Cs 240

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Introduction:

We have some datas about basketball players and their properties. We should provide 3 question about these basketball datas. Then we are going to work about it.

Part 1 :

I determine 3 question ;

- Is there relationship between height of players and free throw made?
- Does free throw madeaffect the point that players got ?
- Is there any relationship between being all star players and points ?

I choose to analyse 2nd question which is “Does free throw made affect the point that players got ? “ . My hypothesis “ there is a strong corelation between them”, and i will try to prove my hypothesis.

Part 2:

```
In [85]: dataframe = pd.read_csv('basketball_players.csv')

In [86]: players_ftMade = dataframe['ftMade'].dropna()
         players_point = dataframe['points'].dropna()
```

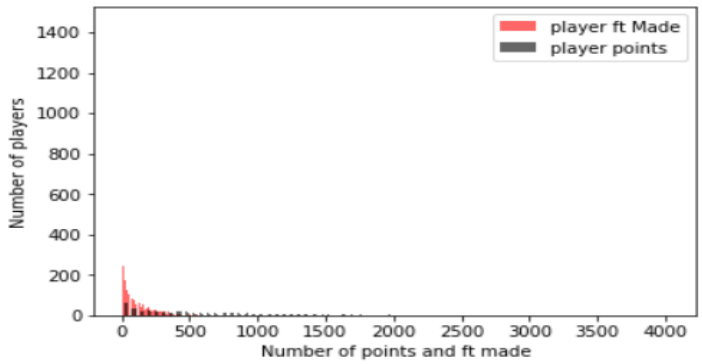
First of all, I define my data frame that I am going to use. I will use ‘basketball_players.csv’ file. Then I defined the columns that I am going to use. I will prove free throw made affect to points that got players. Then, i created two variable as a ‘players_ftMade’ and ‘players_point’.

Part 3 :

```
count    23751.000000
mean       492.130689
std        503.053318
min          0.000000
25%         81.000000
50%        329.000000
75%        758.500000
max       4029.000000
Name: points, dtype: float64

count    23751.000000
mean       101.443981
std        115.982538
min          0.000000
25%         15.000000
50%         60.000000
75%        148.000000
max        840.000000
Name: ftMade, dtype: float64
```

As you can see, I printed out some relevant statistics. Their mean and standard deviations are very close to each other. ‘count’ is very important for correlation and hypothesis testing.

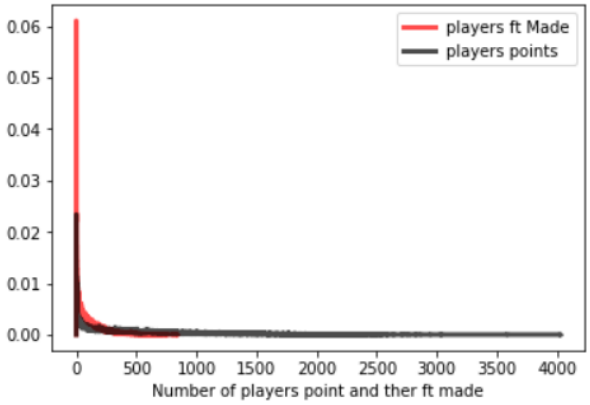
In [98]:
```
histogram = thinkstats2.Hist(players_ftMade, label = "player ft Made")
histogram_2 = thinkstats2.Hist(players_point, label = "player points")
thinkplot.Hist(histogram, color= "red",width = 0.9)
thinkplot.Hist(histogram_2, color = "black", width=0.5)
thinkplot.Show(xlabel= "Number of points and ft made",ylabel= "Number of players",label="upper left")
```




```
<matplotlib.figure.Figure at 0xe3f7810>
```

As you can see, this figure shows you the number of player frequency by number of player points and player free throw made. First I used the .Hist() function to find the frequencies of data. Then I used .PrePlot(2) function to draw to one graph but two values. Then I .Show the graph.

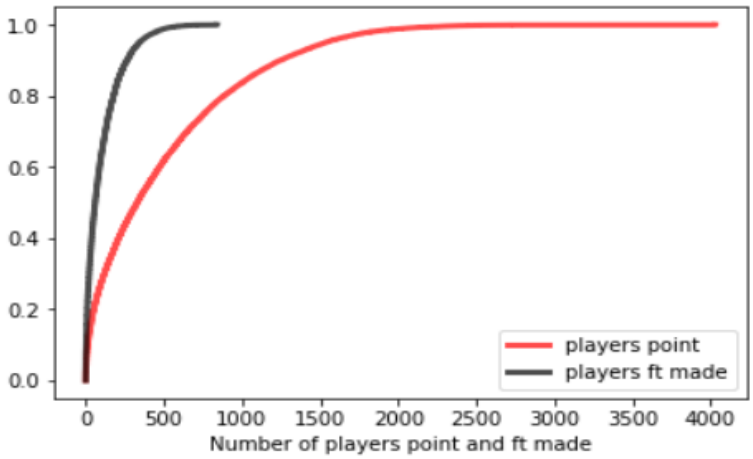
In [100]:
```
PMF = thinkstats2.Pmf(players_ftMade,label= "players ft Made")
PMF_2 = thinkstats2.Pmf(players_point, label = 'players points')
thinkplot.PrePlot(2)
thinkplot.Pmf(PMF, color= "red", align= 'right')
thinkplot.Pmf(PMF_2, color = "black", align= 'right')
thinkplot.Show(xlabel= "Number of players point and ther ft made", label= 'upper left')
```




```
<matplotlib.figure.Figure at 0xe6dcfb0>
```

