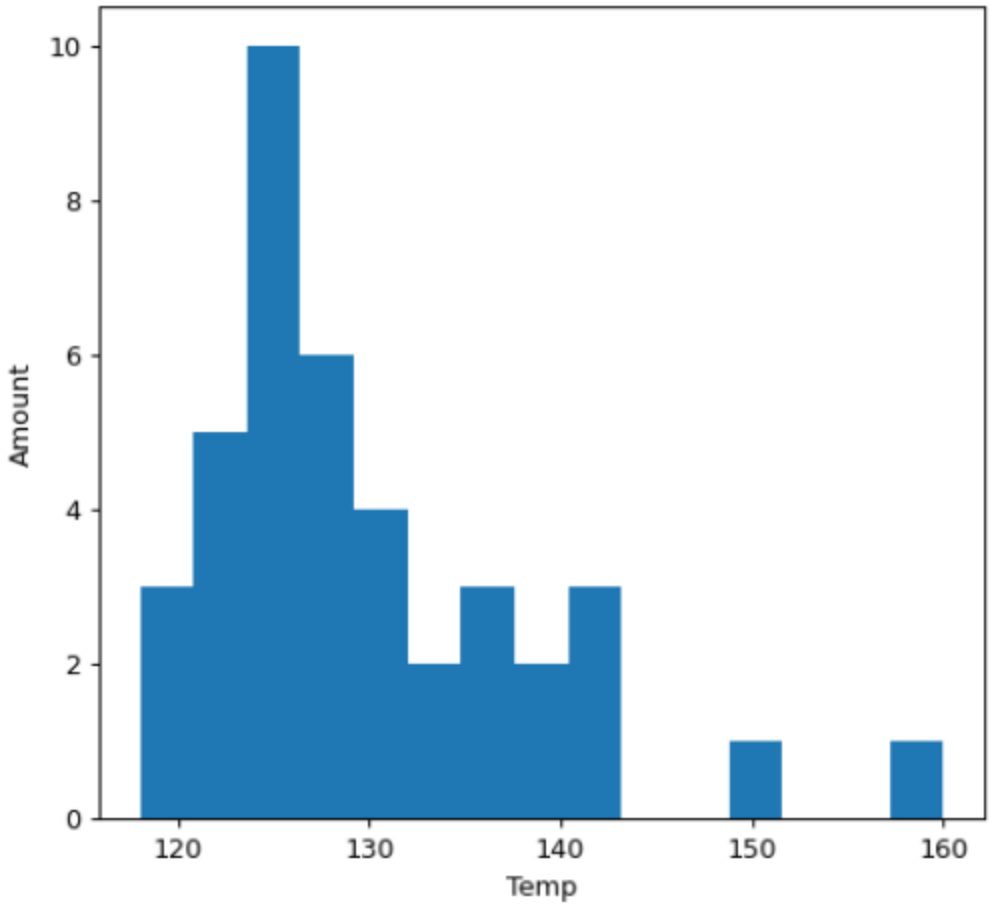
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import stemgraphic
from scipy.special import comb  # For combinatorial calculations (see line 209)
from scipy.stats import hypergeom # For dhyper() equivalent (see line 225)
from scipy.stats import binom # For dbinom() equivalent (see line 264)
from scipy.stats import poisson # For dpois() equivalent (see line 304)
from scipy.stats import nbinom # For dnbinom() equivalent (see line 324)
from scipy.stats import geom # For dgeom() equivalent (see line 338)
from scipy.stats import norm # For pnorm() equivalent (see line 349)
from scipy.stats import probplot # For qqnorm() equivalent (see line 367)
from scipy.stats import lognorm # For plnorm() equivalent (see line 429)
from scipy.stats import expon # For pexp() equivalent (see line 438)
from scipy.stats import gamma # For pgamma() equivalent (see line 453)
from scipy.stats import weibull_min # For pweibull() equivalent (see line 462)

#Problem 1.A
temp = [127, 125, 131, 124, 129, 121, 142, 151, 160, 125, 124, 123,
      120, 119, 128, 133, 137, 124, 142, 123, 121, 136, 140, 137,
      125, 124, 128, 129, 130, 122, 118, 131, 125, 133, 141, 125, 140, 131, 129, 126]
temp.sort()
np.median(temp)
#128

