You can ignore this, this is just initial setup

In [1]:

```
import pandas as pd
import seaborn as sns
import math
```

Section 3.4

PROBLEM 17 a:

Calculate bins using squareroot of number of rows for number of bins.

In [2]:

```
#Initialize dataframe, sort by closing price
NasdaqDF = pd.DataFrame({
    'Stock' : ['Citigroup (C)','Pfizer(PFE)','Herbalife(HLF)', 'JP Morgan Ch
    'Closing Price($)' : [34.7,22.34,69.72,44.34,28.07,60.67,31.52,66.17,24.
}).set_index('Stock').sort_values('Closing Price($)')

def calculateBins(df = pd.DataFrame(), column = ""):
    bins = [0]
    #df is already sorted descending by price, so df[column].iloc(df.size-1)
    numOfClasses = round(math.sqrt(df.size))
    classWidth = math.ceil((df[column].iloc[df.size-1] - df[column].iloc[0])
    #indexing starts at 0 so I added a 1 to make sure the number of bins rem
    for i in range(numOfClasses + 1):
        bins.append(classWidth + bins[i])
    return bins

bins  = calculateBins(NasdaqDF, 'Closing Price($)')
df = NasdaqDF.apply(pd.Series.value_counts, bins = bins).sort_index()
df
```

Out[2]:

	Closing Price($)
(-0.001, 51.0]	10
(51.0, 102.0]	3
(102.0, 153.0]	0
(153.0, 204.0]	0
(204.0, 255.0]	1

For this output the lower limit is an open interval so (-.001, 51.0] is actually 0 to 51 and (51, 102] approaches from the upper side but does not include 51.

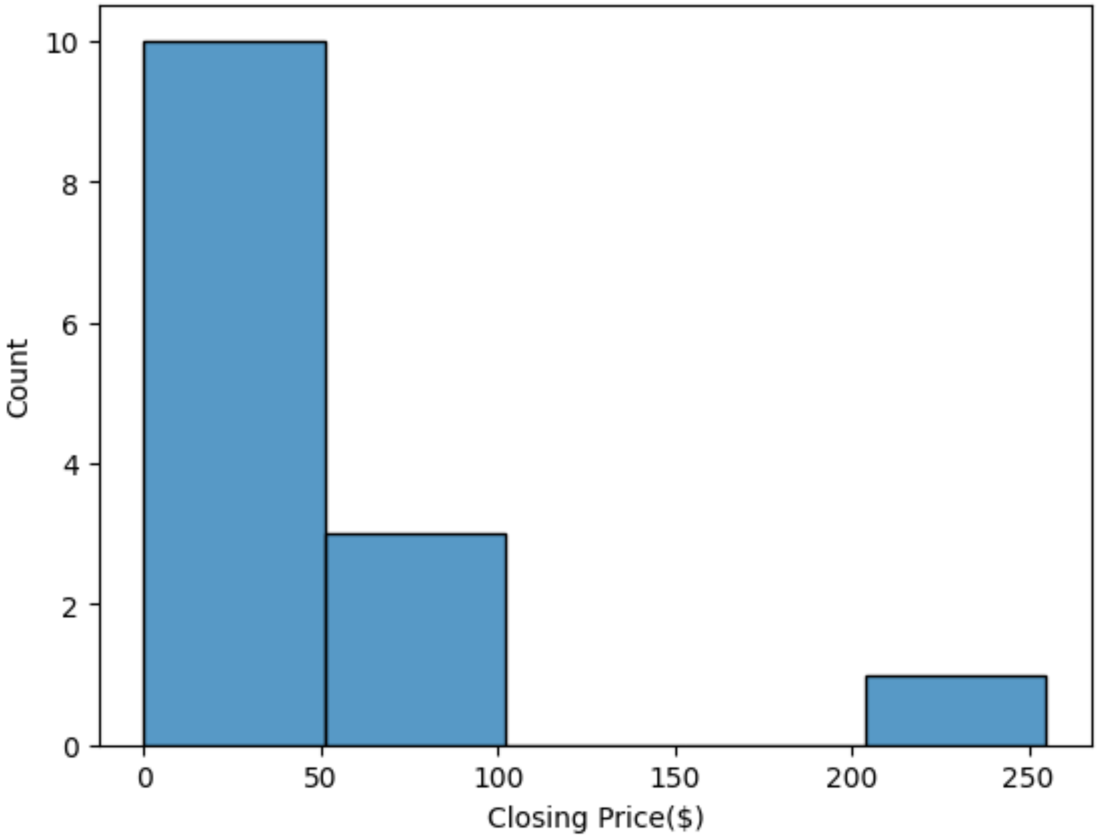
PROBLEM 17 b

In [3]:

```
sns.histplot(NasdaqDF, x='Closing Price($)', bins= bins)
```

Out[3]:

```
<Axes: xlabel='Closing Price($)', ylabel='Count'>
```



PROBLEM 19 a:

Initialize the dataframe, sort by calories descending:

```
In [4]: calDf = pd.DataFrame({ 'Calories' : [34,18,33,25,30,42,40,33,39,40,45,35,45,
```

I will reuse my frequency distribution function, spent way too long on it not to.

```
In [5]: bins  = calculateBins(calDf, 'Calories')
        calBins = calDf.apply(pd.Series.value_counts, bins = bins).sort_index()
        calBins.head()
```

Out[5]:

	Calories
(-0.001, 6.0]	0
(6.0, 12.0]	0
(12.0, 18.0]	1
(18.0, 24.0]	2
(24.0, 30.0]	7

PROBLEM 19 b:

This loops through calBins, calculates the relative frequency for each row and then creates a new dataframe name relFreqDf based off of calBins. then adds a column for the relative frequency to hold the relative frequency data.

In [6]:

```
totalOccurances = calDf['Calories'].sum()
relFreqDf = calBins
relFreq = []

for frequency in calBins['Calories']:
    relFreq.append(frequency/totalOccurances)

relFreqDf['Relative Frequency'] = relFreq
relFreqDf
```

Out[6]:

	Calories	Relative Frequency
(-0.001, 6.0]	0	0.000000
(6.0, 12.0]	0	0.000000
(12.0, 18.0]	1	0.001217
(18.0, 24.0]	2	0.002433
(24.0, 30.0]	7	0.008516
(30.0, 36.0]	8	0.009732

PROBLEM 21 a:

WRITTEN ANSWER: The data possesses a ratio and interval level of measurement.

Initialize and sort dataframe.

In [7]:

```
dailyChargesDf = pd.DataFrame({
    'Daily Charges' : [125,135,148,156,248,215,156,148,135,149,
                     178,156,135,125,214,256,258,265,156,148,
                     123,147,189,199,189,248,215,259,158,235,
                     268,269,158,198,147,258,269,239,288,199,
                     179,179,189,169,258,178,257,249,259,259]
}).sort_values('Daily Charges')
for i in dailyChargesDf['Daily Charges']:
    print(i)
```

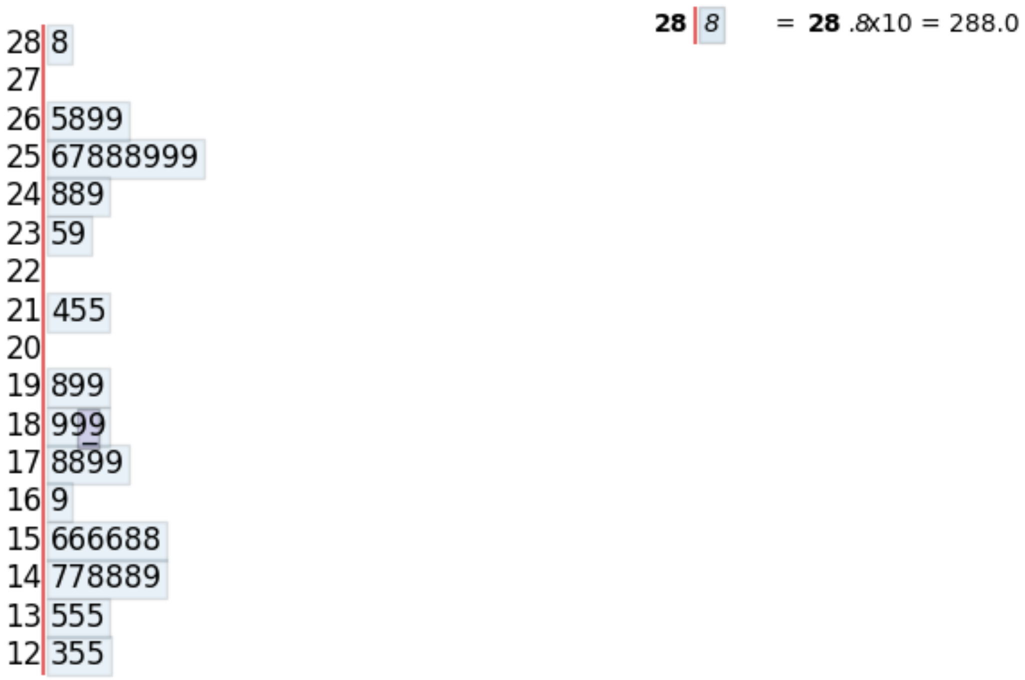
```
123
125
125
135
135
135
147
147
148
148
148
149
156
156
156
156
158
158
169
178
178
179
179
189
189
189
198
199
199
214
215
215
235
239
248
248
249
256
257
258
258
258
259
259
259
265
268
269
269
288
```

