Yeap_Lab1

February 3, 2019

In [1]:
```
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"
```

In [2]:
```
#import packages for analysis and modeling
import pandas as pd
import numpy as np
from scipy.stats import uniform
import statsmodels.api as sm
import statsmodels.formula.api as smf
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

In [3]:
```
#import "coaches" dataset
coaches = pd.read_csv("Coaches.csv")

#print the first five rows of the data frame and show summary
coaches.head()
coaches.describe()
```

Out[3]:

	School	Conference	Coach	SchoolPay	TotalPay	Bonus	BonusPaid	AssistantPay	Buyout
0	Air Force	Mt. West	Troy Calhoun	885000	885000	247000	--	$0	--
1	Akron	MAC	Terry Bowden	$411,000	$412,500	$225,000	$50,000	$0	$688,500
2	Alabama	SEC	Nick Saban	$8,307,000	$8,307,000	$1,100,000	$500,000	$0	$33,600,000
3	Alabama at Birmingham	C-USA	Bill Clark	$900,000	$900,000	$950,000	$165,471	$0	$3,847,500
4	Appalachian State	Sun Belt	Scott Satterfield	$712,500	$712,500	$295,000	$145,000	$0	$2,160,417

Out[3]:

	School	Conference	Coach	SchoolPay	TotalPay
count	130	130	130	130	130
unique	130	11	130	104	105
top	Southern Methodist	Big Ten	Pat Narduzzi	$3,500,000	$3,500,000

```
freq                    1         14             1            5            5
```

```
       Bonus BonusPaid AssistantPay Buyout
count    130       130          130    130
unique    85        51            1    102
top       --        --           $0     --
freq      23        42          130     23
```

In [4]:
```
#convert column names to lowercase
coaches.columns = coaches.columns.str.lower()

#convert values to string and lowercase
coaches[['school','conference','coach']] = coaches[['school','conference','coach']].as

#convert values to lowercase
coaches['school']= coaches['school'].str.lower()
coaches['conference']= coaches['conference'].str.lower()
coaches['coach']= coaches['coach'].str.lower()

#convert values to numeric
coaches_num = ['schoolpay','totalpay','bonus','bonuspaid','assistantpay','buyout']

#remove all non-numeric to an empty space
coaches[coaches_num] = coaches[coaches_num].replace('[\$,--]', '', regex=True)

#convert coaches_num to numeric
coaches[coaches_num] = coaches[coaches_num].apply(pd.to_numeric).fillna(0)
coaches.head()
coaches.describe()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\pandas\core\dtypes\inference.py:244: FutureWarning:
  re.compile(obj)
```

Out[4]:
```
                   school conference              coach  schoolpay   totalpay  \
0             air force   mt. west       troy calhoun   885000.0   885000.0
1                 akron        mac       terry bowden   411000.0   412500.0
2               alabama        sec         nick saban  8307000.0  8307000.0
3  alabama at birmingham      c-usa         bill clark   900000.0   900000.0
4      appalachian state   sun belt  scott satterfield   712500.0   712500.0

       bonus  bonuspaid  assistantpay      buyout
0   247000.0        0.0             0         0.0
1   225000.0    50000.0             0    688500.0
2  1100000.0   500000.0             0  33600000.0
3   950000.0   165471.0             0   3847500.0
4   295000.0   145000.0             0   2160417.0
```

Out[4]:
```
          schoolpay      totalpay         bonus     bonuspaid  assistantpay  \
count  1.300000e+02  1.300000e+02  1.300000e+02  1.300000e+02         130.0
```

