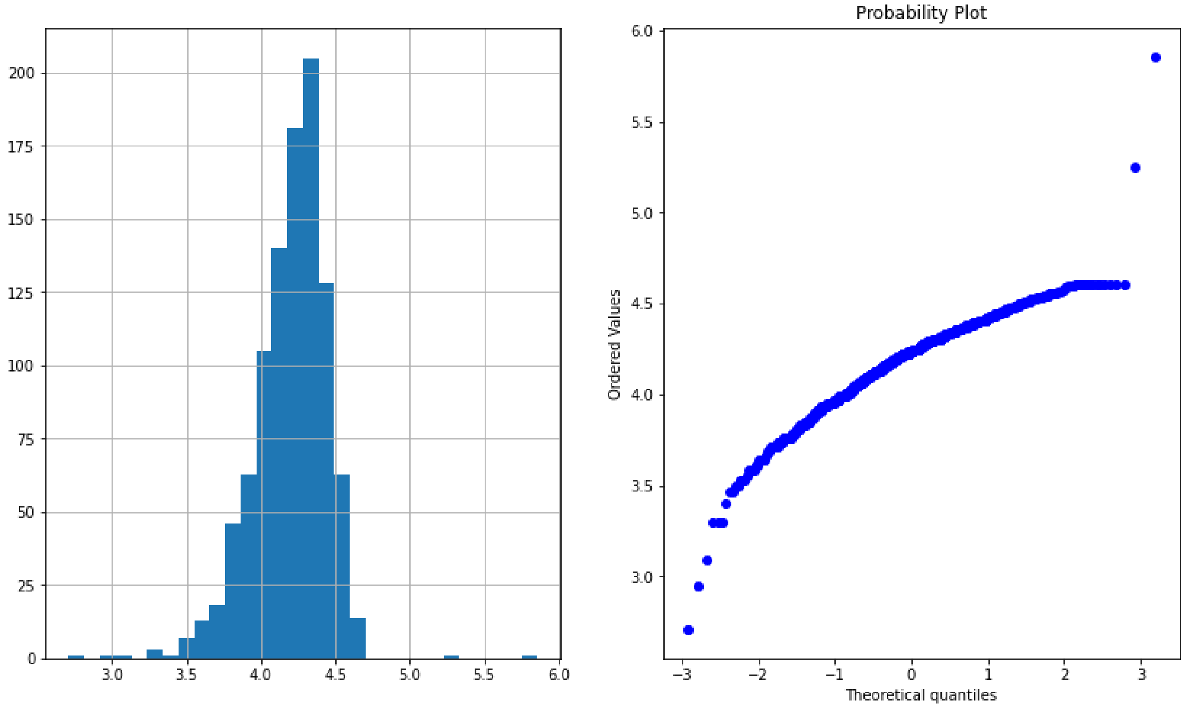
```
plt.figure(figsize=(14,8))
plt.subplot(1,2,1) ## means 1 row , 2 columns and 1st plot
dfs['writing score'].hist(bins=30)

plt.subplot(1,2,2)
stats.probplot(dfs['writing score'], dist="norm", plot=plt)
plt.show()
```



