IndiaMart Hackathon- Phase 1

June 2, 2019

This notebook is a working prototype solution to gauge the appropriate unit wise price range for the 3 categories(Gloves,Kurtas,Drills) based on their units by removing outliers from the data.

Instructions for running this notebook

- Jupyter notebook is needed to run this notebook, if it is not available, Please use Colab from google to run it.
- required libraries to run this notebook are pandas,numpy,seaborn and scipy.
- Incase you are running this notebook please make sure all **.csv** files are uploaded

```
In [0]: import pandas as pd
        import matplotlib.pyplot as plt
        import seaborn as sns
        import numpy as np
        from scipy.stats import norm
        from scipy.signal import argrelextrema
        from scipy import stats
```

We can import the required data either from the folder or our git repository. The given .xlsx file is split into Three parts and and converted to .csv file which is easy to handle.

```
In [0]: try:
            drilldf = pd.read_csv('./phaseone-drill.csv')
            glovedf = pd.read_csv('./phaseone-gloves.csv')
            kurtadf = pd.read_csv('./phaseone-kurta.csv')
        except:
            try:
                drilldf = pd.read_csv('https://raw.githubusercontent.com/nik299/IndiaMart-Hackat
                glovedf = pd.read_csv('https://raw.githubusercontent.com/nik299/IndiaMart-Hackat
                kurtadf = pd.read_csv('https://raw.githubusercontent.com/nik299/IndiaMart-Hackat
            except:
                print("no file found and no internet connection")
```

The following piece of code prints out all unique units of the three item given.

```
In [3]: drill_units=drilldf['Unit'].unique()
        print(drill_units,'drills')
        glove_units=glovedf['Unit'].unique()
        print(glove_units,'gloves')
        kurta_units=kurtadf['Unit'].unique()
        print(kurta_units,'kurtas')
```

```
['Piece' 'Piece(s)' 'pack' 'unit' 'Number' 'Unit' 'Pack' '1nos' 'Unit(s)'
 'kit' 'Set' 'Pc_Onwards' 'ONWARDS' 'Kit'] drills
['Pair' 'Piece' 'pack' 'Unit' 'Pack' 'Unit/Onwards' 'Pair(s)' 'unit' 'Set'
 'Pieces'] gloves
['Piece' 'dollar' 'Packet' 'piece' 'Meter' 'Piece(s)' 'Set' 'Per piece'
 'Unit' '1' '1pc' 'Box' '170 per peice' 'Unstitch' 'Barrel' 'Carton'
 'peice' 'Pieces' 'Sets' 'Unit(s)' 'one' 'Bag' 'Selfie Kurtis' 'Pack'
 'Pair' 'Pound' 'Peice' '1piece' 'No' 'Kilogram' 'Number' "40' Container"
 'pack' '100 pic' 'Year' "20' Container" 'Pcs' 'Piece(s) Onwards' 'One'
 'kurtI' 'Ounce' 'onwards' '10-10000' 'per piese' 'Day' 'Set(s)'
 '12 units' '1pis' 'Onwards' 'One peace' 'Set(S)' 'Pair piece' 'Ounce(s)'
 'Packet(s)' 'Single' 'one pcs' 'Pc' '4 pcs' '4 units' '5' 'set' 'kurti'
 'pcs' 'pices' 'Pics' 'single piece' 'pi' 'per piece' 'Kurti' 'one unit'
 '1 piece' '1 pice' 'Suit' 'pair piece' '10' 'pieces' '1pcs' '1 pc'
 '3 set' 'Xl size' '1000 per unit' '1pcd' 'Psc' 'Gram' 'Rs' 'in' '1 pcs'
 'Feet' 'onepices'] kurtas
```

0.1 Cleaning Data

0.1.1 Impact Drill

First we will check count of each unique unit.

```
In [4]: drilldf['Unit'].value_counts()
```

```
Out[4]: Piece          119
        pack            47
        unit            25
        Unit            17
        Number          14
        Pack             9
        Pc_Onwards       5
        Piece(s)         5
        kit              1
        Kit              1
        Unit(s)          1
        1nos             1
        ONWARDS          1
        Set              1
        Name: Unit, dtype: int64
```

Following units are unsignificant in Impact Drill dataframe.
'Pc_Onwards', 'ONWARDS', 'Set', 'Kit', 'kit'
We have to remove them.

```
In [0]: removal=['Pc_Onwards', 'ONWARDS', 'Set', 'Kit', 'kit']
        for each in removal:
            drilldf=drilldf.drop(drilldf[(drilldf['Unit']==each)].index)
```