```
mean   2.317597e+06  2.324097e+06  7.195159e+05  1.012164e+05          0.0
std    1.902341e+06  1.906820e+06  6.657034e+05  2.082616e+05          0.0
min    0.000000e+00  0.000000e+00  0.000000e+00  0.000000e+00          0.0
25%    7.250175e+05  7.250175e+05  2.125000e+05  0.000000e+00          0.0
50%    1.775000e+06  1.815000e+06  6.050000e+05  2.000000e+04          0.0
75%    3.550000e+06  3.550000e+06  1.018750e+06  9.875000e+04          0.0
max    8.307000e+06  8.307000e+06  3.100000e+06  1.350000e+06          0.0

              buyout
count  1.300000e+02
mean   6.682650e+06
std    9.980033e+06
min    0.000000e+00
25%    5.180752e+05
50%    2.590104e+06
75%    8.791667e+06
max    6.812500e+07
```

In [5]:
```
#import Stadiums data
stadiums = pd.read_csv("stadiums.csv")

#print the first five rows of the data frame and show summary
stadiums.head()
stadiums.describe()
```

Out[5]:
```
             stadium             city state        team conference  capacity  \
0  Michigan Stadium        Ann Arbor    MI    Michigan    Big Ten    107601
1    Beaver Stadium  University Park    PA  Penn State    Big Ten    106572
2      Ohio Stadium         Columbus    OH  Ohio State    Big Ten    104944
3        Kyle Field  College Station    TX   Texas A&M        SEC    102733
4   Neyland Stadium        Knoxville    TN   Tennessee        SEC    102455

   built expanded  div   latitude  longitude
0   1927     2015  fbs  42.265869 -83.748726
1   1960     2001  fbs  40.812153 -77.856202
2   1922     2014  fbs  40.001686 -83.019728
3   1927     2015  fbs  30.610098 -96.340729
4   1921     2010  fbs  35.954734 -83.925333
```

Out[5]:
```
            capacity        built    latitude   longitude
count     253.000000   253.000000  253.000000  253.000000
mean    33200.466403  1963.454545   37.188850  -89.485439
std     25904.041476    29.540041    4.764327   14.010477
min      2200.000000  1895.000000   21.372783 -157.929969
25%     12283.000000  1934.000000   33.509339  -95.409265
50%     25200.000000  1966.000000   37.354414  -85.952177
75%     50000.000000  1986.000000   40.820484  -79.956432
max    107601.000000  2014.000000   47.911254  -68.673551
```

In [8]:
```
#convert column names to lowercase
stadiums.columns = stadiums.columns.str.lower()

#convert values to string and lowercase
stadiums = stadiums.apply(lambda x: x.astype(str).str.lower())

# convert column name: to allow data merge
stadiums = stadiums.rename(columns={'team': 'school','capacity':'stadium_capacity'})

#convert values to numeric
stadiums_num = ['stadium_capacity','built','expanded']

#convert stadiums_num to numeric
stadiums[stadiums_num] = stadiums[stadiums_num].apply(pd.to_numeric, errors='coerce', a
stadiums.head()
stadiums.describe()
```

Out[8]:

	stadium	city	state	school	conference	\
0	michigan stadium	ann arbor	mi	michigan	big ten	
1	beaver stadium	university park	pa	penn state	big ten	
2	ohio stadium	columbus	oh	ohio state	big ten	
3	kyle field	college station	tx	texas a&m	sec	
4	neyland stadium	knoxville	tn	tennessee	sec	

	stadium_capacity	built	expanded	div	latitude	\
0	107601.0	1927.0	2015.0	fbs	42.26586873251738	
1	106572.0	1960.0	2001.0	fbs	40.81215273275043	
2	104944.0	1922.0	2014.0	fbs	40.001685689369396	
3	102733.0	1927.0	2015.0	fbs	30.610097578174763	
4	102455.0	1921.0	2010.0	fbs	35.954734372622575	

	longitude
0	-83.7487256526947
1	-77.85620212554932
2	-83.01972806453705
3	-96.34072922859283
4	-83.9253330230713

Out[8]:

	stadium_capacity	built	expanded
count	253.000000	253.000000	2.530000e+02
mean	33200.466403	1963.454545	8.041287e+04
std	25904.041476	29.540041	1.261218e+06
min	2200.000000	1895.000000	0.000000e+00
25%	12283.000000	1934.000000	0.000000e+00
50%	25200.000000	1966.000000	1.992000e+03
75%	50000.000000	1986.000000	2.006000e+03
max	107601.000000	2014.000000	2.006201e+07

In [9]:
```
#import Graduation data
```