The I used .Pmf() function to find probability of each number of players ft made and points. Then I draw it on graph with using the same steps on histogram graph. In this graph it's really difficult to compare the values between the lines. We can also use PercentileRank() function to compare a score with one of the data. You can check the codes. That function can show you, where are you in the distribution.

In [101]:
```
CDF = thinkstats2.Cdf(players_point, label= 'players point')
CDF_2 = thinkstats2.Cdf(players_ftMade, label= 'players ft made')
thinkplot.Cdf(CDF, color='red')
thinkplot.Cdf(CDF_2, color= 'black')
thinkplot.Show(xlabel= 'Number of players point and ft made',label='top')
```




```
<matplotlib.figure.Figure at 0x4164490>
```

To read CDF graph, we need to look up percentiles. But the figure on the left cannot give me enough details.

In [102]:
```
point_mean, point_std = players_point.mean() , players_point.std()
print ('Mean of point :'+ " " + str(point_mean) )
print ('Std of point :' + " " + str(point_std))
```

```
Mean of point : 492.130689234
Std of point : 503.05331777
```

In [53]:
```
ftmade_mean , ftmade_std = players_ftMade.mean() , players_ftMade.std()
print ('Mean of ft made: '+" "+ str(ftmade_mean))
print('Std of the ft made: '+" "+ str(ftmade_std))
```

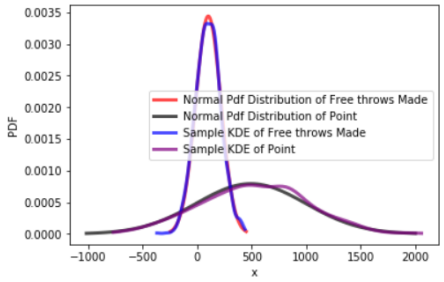
```
Mean of ft made:  101.443981306
Std of the ft made:  115.982537927
```

In [103]:
```
ftmade_mean , ftmade_std = players_ftMade.mean() , players_ftMade.std()
point_mean, point_std = players_point.mean() , players_point.std()

PDF = thinkstats2.NormalPdf(ftmade_mean, ftmade_std)
PDF_2 = thinkstats2.NormalPdf(point_mean, point_std)

def Median(xs):
    CDF = thinkstats2.Cdf(xs)
    return CDF.Value(0.5)

MEDIAN = Median(PDF)
MEDIAN_2 = Median(PDF_2)



print ('Median of Free throws Made :'  + str(MEDIAN))

print ('Median of Point :'  + str(MEDIAN_2))

print ('Density of Pdf of Free throws Made :' +str(PDF.Density(ftmade_mean+ ftmade_std)))

print ('Density of Pdf of Point :' +str(PDF_2.Density(point_mean+point_std)))
```

```
Median of Free throws Made :101.443981306
Median of Point :492.130689234
Density of Pdf of Free throws Made :0.0020862685784
Density of Pdf of Point :0.00048100413211
```

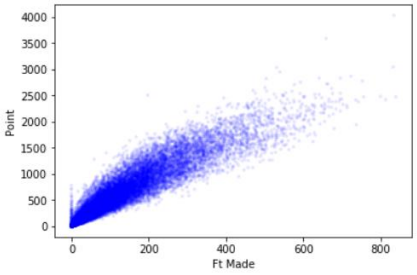
I found mean and std of point an ftMade. Then, i just used Median( ) to Median and Pdf for both of them.

In [104]:
```
thinkplot.Pdf(PDF, label='Normal Pdf Distribution of Free throws Made',color='red')
thinkplot.Pdf(PDF_2, label='Normal Pdf Distribution of Point',color='black')

SAMPLE = np.random.normal(ftmade_mean, ftmade_std, 1000)
SAMPLE_2 = np.random.normal(point_mean, point_std, 1000)

PDF_SAMPLE = thinkstats2.EstimatedPdf(SAMPLE)
PDF_SAMPLE_2 = thinkstats2.EstimatedPdf(SAMPLE_2)

thinkplot.Pdf(PDF_SAMPLE, label='Sample KDE of Free throws Made',color='blue')
thinkplot.Pdf(PDF_SAMPLE_2, label='Sample KDE of Point',color='purple')

thinkplot.Show(xlabel='x', ylabel='PDF')
```



This figure shows the normal probability distribution. Firstly we create two model for our data with using mean and standard deviation.