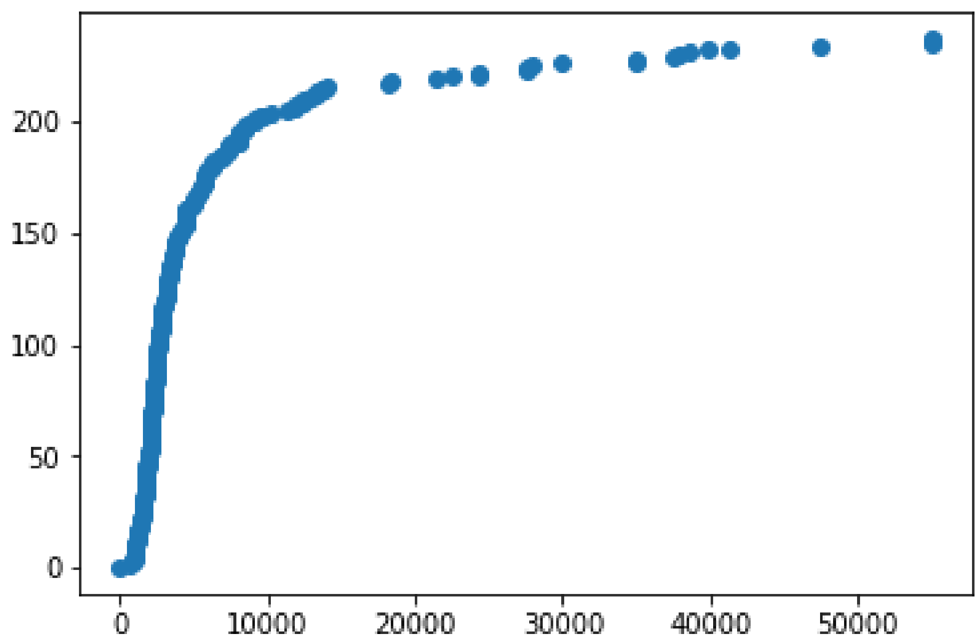
Let us assume that all other units, are trying to represent a single piece of impact drill. So, drill dataframe is cleaned. Below table represents the description of data.

```
In [6]: drilldf.describe()
```

```
Out[6]:               Price
        count    238.000000
        mean    6571.428571
        std     9709.722619
        min        2.000000
        25%     2100.000000
        50%     2999.500000
        75%     5939.000000
        max    55000.000000
```

This is a normal scatter plot of Price.

```
In [7]: array=np.arange(238)
        plt.scatter(drilldf['Price'],array);
```



0.1.2 Leather safety gloves

Let us know the count of each unique unit.

```
In [8]: glovedf['Unit'].value_counts()
```

```
Out[8]: Pair            113
        unit              9
        Piece             6
        pack              5
        Pack              3
        Unit              3
        Pair(s)           2
        Pieces            1
        Unit/Onwards      1
        Set               1
        Name: Unit, dtype: int64
```

Some of the above units like 'Pack', 'Set', 'pack' are unsignificant as we do not know how many are inside that. 'Unit/Onwards' is also unsignificant as that is like a starting range for the product. We assume remaining all units 'Pair', 'Piece', 'pack', 'Unit','Pair(s)' 'unit', 'Pieces' are trying to represent the same, which is 'Pair', a pair of leather gloves.

```
In [0]: glovedf=glovedf.drop(glovedf[(glovedf['Unit']=='Pack')].index)
        glovedf=glovedf.drop(glovedf[(glovedf['Unit']=='pack')].index)
        glovedf=glovedf.drop(glovedf[(glovedf['Unit']=='Set')].index)
```

Let us know the mean price of each significant unit.

```
In [10]: for each in glove_units:
             print(each,glovedf[glovedf['Unit']==each]['Price'].mean())
```

```
Pair 102.5575221238938
Piece 136.66666666666666
pack nan
Unit 318.6666666666667
Pack nan
Unit/Onwards 100.0
Pair(s) 315.0
unit 2442.777777777778
Set nan
Pieces 695.0
```

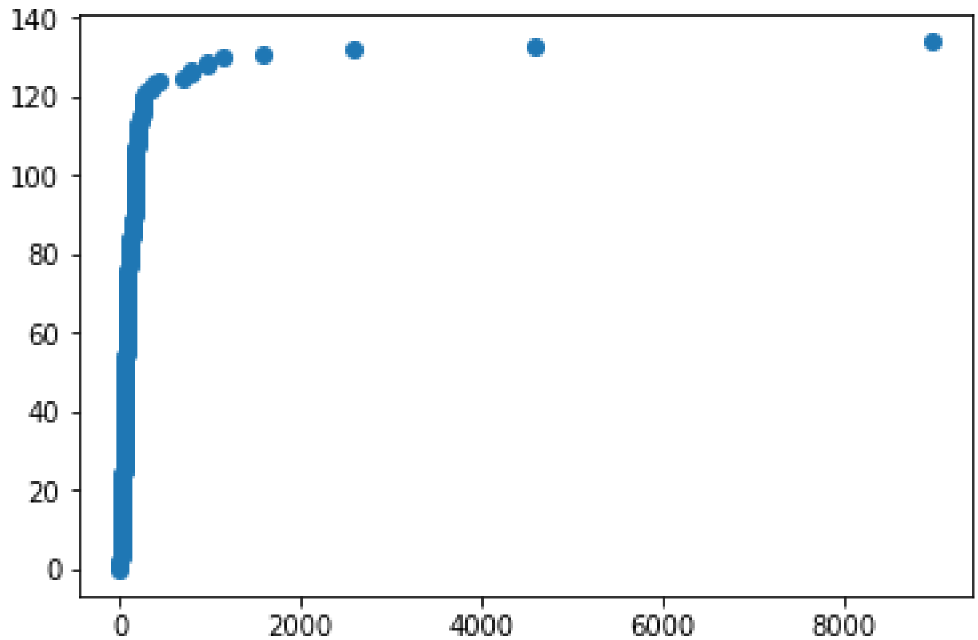
Below table represents the description of data.

```
In [11]: glovedf.describe()
```

```
Out[11]:              Price
         count   135.000000
         mean    272.407407
         std     898.047453
         min      10.000000
         25%      50.000000
         50%      90.000000
         75%     180.000000
         max    8978.000000
```