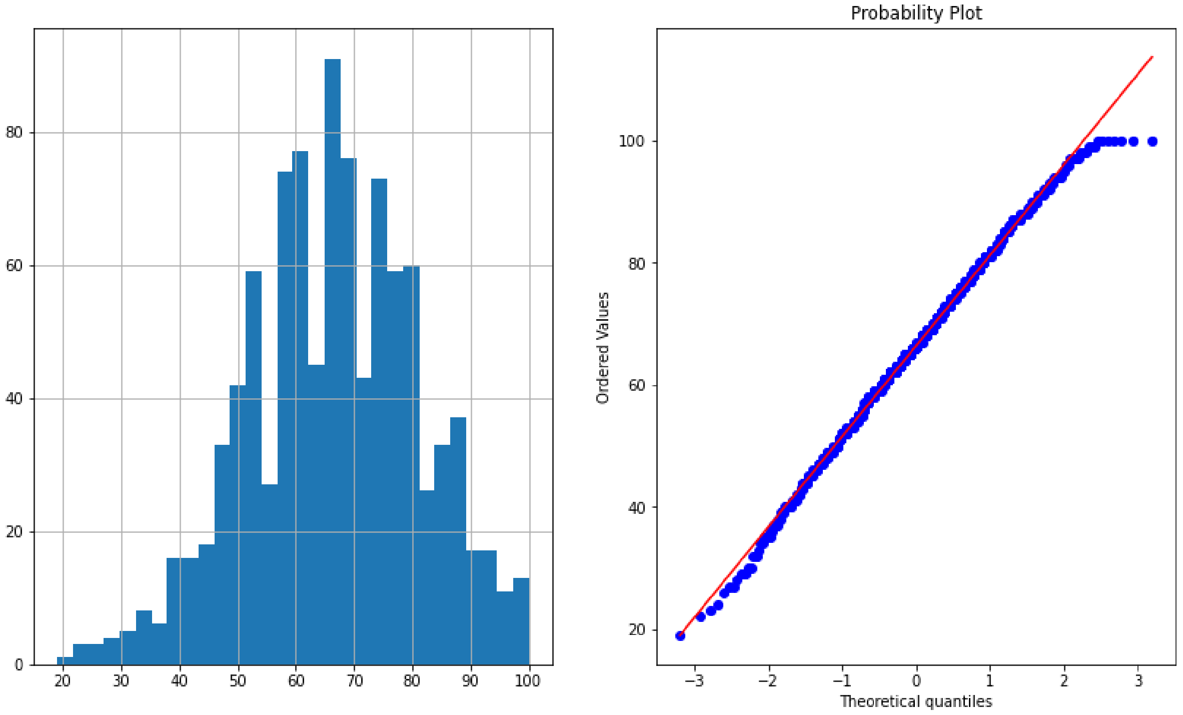
In [22]:

```
plt.figure(figsize=(14,8))
plt.subplot(1,2,1) ## means 1 row , 2 columns and 1st plot
# dfs['writing log'].hist(bins=30)

a[np.isfinite(a)].hist(bins=30)

plt.subplot(1,2,2)
stats.probplot(a, dist="norm", plot=plt)
plt.show()
```

```
/Users/apple/opt/anaconda3/lib/python3.9/site-packages/numpy/lib/function_base.py:
2487: RuntimeWarning: invalid value encountered in subtract
  X -= avg[:, None]
```

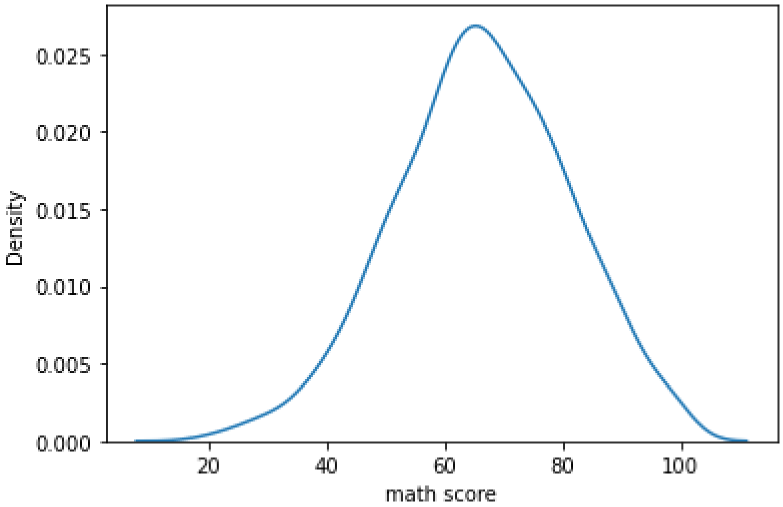


In [23]:
```
plt.figure(figsize=(14,8))
plt.subplot(1,2,1) ## means 1 row , 2 columns and 1st plot
dfs['math score'].hist(bins=30)

plt.subplot(1,2,2)
stats.probplot(dfs['math score'], dist="norm", plot=plt)
plt.show()
```



