1. Generating random data for English Marks and creating dataset

```
import pandas as pd
from numpy.random import randint

#generating random marks for english subject and storing it in array
english_marks = randint(28, 100, 100)


#creating dataframe having fields as Roll No of Student and English Marks
exam_score = pd.DataFrame({"Roll No of Student" : np.arange(1,101),
                     "English Marks" : english_marks})
#Display
exam_score
```

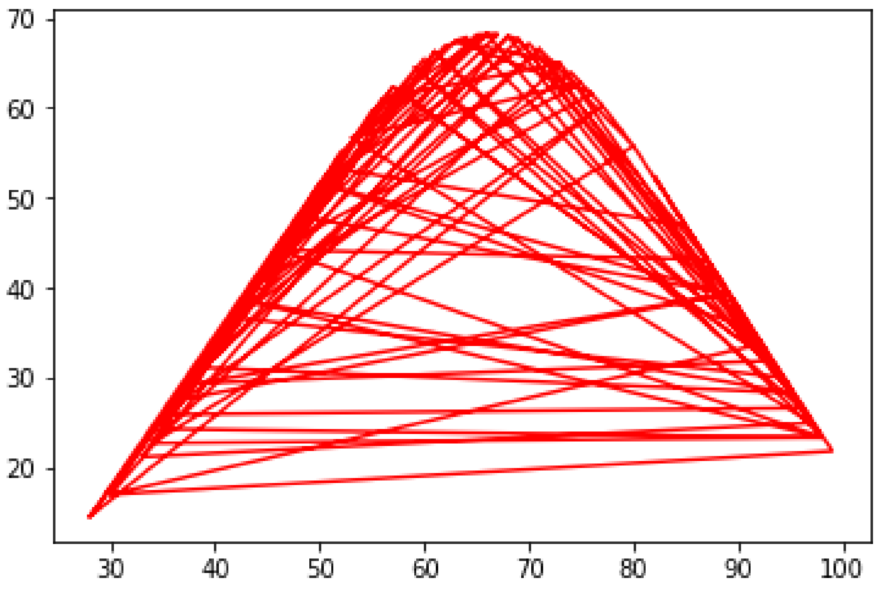
	Roll No of Student	English Marks
0	1	97
1	2	95
2	3	94
3	4	42
4	5	48
...	...	...
95	96	66
96	97	95
97	98	39
98	99	71
99	100	42

100 rows × 2 columns

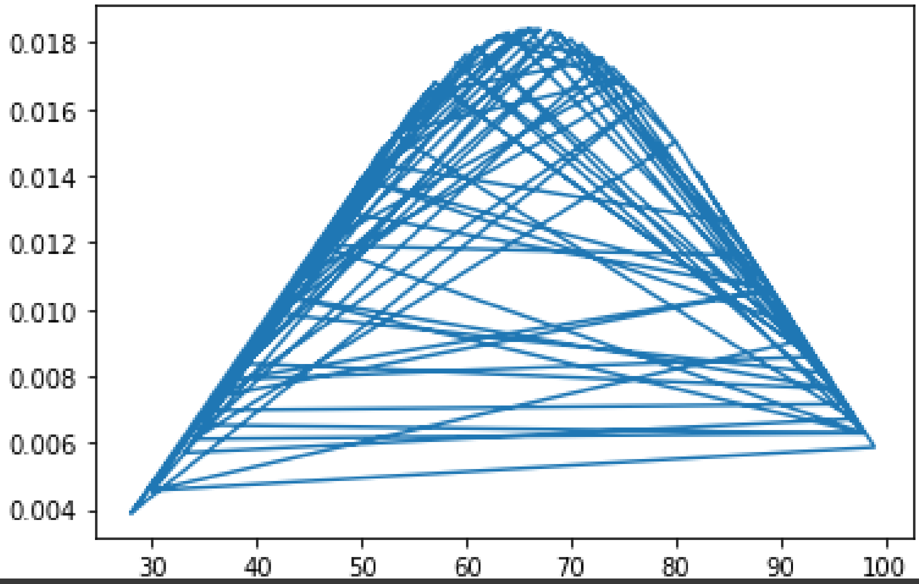
2. Plotting Normal Distribution

```
import numpy as np
import matplotlib.pyplot as plt

#Defining function to calculate normal distribution
def normal_dist(x , mean , sd):
    #formula to calculate normal distribution
    normal_distribution = (np.pi * sd) * np.exp(-0.5 * ((x - mean) / sd)**
    return normal_distribution

#calculating mean & standard deviation
mean = np.mean(exam_score['English Marks'])
sd = np.std(exam_score['English Marks'])

normal_distri = normal_dist(exam_score['English Marks'], mean, sd)

#Plotting normal distribution
print("Plotting Normal Distribution of English score of students : \n")
plt.plot(exam_score['English Marks'], normal_distri, color = 'red');
```

```
Plotting Normal Distribution of English score of students :
```




```
from scipy.stats import norm

#plotting normal distribution with built-in function
plt.plot(exam_score['English Marks'], norm.pdf(exam_score['English Marks']
plt.show()
```