This is a normal scatter plot of Price.

```
In [12]: array=np.arange(135)
         plt.scatter(glovedf['Price'],array);
```



0.1.3 Ladies Kurta

In kurta dataframe, there are many meaningless units (Unsignificant to be specific). Those are 'dollar', 'Packet', 'Meter', 'Set', 'Box', '170 per peice', 'Unstitch', 'Barrel', 'Carton', 'Sets', 'Bag', 'Selfie Kurtis', 'Pack', 'Pair', 'Pound', 'Kilogram', "40' Container", 'pack', '100 pic', 'Year', "20' Container", 'Ounce', '10-10000', 'Day', 'Set(s)', 'Set(S)', 'Pair piece', 'Ounce(s)', 'Packet(s)', 'set', 'Suit', 'pair piece', '3 set', 'Gram', 'Rs', 'Feet', '1000 per unit','in','5','10','Piece(s) Onwards','onwards','Onwards','Xl size'. Let us remove them all.

```
In [0]: removal=['dollar', 'Packet', 'Meter', 'Set', 'Box', '170 per peice', 'Unstitch', 'Barrel

In [0]: for each in removal:
            kurtadf=kurtadf.drop(kurtadf[(kurtadf['Unit']==each)].index)

In [15]: kurta_units=kurtadf['Unit'].unique()
         print(kurta_units,'kurtas')

['Piece' 'piece' 'Piece(s)' 'Per piece' 'Unit' '1' '1pc' 'peice' 'Pieces'
 'Unit(s)' 'one' 'Peice' '1piece' 'No' 'Number' 'Pcs' 'One' 'kurtI'
 'per piese' '12 units' '1pis' 'One peace' 'Single' 'one pcs' 'Pc' '4 pcs'
 '4 units' 'kurti' 'pcs' 'pices' 'Pics' 'single piece' 'pi' 'per piece'
```

```
'Kurti' 'one unit' '1 piece' '1 pice' 'pieces' '1pcs' '1 pc' '1pcd' 'Psc'
'1 pcs' 'onepices'] kurtas
```

Some units like '4 pcs', '4 pieces', '12 units' are unsignificant, but they contain significant information about the price. We can divide the price by 4 for the unit '4 pcs' to know the price of each.

```
In [0]: kurtadf.loc[(kurtadf['Unit']=='4 units'),'Price']=kurtadf.loc[(kurtadf['Unit']=='4 units
        kurtadf.loc[(kurtadf['Unit']=='4 pcs'),'Price']=kurtadf.loc[(kurtadf['Unit']=='4 pcs'),'
        kurtadf.loc[(kurtadf['Unit']=='12 units'),'Price']=kurtadf.loc[(kurtadf['Unit']=='12 uni
```

Let us know the count of each unique and significant unit.

```
In [17]: kurtadf['Unit'].value_counts().head(15)

Out[17]: Piece        3334
         Piece(s)      500
         1              76
         Unit           63
         piece          38
         No             37
         Number         23
         Pieces         13
         Unit(s)        11
         one             3
         1piece          3
         Psc             3
         kurti           3
         peice           3
         1pc             3
         Name: Unit, dtype: int64
```

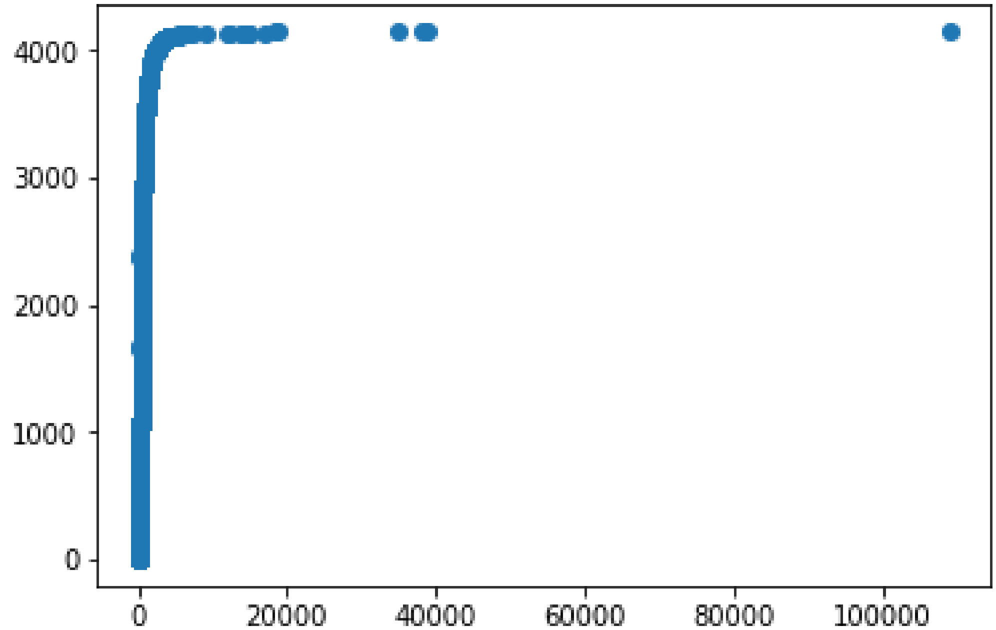
Let us find the mean price for each unit.

```
In [18]: kurtadf.describe()

Out[18]:              Price
         count    4149.000000
         mean      787.490600
         std      2178.518976
         min         1.000000
         25%       325.000000
         50%       500.000000
         75%       800.000000
         max    109000.000000
```

This is a normal scatter plot of Price.

```
In [19]: array=np.arange(4149)
         plt.scatter(kurtadf['Price'],array);
```



0.2 Removing Outliers : Calculating Z-score

Z-score is meausure of how much given sample is deviating compared to Standaed deviation. In python the function is available in scipy.stats which we are using in the following cells.