#Problem 1.B
```

```
#Any amount. It will not change the median


#Problem 1.C
np.mean(temp)
#Mean: 129.975
np.std(temp)
#Std Dev:8.8019

#Problem 1.D
plt.close()
plt.hist(temp, bins=15)
plt.xlabel('Temp')
plt.ylabel('Amount')
plt.show()
```



#Problem 1.E

plt.close()

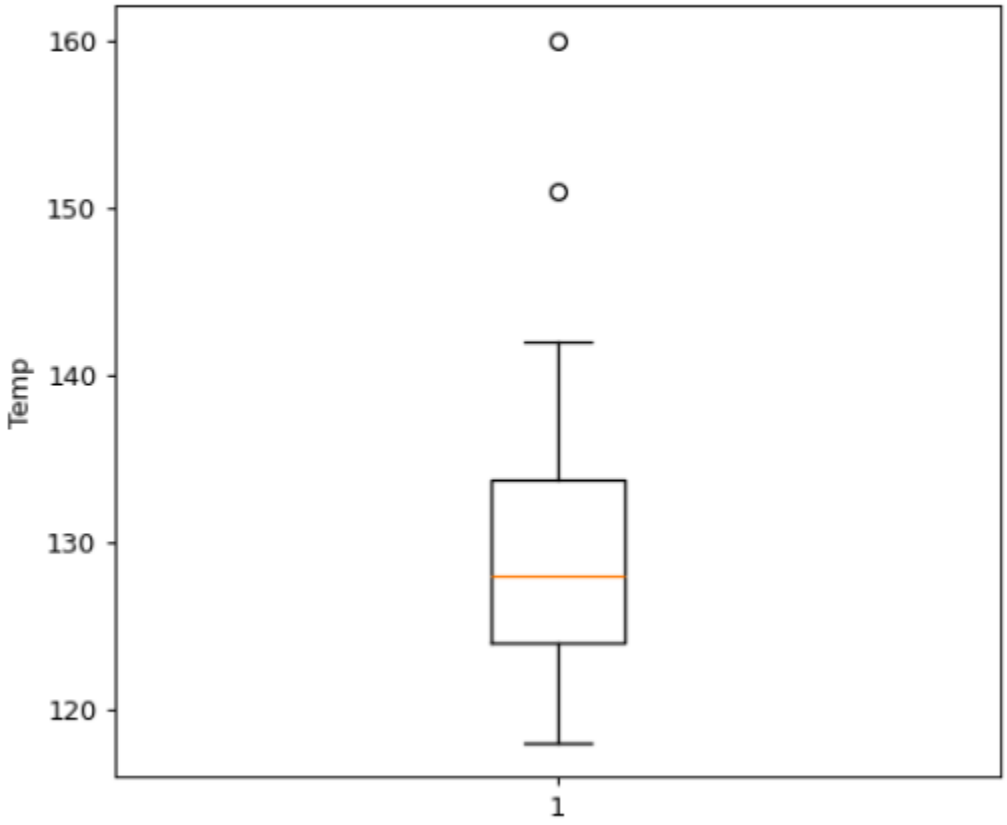
stemgraphic.stem_graphic(temp, scale=10, leaf_order=True)

plt.show()


```
#Problem 1.E

plt.close()

stemgraphic.stem_graphic(temp, scale=10, leaf_order=True)

plt.show()


#Problem 1.F

tempQuarts = np.quantile(temp, [.25, .75])

print(tempQuarts)

#124. 133.75
```

#Problem 1.G

```
plt.close()
plt.boxplot(temp)
plt.ylabel('Temp')
plt.show()
```



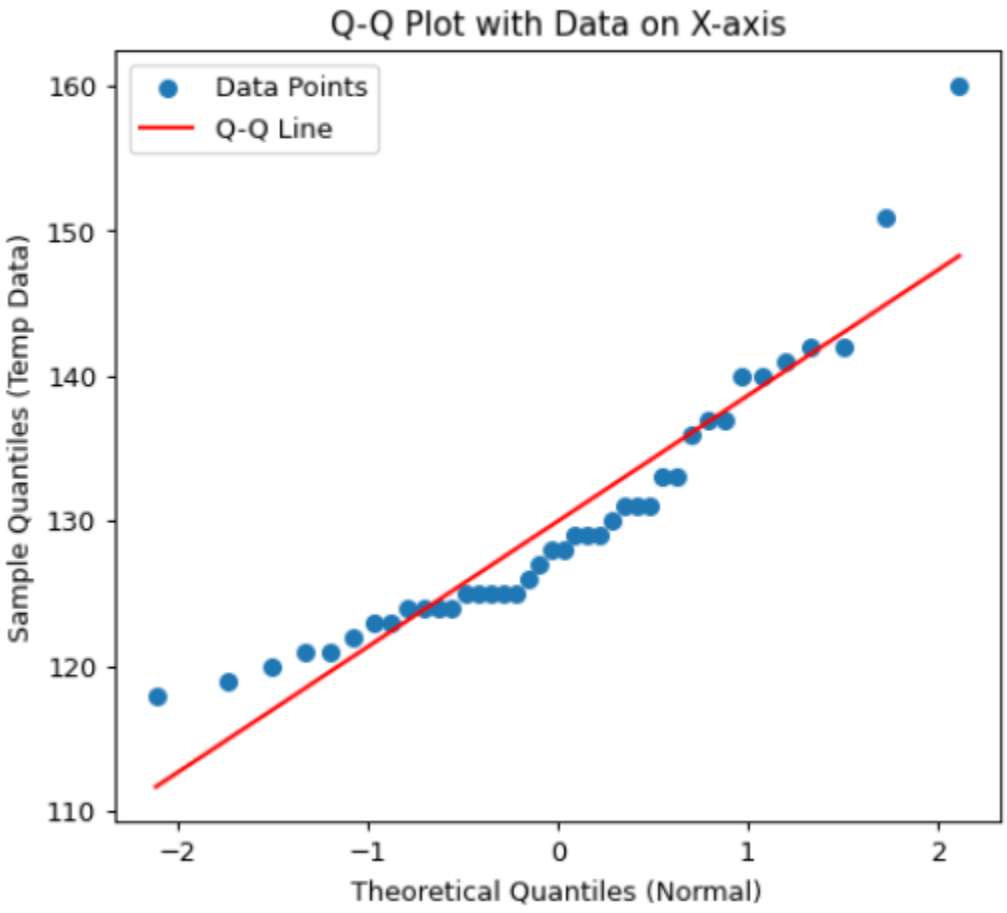
#Problem 1.H

#Right Leaning. Has 2 outliers.

#Problem 1.I