```
grad = pd.read_csv("graduation.csv")

#print the first five rows of the data frame and show summary
grad.head()
grad.describe()
```

Out[9]:

	school	gsr	fgr
0	Air Force	93.0	NaN
1	Akron	58.0	52.0
2	Alabama	73.0	57.0
3	Alabama at Birmingham	60.0	55.0
4	Appalachian State	68.0	56.0

Out[9]:

	gsr	fgr
count	126.000000	122.000000
mean	69.261905	57.368852
std	11.304639	10.243483
min	44.000000	37.000000
25%	61.000000	52.000000
50%	68.000000	57.000000
75%	75.750000	62.750000
max	96.000000	89.000000

In [10]:
```
#convert values to string and lowercase
grad = grad.apply(lambda x: x.astype(str).str.lower())

#convert values to numeric
grad_num = ['gsr','fgr']

#convert grad_num to numeric
grad[grad_num] = grad[grad_num].apply(pd.to_numeric, errors='coerce', axis=1).fillna(
grad.head()
grad.describe()
```

Out[10]:

	school	gsr	fgr
0	air force	93.0	0.0
1	akron	58.0	52.0
2	alabama	73.0	57.0
3	alabama at birmingham	60.0	55.0
4	appalachian state	68.0	56.0

Out[10]:

	gsr	fgr
count	130.000000	130.000000
mean	67.130769	53.838462
std	16.370889	17.028387
min	0.000000	0.000000
25%	60.000000	49.000000
50%	67.500000	57.000000
75%	75.000000	62.000000
max	96.000000	89.000000

In [11]:
```
#import past season data
season = pd.read_csv("season2017.csv")

#print the first five rows of the data frame and show summary
season.head()
season.describe()
```

Out[11]:

	school	win	loss	pct
0	Air Force	5	7	0.416667
1	Akron	7	7	0.500000
2	Alabama	13	1	0.928571
3	Alabama at Birmingham	4	7	0.363636
4	Appalachian State	9	4	0.692308

Out[11]:

	win	loss	pct
count	130.000000	130.000000	130.000000
mean	6.584615	5.961538	0.515831
std	3.082294	2.549977	0.220238
min	0.000000	0.000000	0.000000
25%	4.000000	4.000000	0.363636
50%	7.000000	6.000000	0.538462
75%	9.000000	7.000000	0.692308
max	13.000000	12.000000	1.000000

In [12]:
```
#convert values to string and lowercase
season = season.apply(lambda x: x.astype(str).str.lower())

#convert values to numeric
season_num = ['win','loss','pct']

#convert season_num to numeric
season[season_num] = season[season_num].apply(pd.to_numeric, errors='coerce', axis=1)
season.head()
season.describe()
```

Out[12]:

	school	win	loss	pct
0	air force	5.0	7.0	0.416667
1	akron	7.0	7.0	0.500000
2	alabama	13.0	1.0	0.928571
3	alabama at birmingham	4.0	7.0	0.363636
4	appalachian state	9.0	4.0	0.692308

Out[12]:

	win	loss	pct
count	130.000000	130.000000	130.000000
mean	6.584615	5.961538	0.515831
std	3.082294	2.549977	0.220238
min	0.000000	0.000000	0.000000
25%	4.000000	4.000000	0.363636
50%	7.000000	6.000000	0.538462