Note: we are calculating only absolute values as sign of z-score doesn't matter in finding outliers.

```
In [0]: drill_z = np.abs(stats.zscore(drilldf['Price']))
        glove_z = np.abs(stats.zscore(glovedf['Price']))
        kurta_z = np.abs(stats.zscore(kurtadf['Price']))
```

After obtaing z-score we are not considering all entries whse z-score is greater than 3 or less than -3 and also we are considering only some units values as unit conversion is not as indicative as the sugar example given.

```
In [0]: npa=drilldf[(drill_z < 3)]['Price']
        npa1=glovedf[(glove_z < 3)]['Price']
        npa2=kurtadf[(kurta_z < 3)]['Price'][:-1]
```

The following 3 cells describe the data taken for consideration

```
In [22]: drilldf[(drill_z < 3)].describe()
```

```
Out[22]:               Price
         count    229.000000
         mean    5049.799127
         std     5860.012946
         min        2.000000
         25%     2079.000000
         50%     2890.000000
         75%     5600.000000
         max    35000.000000
```

```
In [23]: glovedf[(glove_z < 3)].describe()
```

```
Out[23]:              Price
         count   133.000000
         mean    174.511278
         std     306.394962
         min      10.000000
         25%      50.000000
         50%      85.000000
         75%     180.000000
         max    2594.000000
```

```
In [24]: kurtadf[(kurta_z < 3)].describe()
```

```
Out[24]:              Price
         count  4134.000000
         mean    699.914006
         std     677.359663
         min       1.000000
         25%     325.000000
         50%     500.000000
         75%     800.000000
         max    6589.000000
```

The following cell is used to store standard deviation which is very important to calculate the bandwidth in later part

```
In [25]: stdev=np.std(npa)
         stdev1=np.std(npa1)
         stdev2=np.std(npa2)
         print(stdev,stdev1,stdev2)
```

```
5847.204158821012 305.2409282990938 671.135426301382
```

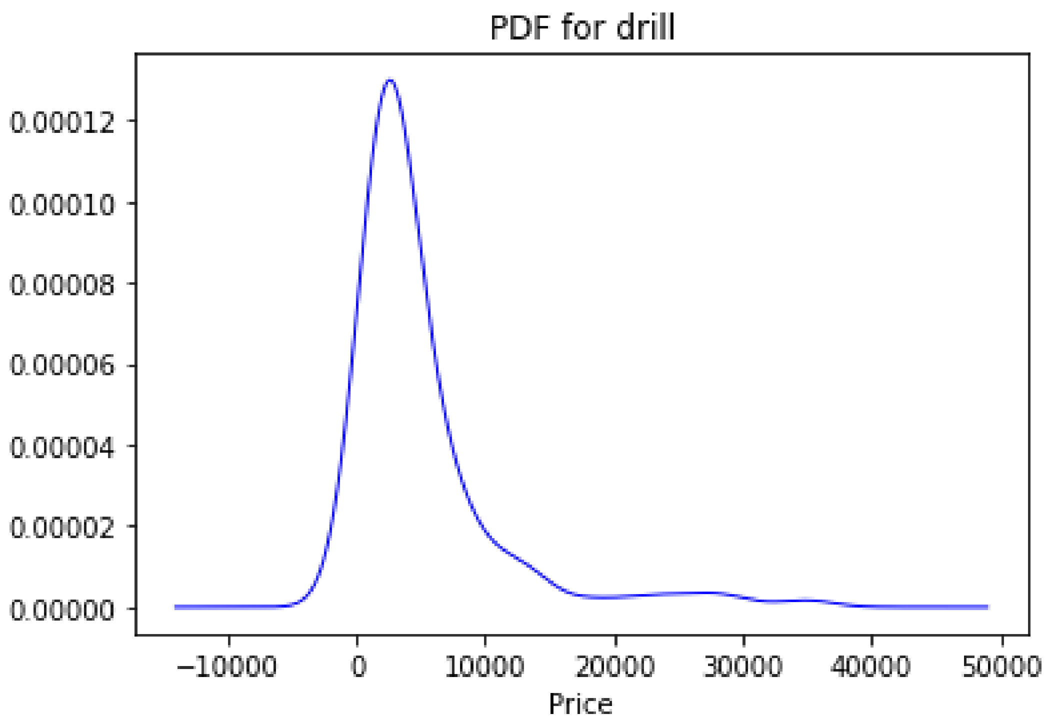
0.3 Kernel Density Estimation method for calculation of Probabilty Disribution Function

We are using probability distribution function for find ing require range as pdf is more suitable for finding relationship in general population.