```
plt.close()
```

```
fig, ax = plt.subplots()

res = probplot(temp, dist="norm")

ax.scatter(res[0][0], res[0][1], label="Data Points")  # Scatter plot for octane data

ax.plot(res[0][0], res[1][1] + res[1][0] * res[0][0], color="red", label="Q-Q Line")  # Reference line

ax.set_title("Q-Q Plot with Data on X-axis")

ax.set_ylabel("Sample Quantiles (Temp Data)")

ax.set_xlabel("Theoretical Quantiles (Normal)")

ax.legend()

plt.show()

#Yes. The data that isn't an outlier lay on the line for the most part.
```



```
#Problem 2.A
n = 3
p = .15
prob = geom.pmf(k=n, p=p)
print(prob)
#.108375

#Problem 2.B
#1/p or 6.6667 patients

#Problem 2.C
n = 50
k = 10
p = .15
prob = binom.pmf(k,n,p)
print(prob)
#.088989

#Problem 3.A
N = 25
n = 5
D = 2
prob = hypergeom.pmf(0, N, D, n)
print(prob)
#.6333333
```

```
#Problem 3.B
p = D/N
prob = binom.pmf(0, n, p)
print(prob)
#.65908. Yes it's probably fine, relatively close to the other one

#Problem 3.C
N=150
p=D/N
prob = hypergeom.pmf(0, N, D, n)
print(prob)
prob = binom.pmf(0, n, p)
print(prob)
#Yes! they are .934 and .935 respectively. it's even better.

#Problem 3.D
N = 25
p = .95
D = 5
x = range(1, N+1)
for n in x:
  prob = hypergeom.pmf(0,N,D,n)
  if 1-prob >= p:
    print(n)
    break
#should sample 11 items.
```

```
#Problem 4
n = 1000
p = .1
x = range(0, n+1)
prob = [poisson.pmf(k, p) for k in x]
print(1-prob[0])
#.09516

#Problem 5
u = 5000
std = 50
p = .005
x = norm.ppf(p, loc = u, scale = std)
print(x)
#4871.2

#Problem 6.A
rate = .1
scale = 1/rate
x = 48
prob = expon.cdf(x, scale=scale)
print(prob)
#.99177

#Problem 6.B
```

```
x = 5
prob = 1 - expon.cdf(x, scale=scale)
print(prob)
#.60653

#Problem 7.A
u = 100
std = 2
ll = 97
ul = 102
proportion = norm.cdf(ul, loc=u, scale=std) - norm.cdf(ll, loc=u, scale=std)
print(proportion)
#77.45%

#Problem 7.B
x = np.arange(0, 201, .01)
llCost = [norm.cdf(ll, loc=k, scale=std) for k in x]
ulCost = [(1 - norm.cdf(ul, loc=k, scale=std)) * 5 for k in x]
table = pd.DataFrame({'llCost': llCost, 'ulCost': ulCost})
sumTable = table['ulCost'] + table['llCost']
minMean = sumTable.idxmin()/100
print(minMean)
#98.21 should minimize

#Problem 8
#using Normal Dist cause n is "large"
```

```
p = 12/38

n = 50

u = n*p

k = 12

std = np.sqrt(u*(1-p))

prob = 1 - norm.cdf(k, loc=u, scale=std)

print(prob)

#.87553
```