PROBLEM 21 b:

Using python library stemgraphic:

In [8]:
```
import stemgraphic
stemgraphic.stem_graphic(dailyChargesDf['Daily Charges'], aggregation=False,
```

Out[8]:
```
(<Figure size 750x500 with 1 Axes>, <Axes: >)
```



```
28 | 8
27 |
26 | 5899
25 | 67888999
24 | 889
23 | 59
22 |
21 | 455
20 |
19 | 899
18 | 999
17 | 8899
16 | 9
15 | 666688
14 | 778889
13 | 555
12 | 355
```

PROBLEM 21 c:

WRITTEN ANSWER: It looks like a bimodal distribution

SECTION 4.1

PROBLEM 22 a

Find the mean:

In [9]:
```
csvDf = pd.read_csv('MTA2.csv').set_index('Year')
csvDf['On Course'].mean()
```

Out[9]:
```
7.450952380952383
```

PROBLEM 22 b:

Find the median:

In [10]:
```
csvDf['On Course'].median()
```

Out[10]:
```
7.68
```

PROBLEM 22 c:

Find the mode

In [11]:

```
csvDf['On Course'].mode()
```

Out[11]:

```
0      0.11
1      0.55
2      0.61
3      0.89
4      2.07
5      2.29
6      2.38
7      2.93
8      6.37
9      6.70
10     7.68
11     7.74
12     7.77
13     8.29
14     9.12
15    11.03
16    11.94
17    11.99
18    12.09
19    21.02
20    22.90
Name: On Course, dtype: float64
```

Pandas is returning 21 modes because there is no mode

PROBLEM 22 d:

In [12]:

```
from scipy import stats
print("0.1 Trimmed Mean: " + str(stats.trim_mean(csvDf,0.1)[0]))
print("Mean: " + str(csvDf['On Course'].mean()))
print("Median: " + str(csvDf['On Course'].median()))
```

```
0.1 Trimmed Mean: 6.581764705882353
Mean: 7.450952380952383
Median: 7.68
```

WRITTEN ANSWER: Trimmed mean is less than median and mode meaning that there are high end outliers

PROBLEM 22 e:

WRITTEN ANSWER: Median is more than mean meaning it is negative skewed

SECTION 4.2

PROBLEM 14 a, b, c:

In [13]:
```
batteryFailures = pd.DataFrame({
    "years until failure": [5,3,4,6,2,5,7,10,8,4]
})
min = batteryFailures["years until failure"].min()
max = batteryFailures["years until failure"].max()
print("sample variance: "+ str(batteryFailures['years until failure'].var())
print("standard deviation: " + str(batteryFailures["years until failure"].st

print("range: " + str(max-min))
```

```
sample variance: 5.822222222222222
standard deviation: 2.4129281427805145
range: 8
```

PROBLEM 14 d:

WRITTEN ANSWER: Could be from manufacturing defects, climate, operator error, or car electrical system differences

SECTION 5.1

PROBLEM 22 a

In [14]:
```
rolls = pd.DataFrame({
    "rolls" : [1,2,1,3,1,4,1,5,6,3,1,3,1,5,1,2,1,3,1,2,1,2,2,1,3,5,1,2,1,2,1
})

bins  = calculateBins(rolls, 'rolls')
rollBins = rolls.apply(pd.Series.value_counts, bins = bins).sort_index()


totalOccurances = rollBins['rolls'].sum()
relFreqDf = rollBins
relFreq = []

for frequency in rollBins['rolls']:
    relFreq.append(frequency/totalOccurances)

df = pd.DataFrame({
    "roll outcome" : [1,2,3,4,5,6],
    "relative frequency" : [relFreq[0], relFreq[1],relFreq[2],relFreq[3],rel
}).set_index("roll outcome")
df
```

Out[14]:

	relative frequency
roll outcome	
1	0.424242
2	0.212121
3	0.151515
4	0.060606
5	0.090909
6	0.060606

Probabilities:

1: 42%

2: 21%

3: 15%

4: 6%

5: 9%

6: 6%