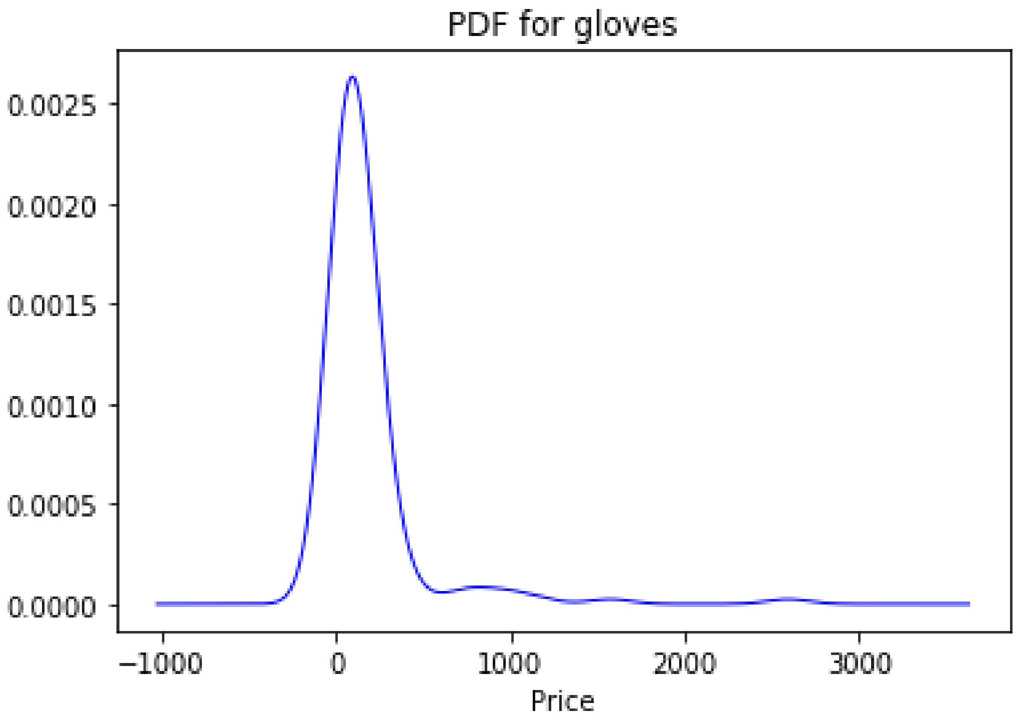
kernel Density Estimation is useful method for calculating pdf from discrete samples.

```
In [0]: from scipy.stats import gaussian_kde
        def kde_scipy(x, x_grid, bandwidth, **kwargs):
            """Kernel Density Estimation with Scipy"""
            # Note that scipy weights its bandwidth by the covariance of the
            # input data.  To make the results comparable to the other methods,
            # we divide the bandwidth by the sample standard deviation here.
            kde = gaussian_kde(x, bw_method=bandwidth / x.std(ddof=1), **kwargs)
            return kde.evaluate(x_grid)
```

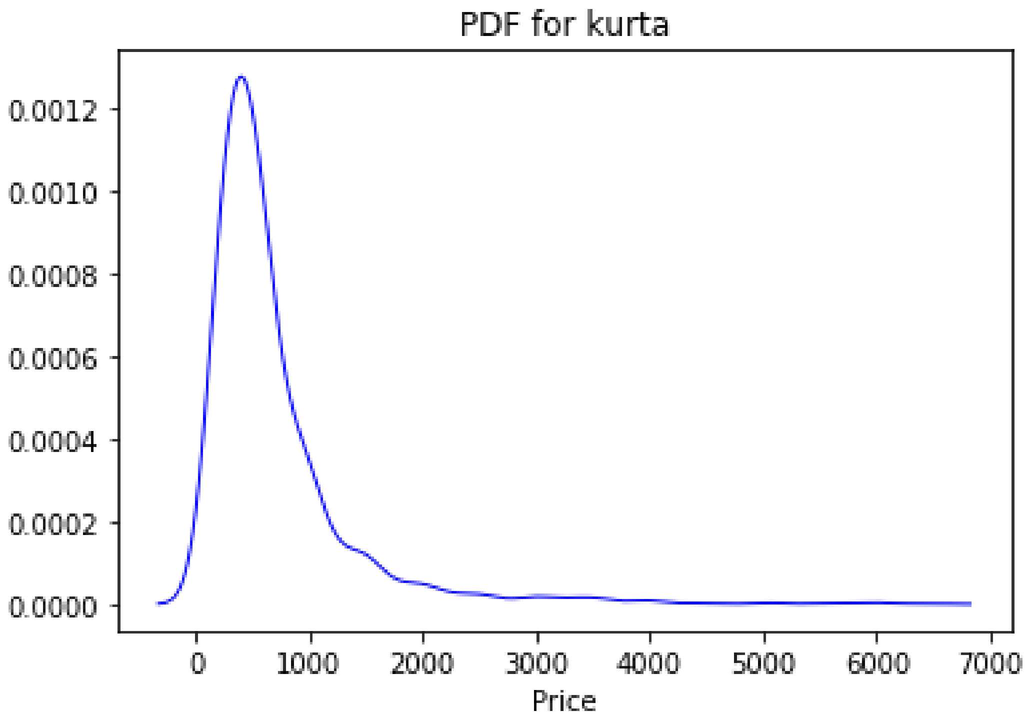
```
In [27]: y_grid=np.linspace(np.amin(npa)-(np.amax(npa)-np.amin(npa))*0.4,np.amax(npa)+(np.amax(n
         ideal=1.06*(np.std(npa))*((len(npa)**(-1/5)))
         pdf = kde_scipy(npa, y_grid, bandwidth=ideal)
         plt.plot(y_grid, pdf, color='blue', alpha=1, lw=1)
         plt.title('PDF for drill')
         plt.xlabel('Price')
         plt.show()
```




```
In [28]: y_grid1=np.linspace(np.amin(npa1)-(np.amax(npa1)-np.amin(npa1))*0.4,np.amax(npa1)+(np.a
         ideal1=1.06*(np.std(npa1))*((len(npa1)**(-1/5)))
         pdf1 = kde_scipy(npa1, y_grid1, bandwidth=ideal1)
         plt.plot(y_grid1, pdf1, color='blue', alpha=1, lw=1)
         plt.title('PDF for gloves')
         plt.xlabel('Price')
         plt.show()
```




```
In [29]: y_grid2=np.linspace(-(np.amax(npa2)-np.amin(npa2))*0.05,np.amax(npa2)*1.05,10000)
         ideal2=1.06*(np.std(npa2))*((len(npa2)**(-1/5)))
         pdf2 = kde_scipy(npa2, y_grid2, bandwidth=ideal2)
         plt.plot(y_grid2, pdf2, color='blue', alpha=1, lw=1)
         plt.title('PDF for kurta')
         plt.xlabel('Price')
         plt.show()
```




```
In [30]: w=((np.amax(npa)-np.amin(npa))*1.8)/10000
         w1=((np.amax(npa1)-np.amin(npa1))*1.8)/10000
         w2=((np.amax(npa2)-np.amin(npa2))*0.05+np.amax(npa2)*1.05)/10000
         print(np.sum(pdf)*w,np.sum(pdf1)*w1,np.sum(pdf2)*w2)
```

```
0.9998999999998275 0.9998999999999999 0.9998576396600676
```

```
In [31]: pdf_area=np.zeros(len(pdf)-1)
         for a in range(len(pdf_area)):
             pdf_area[a]=(pdf[a]+pdf[a+1])*(w/2)
         print(np.sum(pdf_area))
```

```
0.9998999999998258
```