In [24]:
```
sns.kdeplot(dfs['math score'])
```

Out[24]:
```
<AxesSubplot:xlabel='math score', ylabel='Density'>
```

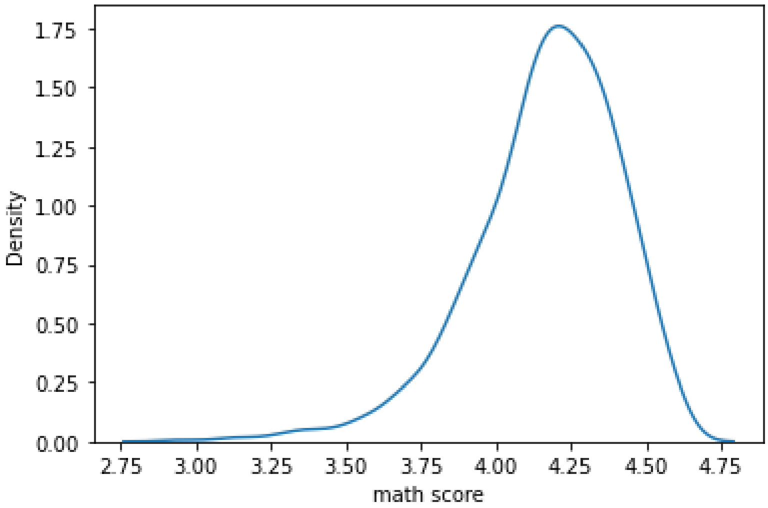


In [25]:

```
m = np.log(dfs['math score'])

m.skew(axis=0)

sns.kdeplot(m)
```

Out[25]:

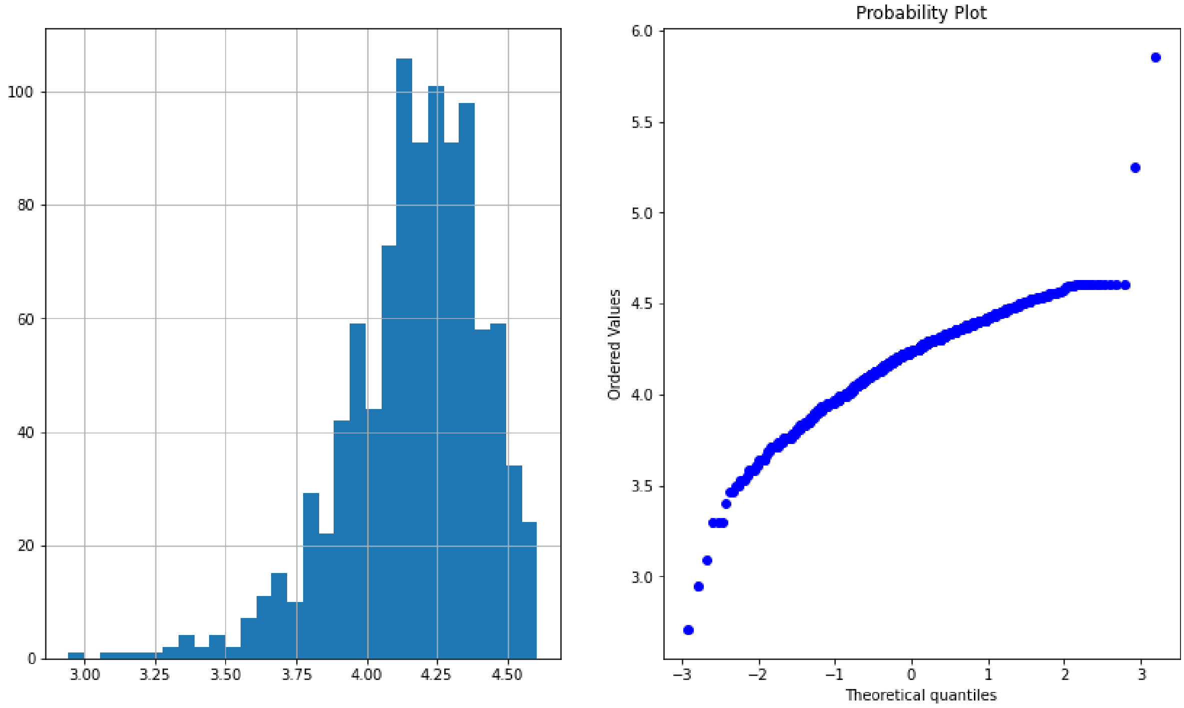
```
<AxesSubplot:xlabel='math score', ylabel='Density'>
```



In [26]:

```
plt.figure(figsize=(14,8))
plt.subplot(1,2,1) ## means 1 row , 2 columns and 1st plot
# dfs['writing log'].hist(bins=30)

m[np.isfinite(m)].hist(bins=30)

plt.subplot(1,2,2)
stats.probplot(a, dist="norm", plot=plt)
plt.show()
```

```
/Users/apple/opt/anaconda3/lib/python3.9/site-packages/numpy/lib/function_base.py:
2487: RuntimeWarning: invalid value encountered in subtract
  X -= avg[:, None]
```


100
80
60
40
20
0
3.00
3.25
3.50
3.75
4.00
4.25
4.50
Probability Plot
Ordered Values
6.0
5.5
5.0
4.5
4.0
3.5
3.0
−3
−2
−1
0
1
2
3
Theoretical quantiles