```
75%       9.000000    7.000000    0.692308
max      13.000000   12.000000    1.000000
```

In [13]:
```
#For the purpose of this analysis, I decide to narrow down the scope and choose the v
coaches = coaches[['school','conference','totalpay','bonus']]
stadiums = stadiums[['school','stadium_capacity']]
```

In [14]:
```
#To merge all the datasets as one data frame, I need to rename the school names so th
#Replace acronym with school name.
stadiums['school'] = stadiums['school'].replace(['ucf'], 'central florida')
stadiums['school'] = stadiums['school'].replace(['usf'], 'south florida')
stadiums['school'] = stadiums['school'].replace(['utsa'], 'texas-san antonio')
stadiums['school'] = stadiums['school'].replace(['byu'], 'brigham young')
stadiums['school'] = stadiums['school'].replace(['utep'], 'texas-el paso')
stadiums['school'] = stadiums['school'].replace(['tcu'], 'texas christian')
stadiums['school'] = stadiums['school'].replace(['unlv'], 'nevada-las vegas')
stadiums['school'] = stadiums['school'].replace(['smu'], 'southern methodist')
stadiums['school'] = stadiums['school'].replace(['niu'], 'northern illinois')
stadiums['school'] = stadiums['school'].replace(['miami (oh)'], 'miami (ohio)')
stadiums['school'] = stadiums['school'].replace(['fiu'], 'florida international')
stadiums['school'] = stadiums['school'].replace(['umass'], 'massachusetts')
```

In [26]:
```
#merged all datasets into one dataframe
merge = coaches.merge(stadiums, on = 'school').merge(grad, on = 'school').merge(seaso
merge.head()
merge.describe()