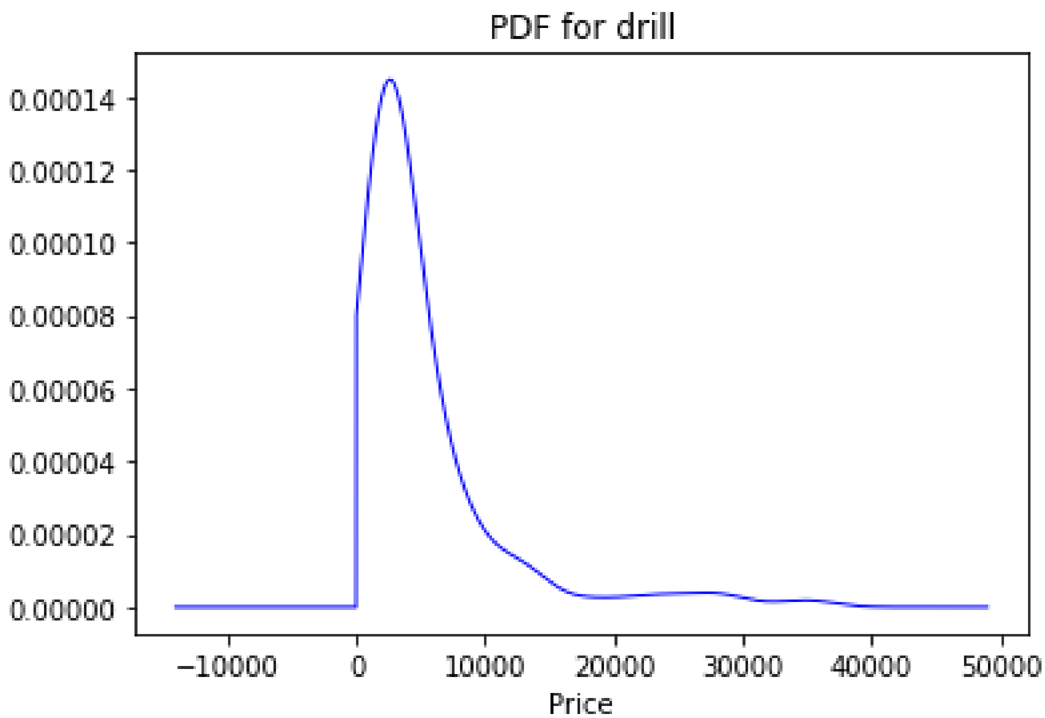
before going to calculation for area we need to make sure that probability of a product price below Rupees 0 is 0(for PDF calculated above we have finite probability for price less than 0) we can usee bayes theorem to re calculate the PDF.

$$PDF(x|Price > 0) = \frac{probab(x > 0) * PDF(x)}{probab(Price > 0)}$$

here PDF(x) is the pdf function
probab(price >0) is probabilty that price >0 which sum of area under pdf for price >0
probab(x>0) is eiter 1 or 0 depending on x

