Problem Statement

A hospital wants to determine whether there is any difference in the average Turn Around Time (TAT) of reports of the laboratories on their preferred list. They collected a random sample and recorded TAT for reports of 4 laboratories. TAT is defined as sample collected to report dispatch. Analyze the data and determine whether there is any difference in average TAT among the different laboratories at 5% significance level.

1. Understanding Business Problem

To find out if there is any difference in average TAT among the different laboratories at 5% significance level

2. Given Data

Level of Significance → α = 0.05

3. Import Necessary Libraries

In [1]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import statsmodels.api as sm
import statsmodels.formula.api as smf
from matplotlib import pyplot as plt
from scipy import stats

import warnings
warnings.filterwarnings('ignore')
```

4. Import Data

In [12]:

```
labs_data = pd.read_csv('LabTAT.csv')
labs_data
```

Out[12]:

	Laboratory 1	Laboratory 2	Laboratory 3	Laboratory 4
0	185.35	165.53	176.70	166.13
1	170.49	185.91	198.45	160.79
2	192.77	194.92	201.23	185.18
3	177.33	183.00	199.61	176.42
4	193.41	169.57	204.63	152.60
...	...	...	...	...
115	178.49	170.66	193.80	172.68
116	176.08	183.98	215.25	177.64
117	202.48	174.54	203.99	170.27
118	182.40	197.18	194.52	150.87
119	182.09	215.17	221.49	162.21

120 rows × 4 columns

5. Perform Initial Analysis

In [13]:

```
labs_data.shape
```

Out[13]:

```
(120, 4)
```

In [15]:

```
labs_data.dtypes
```

Out[15]:

```
Laboratory 1    float64
Laboratory 2    float64
Laboratory 3    float64
Laboratory 4    float64
dtype: object
```

In [14]:

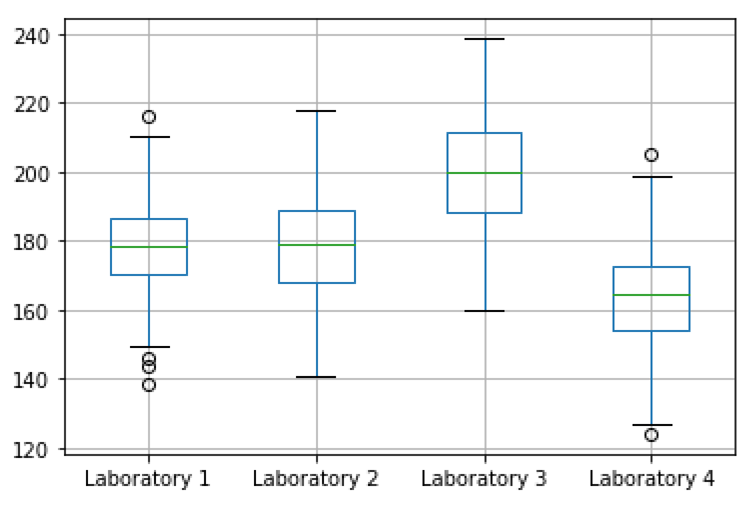
```
labs_data.isnull().sum()
```

Out[14]:

```
Laboratory 1    0
Laboratory 2    0
Laboratory 3    0
Laboratory 4    0
dtype: int64
```

In [16]:

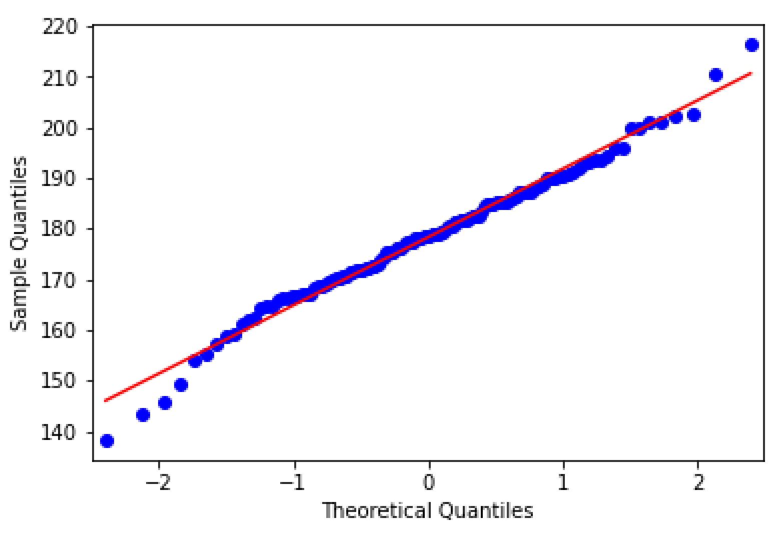
```
labs_data.boxplot(column= ['Laboratory 1','Laboratory 2','Laboratory 3','Laboratory 4'])
plt.show() # understanding the labs_data using boxplotb
```



Checking normality with the help of QQ Plot

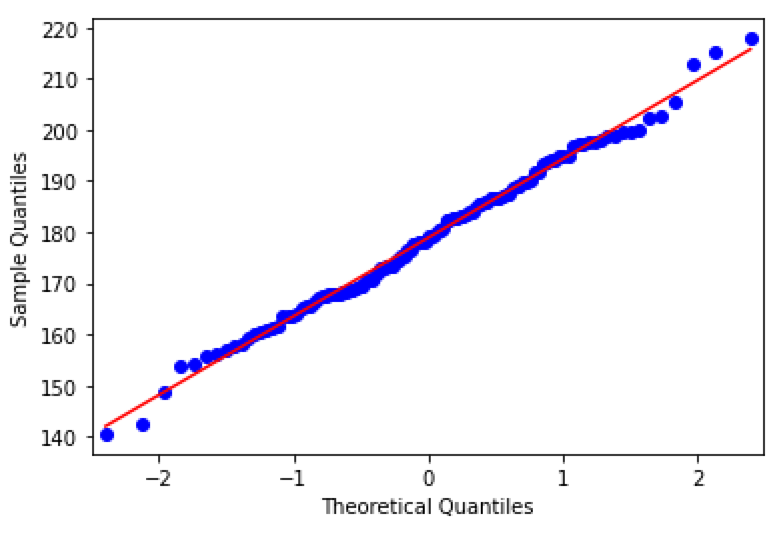
In [17]:

```
sm.qqplot(data = labs_data['Laboratory 1'],line= 'r')
plt.show()
```



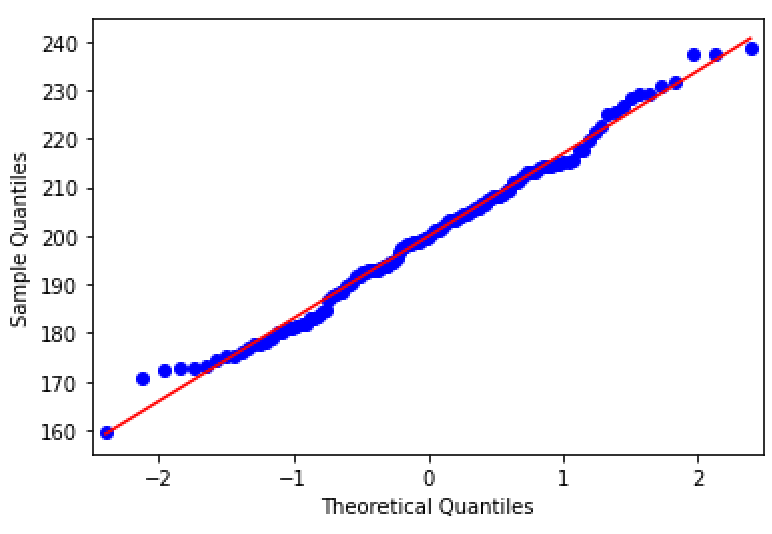
In [18]:

```
sm.qqplot(data = labs_data['Laboratory 2'],line= 'r')
plt.show()
```



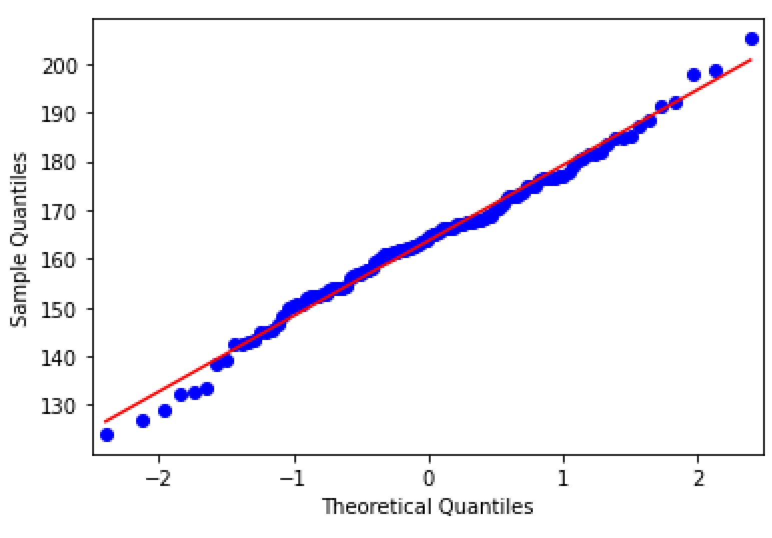
In [19]:

```
sm.qqplot(data = labs_data['Laboratory 3'],line= 'r')
plt.show()
```



In [20]:

```
sm.qqplot(data = labs_data['Laboratory 4'],line= 'r')
plt.show()
```



6. Hypothesis Formulation

HO = There is no significant difference in average TAT among the 4 different laboratories.
H1 = There is a significant difference in average TAT among the 4 different laboratories.
α = 5%**

7. Perform Hypothesis Testing

Here we have 4 samples from 4 different labs. We can use one-way ANOVA test to determine if two or more groups have the same population mean.

Since we have 4 samples from 4 different labs. We will use 'one-way ANOVA test' to determine if two or more groups have the same population mean.

In [21]:

```
f_statistic_labs,p_val_labs = stats.f_oneway(labs_data['Laboratory 1'], labs_data['Laboratory 2'],
                                             labs_data['Laboratory 3'], labs_data['Laboratory 4'], axis=0)
```

In [22]:

```
p_val_labs
```

Out[22]:

```
2.1156708949992414e-57
```

In [23]:

```
print('**************************************************')
print('F statistic Value           :',f_statistic_labs)
print('P-Value for laboratory data :',p_val_labs)
print('**************************************************')
```

```
**************************************************
F statistic Value           : 118.70421654401437
P-Value for laboratory data : 2.1156708949992414e-57
**************************************************
```

In [24]:

```
if p_val_labs < 0.05:
    print('At 5% level of significance we can reject the Null Hypothesis and we can state that there is a signi
else:
    print('At 5% level of significance we cannot reject the Null Hypothesis and we can state that there is no s
```

```
At 5% level of significance we can reject the Null Hypothesis and we can state that there is a significant diff
erence in average TAT among the 4 different laboratories.
```

8. Verifying the above conclusion manually

Verifying the result by calculating the mean of 'Laboratory 1', 'Laboratory 2', 'Laboratory 3' and 'Laboratory 4'

In [25]:

```
mean_lab1 = labs_data['Laboratory 1'].mean()
mean_lab1
```

Out[25]:

```
178.36158333333339
```

In [26]:

```
mean_lab2 = labs_data['Laboratory 2'].mean()
mean_lab2
```

Out[26]:

```
178.9029166666668
```

In [27]:

```
mean_lab3 = labs_data['Laboratory 3'].mean()
mean_lab3
```

Out[27]:

```
199.91325000000003
```

In [28]:

```
mean_lab4 = labs_data['Laboratory 4'].mean()
mean_lab4
```

Out[28]:

```
163.6827499999999
```