```

Out[26]:

	school	conference	totalpay	bonus	stadium_capacity	gsr	fgr	win	loss	pct
0	air force	mt. west	885000.0	247000.0	46692.0	93.0	0.0	5.0	7.0	0.416667
1	akron	mac	412500.0	225000.0	30000.0	58.0	52.0	7.0	7.0	0.500000
2	alabama	sec	8307000.0	1100000.0	101821.0	73.0	57.0	13.0	1.0	0.928571
3	appalachian state	sun belt	712500.0	295000.0	24050.0	68.0	56.0	9.0	4.0	0.692308
4	arizona	pac-12	2000000.0	2025000.0	51811.0	61.0	59.0	5.0	4.0	0.555556

Out[26]:

	totalpay	bonus	stadium_capacity	gsr	fgr
count	1.230000e+02	1.230000e+02	123.000000	123.000000	123.000000
mean	2.372579e+06	7.264802e+05	51790.764228	67.024390	53.544715
std	1.922699e+06	6.737894e+05	23413.315833	16.723138	17.426780
min	0.000000e+00	0.000000e+00	15314.000000	0.000000	0.000000
25%	7.812850e+05	2.200000e+05	30982.000000	59.000000	49.000000
50%	1.831580e+06	5.850000e+05	49250.000000	68.000000	57.000000
75%	3.583750e+06	1.037500e+06	65428.500000	75.500000	62.000000

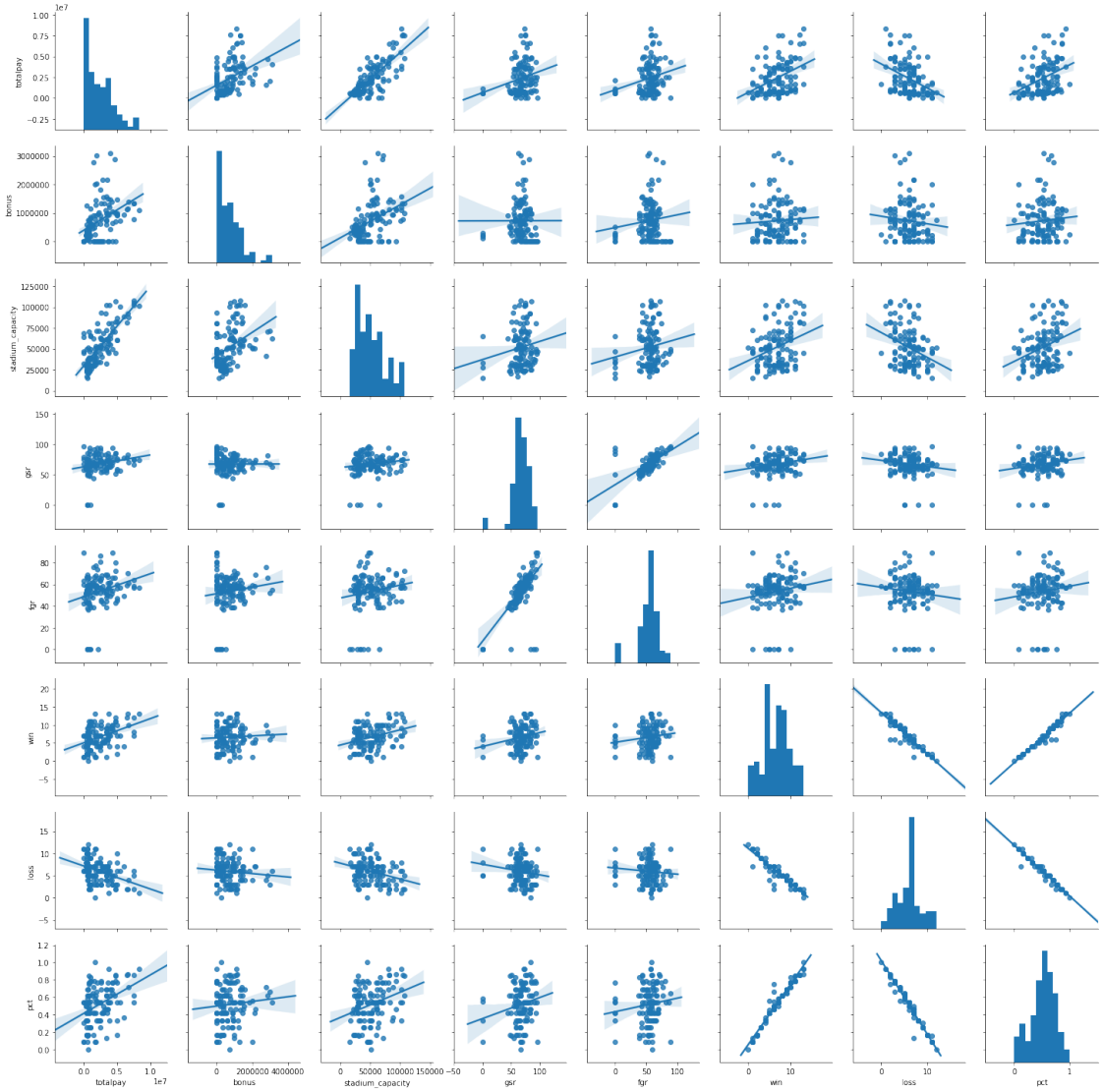
```
max    8.307000e+06  3.100000e+06     107601.000000   96.000000   89.000000
```

	win	loss	pct
count	123.000000	123.000000	123.000000
mean	6.609756	5.959350	0.516846
std	3.101121	2.568403	0.221514
min	0.000000	0.000000	0.000000
25%	4.500000	4.000000	0.390152
50%	7.000000	6.000000	0.538462
75%	9.000000	7.000000	0.692308
max	13.000000	12.000000	1.000000

In [35]:
```
#plot a correlation matrix
sns.pairplot(merge, kind="reg")
plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWarning: Using a no
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```