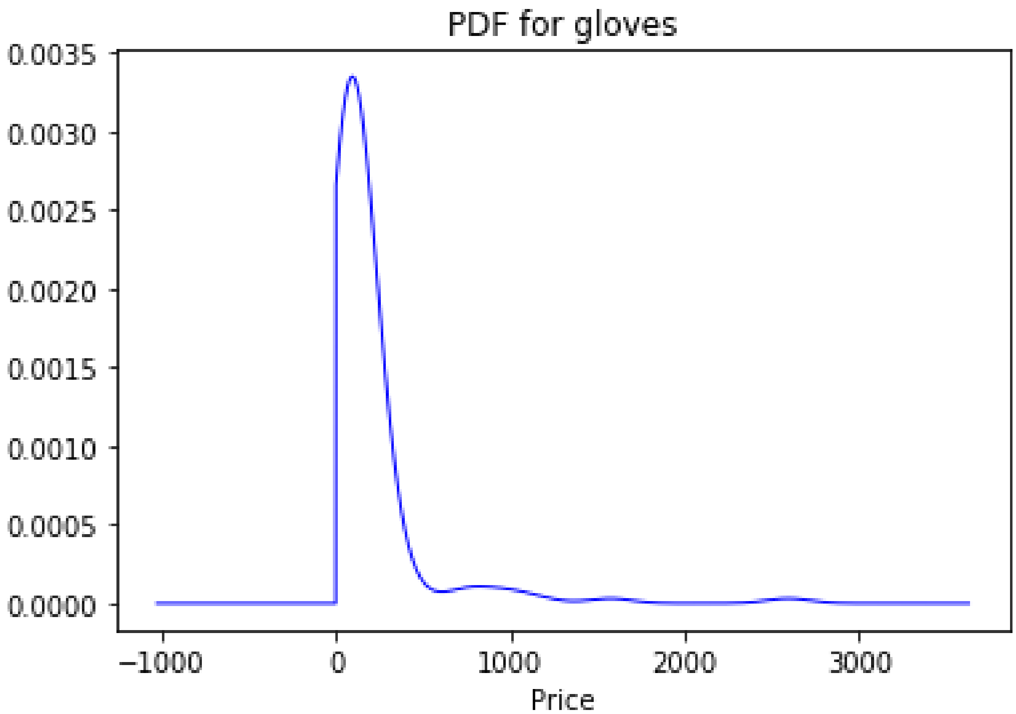
In [32]:
```
for a in range(len(pdf)):
    if y_grid[a] > 0:
        break
probab=np.sum(pdf[a:])*w
for a in range(len(pdf)):
    if y_grid[a] > 0:
        break
    pdf[a]=0
pdf=pdf/probab
print(np.sum(pdf)*w)
plt.plot(y_grid, pdf, color='blue', alpha=1, lw=1)
plt.title('PDF for drill')
plt.xlabel('Price')
plt.show()
```

```
1.0000000000000002
```