3. Calculating Skewness

```
import statistics as stat
import scipy.stats as sci
import math

#Calculating skewness without built-in function

##Formula for skewness is = m3/m2^3/2
#where m3 = ∑(x-mean)³/no_of_items
#m2 = ∑(x-mean)²/no_of_items

#defining function to calculate m3 as mentioned in formula i.e  m3 = ∑(x-r
def calculate_m3(x,n,mean):
  sum1 = 0
  for i in range(n):
    sum1 = sum1 + (pow((x[i] - mean),3))

  return sum1/n

#defining function to calculate m3 as mentioned in formula i.e m2 = ∑(x-me
def calculate_m2(x,n,mean):
  sum1 = 0
  for i in range(n):
    sum1 = sum1 + (pow((x[i] - mean),2))

  return sum1/n

#calculating mean
```

```
mean = np.mean(exam_score['English Marks'])

#calculating no of items
n = len(exam_score['English Marks'])

m3 = calculate_m3(exam_score['English Marks'],n,mean)
m2 = calculate_m2(exam_score['English Marks'],n,mean)
#print("M3 is : ",m3)
#print("M2 is : ",m2)

#After getting values of m3 & m2 finally calculating skewness with formula
skewness = m3/(math.pow(m2,3/2))
print("Skewness without built-in function is : ",skewness)

#finding skewness with built-in function
skew2 = sci.skew(exam_score['English Marks'])
print("\nSkewness with built-in function is : ",skew2)
```

```
Skewness without built-in function is :  -0.03673205685914304

Skewness with built-in function is :  -0.03673205685914299
```

Calculating Sample Skewness

```
#Sample Skewness
#for calculating sample skewness we have formula G1 = √(n * (n -1 ))/(n -
#Where g1 = skewness which is calculated previously


n = len(exam_score['English Marks'])
numerator = math.sqrt(n * (n - 1))

#calculating sample skewness as mentioned in formula
sample_skewness = (numerator / (n - 2)) * skewness
print("Sample skewness is : ",sample_skewness)
```

```
Sample skewness is :  -0.03729381134074834
```

3. Calculating Kurtosis

```
#Calculating kurtosis without built-in function
```

```
##Formula for kurtosis is = m4/m2²
#where m4 = ∑(x-mean)⁴/no_of_items
#m2 = ∑(x-mean)²/no_of_items


#defining function to calculate m4 as mentioned in formula i.e   m4 = ∑(x-
def calculate_m4(x,n,mean):
  sum1 = 0
  for i in range(n):
    sum1 = sum1 + (pow((x[i] - mean),4))

  return sum1/n

#defining function to calculate m3 as mentioned in formula i.e m2 = ∑(x-me
def calculate_m2(x,n,mean):
  sum1 = 0
  for i in range(n):
    sum1 = sum1 + (pow((x[i] - mean),2))

  return sum1/n

#calculating mean
mean = np.mean(exam_score['English Marks'])

#calculating no of items
n = len(history_marks)


m4 = calculate_m4(exam_score['English Marks'],n,mean)
m2 = calculate_m2(exam_score['English Marks'],n,mean)
#print("M4 is : ",m4)
#print("M2 is : ",m2)

#calculating kurtosis i.e. a4 with mentioned formula which is kurtosis = m
a4 = m4/(math.pow(m2,2))
print("Kurtosis (a4) without buil-in function is : ",a4)

#calculating excess kurtosis which can be derived like excess_kurtosis = a
excess_kurtosis = a4 - 3
print("\nKurtosis (Excess) without built-in function is : ",excess_kurtosi

#calculating kurtosis with built-in function
kurtosis2 = sci.kurtosis(exam_score['English Marks'])
print("\nKurtosis with built-in function is : ",kurtosis2)
```

```
Kurtosis (a4) without buil-in function is :  1.7201701427724467

Kurtosis (Excess) without built-in function is :  -1.27982985722755З

Kurtosis with built-in function is :  -1.2798298572275535
```

Calculating Sample Kurtosis

```
#Sample Kurtosis
#for calculating sample kurtosis we have formula G2 = n - 1/(n - 2)*(n - 
#Where g2 = excess kurtosis which is calculated previously


denominator = (n - 2) * (n - 3)
multiplier = ((n + 1) * excess_kurtosis + 6)

#calculating sample kurtosis as mentioned in formula
sample_kurtosis = ((n - 1) / denominator ) * multiplier
print("Sample Kurtosis is : ",sample_kurtosis)
```

```
Sample Kurtosis is :  -1.2837175197157906
```

4. Commenting on Data

```
def is_skewed(skewness):
  if skewness < 0 :
    print("\nThe sample of English Marks is Left skewed sample!")
  elif skewness > 0:
    print("\nThe sample of English Marks is Right skewed sample!")
  elif skewness == 0:
    print("\nThe sample of English Marks is symmetrical sample!")

def which_kurtosis(excess_kurtosis):
  if excess_kurtosis > 3:
    print("\nThe sample of English Marks is Leptokurtic!")
  elif excess_kurtosis == 3:
    print("\nThe sample of English Marks is Mesokurtic!")
  elif excess_kurtosis < 3:
    print("\nThe sample of English Marks is Platykurtic!")
```

```
is_skewed(skewness)
which_kurtosis(excess_kurtosis)
```

```
The sample of English Marks is Left skewed sample!

The sample of English Marks is Platykurtic!
```