Out[35]: <seaborn.axisgrid.PairGrid at 0x193bb6a7940>



Among all numerical variables, only 'loss' has negative correlation to 'totalpay'

```
In [44]: #plot totalpay in histogram
         plt.hist(merge['totalpay'], normed = False, stacked = False, rwidth = .9)
         plt.title("Total Pay of the Coaches")
         plt.xlabel('Total Pay($)')
         plt.ylabel('Frequency')

         plt.show()
```

```
C:\ProgramData\Anaconda3\lib\site-packages\matplotlib\axes\_axes.py:6571: UserWarning: The 'nor
  warnings.warn("The 'normed' kwarg is deprecated, and has been "
```

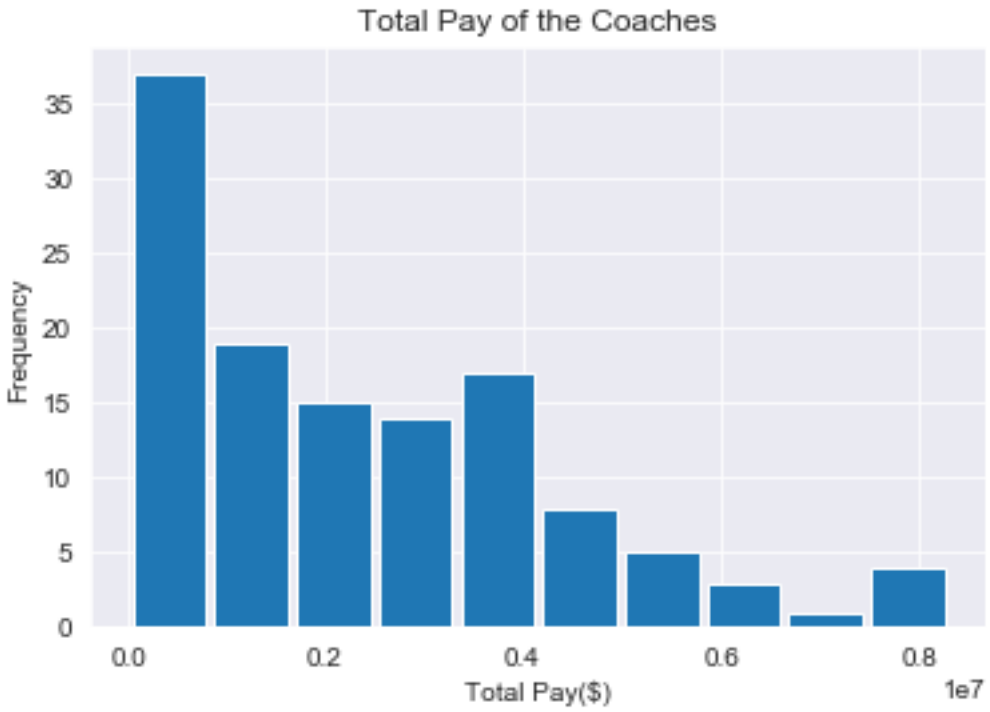
```
Out[44]: (array([37., 19., 15., 14., 17.,  8.,  5.,  3.,  1.,  4.]),
          array([      0.,  830700., 1661400., 2492100., 3322800., 4153500.,
```

```
        4984200., 5814900., 6645600., 7476300., 8307000.]),
 <a list of 10 Patch objects>)
```

Out[44]: Text(0.5,1,'Total Pay of the Coaches')

Out[44]: Text(0.5,0,'Total Pay($)')