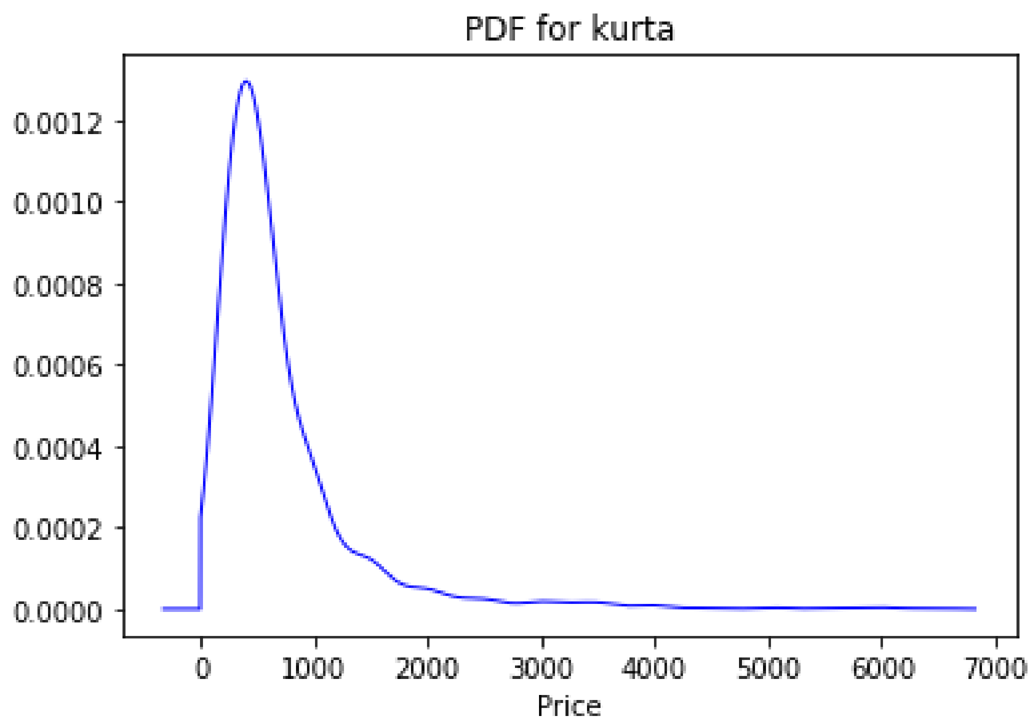


In [33]:
```
for a in range(len(pdf1)):
    if y_grid1[a] > 0:
        break
probab1=np.sum(pdf1[a:])*w1
for a in range(len(pdf1)):
    if y_grid1[a] > 0:
```

```
        break
    pdf1[a]=0
pdf1=pdf1/probab1
plt.plot(y_grid1, pdf1, color='blue', alpha=1, lw=1)
plt.title('PDF for gloves')
plt.xlabel('Price')
plt.show()
```




```
In [34]: for a in range(len(pdf2)):
             if y_grid2[a] > 0:
                 break
         probab2=np.sum(pdf2[a:])*w2
         for a in range(len(pdf2)):
             if y_grid2[a] > 0:
                 break
             pdf2[a]=0
         pdf2=pdf2/probab2
         plt.plot(y_grid2, pdf2, color='blue', alpha=1, lw=1)
         plt.title('PDF for kurta')
         plt.xlabel('Price')
         plt.show()
```



0.4 Range calculation from PDF

We used 2 methods for calculating a range. They are 1. Finding the smallest range which covers majority of the region (we can use range which covers 50%/60% (adjustable parameter) of the region). The advantage with this method is it ensures ranges is minimum.(Final method). 2. Finding the peak and finding a range which covers 50% of the area under pdf and having peak as mean point of that range(it means there is 50% chance for a product to be in that range) this ensures price which has maximum entries lies in that region.

0.4.1 Method 1

```
In [43]: qq1=len(pdf)
         for q in range(len(pdf)):
             for p in range(len(pdf)-(q+1)):
                 if np.sum(pdf[p:p+q+1])*w > 0.6:
                     print(np.sum(pdf[p:p+q+1])*w,p,q)
                     break
             if np.sum(pdf[p:p+q+1])*w > 0.6:
                 break
         print('This is the range obtained for drill ',max(min(npa),int(np.round((p)*w+np.amin(n
```

```
0.6000191161753164 2274 755
This is the range obtained for drill  328 to 5091
```

```
In [36]: qq2=len(pdf1)
         for q in range(len(pdf1)):
             for p in range(len(pdf1)-(q+1)):
                 if np.sum(pdf1[p:p+q+1])*w1 > 0.75:
                     print(np.sum(pdf1[p:p+q+1])*w1,p,q)
                     break
             if np.sum(pdf1[p:p+q+1])*w1 > 0.5:
                 break
         print('This is the range obtained for gloves ',max(min(npa1),int(np.round((p)*w1+np.ami
```

```
0.7506199138877543 2201 562
This is the range obtained for gloves  10 262
```

```
In [37]: qq3=len(pdf2)
         for q in range(len(pdf2)):
             for p in range(len(pdf2)-(q+1)):
                 if np.sum(pdf2[p:p+q+1])*w2 > 0.7:
                     print(np.sum(pdf2[p:p+q+1])*w2,p,q)
                     break
             if np.sum(pdf2[p:p+q+1])*w2 > 0.6:
                 break
         print('This is the range obtained for Kurta ',max(min(npa2),int(np.round((p)*w2-(np.ama
```

```
0.7000202105467744 589 994
This is the range obtained for Kurta  96 808
```

0.4.2 Method-2

Now we will proceed with the 2nd method(peak) we can improve this method by moving with different speed along both sides which can be determined from the graph

```
In [38]: f_peak=argrelextrema(pdf, np.greater)[0][0]
         for q in range(f_peak):
             if np.sum(pdf[f_peak-q:f_peak+q])*w > 0.5:
                 print(np.sum(pdf[f_peak-q:f_peak+q])*w,q)
                 break
         print('This is the range obtained for drill ',max(min(npa),int(np.round((f_peak-q)*w+np
```

```
0.5010423086461808 301
This is the range obtained for drill  731 4524
```

```
In [39]: f_peak1=argrelextrema(pdf1, np.greater)[0][0]
         q=0
         for q in range(f_peak1):
             if np.sum(pdf1[f_peak1-q:f_peak1+2*q])*w1 > 0.5:
                 print(np.sum(pdf1[f_peak1-q:f_peak1+2*q])*w1,q)
                 break
         print('This is the range obtained for gloves ',max(min(npa1),int(np.round((f_peak1-q)*w
```

```
0.5024022928134061 115
This is the range obtained for gloves  42 202
```

```
In [40]: f_peak2=argrelextrema(pdf2, np.greater)[0][0]
         for q in range(f_peak2):
             if np.sum(pdf2[f_peak2-q:f_peak2+q])*w2 > 0.5:
                 print(np.sum(pdf2[f_peak2-q:f_peak2+q])*w2,q)
                 break
         print('This is the range obtained for Kurta ',max(min(npa2),int(np.round((f_peak2-q)*w2
```

```
0.5002419663004121 302
This is the range obtained for Kurta  189 621
```

0.5 Conclusion

From the above two methods we can conclude the following points.

1. 1st method results in small differnce between minimum and maximum of the price range compared to 2nd method.
2. 2nd method can be improved by moving in different steps(eg : +p*q,-q compared to +q,-q)the parameter p can be determined from the shape of the graph.

Also we shouldn't allow our final answers go below the minimum or go above the maximum. That is made possible by above piece of code.

Final Ranges:
Impact Drill:
Minimum: 734
Maximum: 4524
Leather Safety Gloves:
Minimum: 10
Maximum: 262
Ladies Kurta
Minimum: 96
Maximum: 808