In [107]:
```
def Jitter(values, jitter=0.5):
    n = len(values)
    return np.random.normal(0, jitter, n) + values

Ft_made = Jitter(players_ftMade, 0.3)
Point = Jitter (players_point,0.3)

thinkplot.Scatter(Ft_made,Point, alpha=0.1, s=10)
thinkplot.Config(xlabel='Ft Made',
                 ylabel='Point',
                 legend=False)
```



In [115]:
```
thinkplot.Scatter(players_ftMade, players_point, alpha=1)
thinkplot.Config(xlabel='Number of Free throws Made',
                 ylabel='Number of Points',
                 title="Scatter Plot",
                 legend=False)
```

In [112]:
```
def Cov(xs, ys, meanx=None, meany=None):
    xs = np.asarray(xs)
    ys = np.asarray(ys)

    if meanx is None:
        meanx = np.mean(xs)
    if meany is None:
        meany = np.mean(ys)

    cov = np.dot(xs-meanx, ys-meany) / len(xs)
    return cov

def Corr(xs, ys):
    xs = np.asarray(xs)
    ys = np.asarray(ys)

    meanx, varx = thinkstats2.MeanVar(xs)
    meany, vary = thinkstats2.MeanVar(ys)

    corr = Cov(xs, ys, meanx, meany) / np.sqrt(varx * vary)
    return corr

print('Correlation is',Corr(players_point,players_ftMade)*100)
```

```
Correlation is 93.7150615465
```

In [114]:
```
print ('Covariance is ', Cov (players_ftMade,players_point)*100)
```

```
Covariance is  5467612.58424
```

In this part we are going to analyse the correlation between the player point and free throws made. Firstly, I plot the Scatter Plot graph with Scatter() and Jittering() function. I used Corr() function to do that. This function's output is telling the strength of relationship between two variables. Also Cov() function measure the tendency of two variables to vary together. Covariance is useful for some calculations but it doesn't mean much by itself.

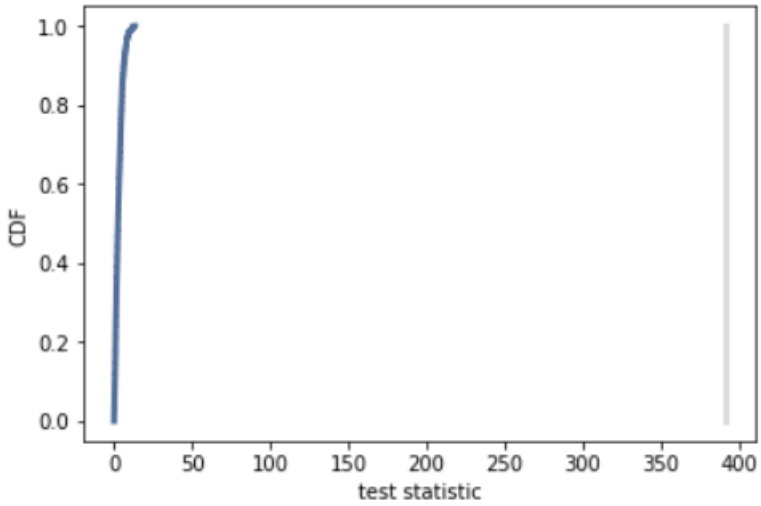
In [79]:
```
class DiffMeansPermute(thinkstats2.HypothesisTest):

    def TestStatistic(self, data):
        Group, Group1 = data
        Test_start = abs(Group.mean() - Group1.mean())
        return Test_start

    def MakeModel(self):
        Group, Group1 = self.data
        self.x, self.y = len(Group), len(Group1)
        self.m = np.hstack((Group, Group1))

    def RunModel(self):
        np.random.shuffle(self.m)
        data = self.m[:self.x], self.m[self.x:]
        return data
```

In [108]:
```
data = players_point.values, players_ftMade.values
ht = DiffMeansPermute(data)
pvalue = ht.PValue()
pvalue
```

Out[108]:
```
0.0
```

In [109]:
```
data = players_point.values, players_ftMade.values
ht = DiffMeansPermute(data)
pvalue = ht.PValue()
print (pvalue)
ht.PlotCdf()
thinkplot.Show(xlabel='test statistic', ylabel='CDF')
```

```
0.0
```




```
<matplotlib.figure.Figure at 0x10a89f70>
```

I used difference means permute function but i replaced means with standard deviation in teststatistic part. Then, i got pvalue as a 0. Then i calculated p value again with different function which is correlation permutation. Then i got again 0. So, i made sure p value is zero.

Conclusion

As i explained steps above, i followed these steps and i got finally p value. The founded p-value is 0, which means that in 2000 trials i didn't see a correlation, under the null hypothesis, that exceeded the observed correlation. That means that the p-value is probably smaller than 1/10001/2000 , but it is not actually 0. So, our hypothesis seems true. It means there is strongly (as we get this information from correlation) positive relationship between these two variables. Free throw made affect the points. Also, the point affect the free throw made as well.