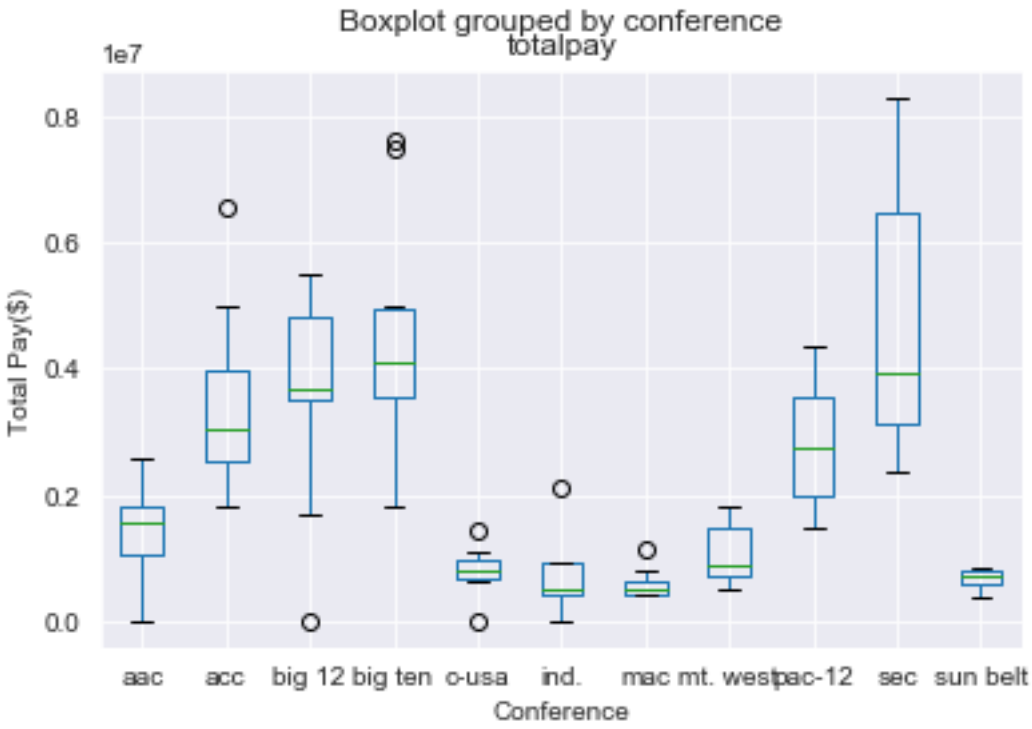
Out[44]: Text(0,0.5,'Frequency')



In [54]:
```
#plot boxplot of totalpay by conference
pay_plt = merge.boxplot('totalpay', by='conference',sym='o', vert=1, whis=1.5)
pay_plt.set_xlabel("Conference")
pay_plt.set_ylabel("Total Pay($)")
```

Out[54]: Text(0.5,0,'Conference')

Out[54]: Text(0,0.5,'Total Pay($)')




```
In [55]: # employ training-and-test regimen for model validation
         np.random.seed(1234)
         merge['runiform'] = uniform.rvs(loc = 0, scale = 1, size = len(merge))
         merge_train = merge[merge['runiform'] >= 0.33]
         merge_test = merge[merge['runiform'] < 0.33]

         # check training data frame
         print('\nmerge_train data frame (rows, columns): ',merge_train.shape)
         print(merge_train.head())

         # check test data frame
         print('\nmerge_test data frame (rows, columns): ',merge_test.shape)
         print(merge_test.head())
```

```
merge_train data frame (rows, columns):  (89, 11)
              school conference   totalpay      bonus  stadium_capacity   gsr  \
1              akron        mac   412500.0   225000.0           30000.0  58.0
2            alabama        sec  8307000.0  1100000.0          101821.0  73.0
3  appalachian state   sun belt   712500.0   295000.0           24050.0  68.0
4            arizona     pac-12  2000000.0  2025000.0           51811.0  61.0
7     arkansas state   sun belt   825000.0   185000.0           30964.0  68.0
```

```
    fgr   win  loss       pct  runiform
1  52.0   7.0   7.0  0.500000  0.622109
2  57.0  13.0   1.0  0.928571  0.437728
3  56.0   9.0   4.0  0.692308  0.785359
4  59.0   5.0   4.0  0.555556  0.779976
7  60.0   6.0   2.0  0.750000  0.801872

merge_test data frame (rows, columns):  (34, 11)
           school conference   totalpay      bonus  stadium_capacity   gsr  \
0       air force   mt. west   885000.0   247000.0           46692.0  93.0
5   arizona state     pac-12  2000000.0  3010000.0           71706.0  67.0
6        arkansas        sec  3500000.0  1000000.0           72000.0  54.0
17     california     pac-12  1500000.0   900000.0           62717.0  44.0
22        clemson        acc  6543350.0  1125000.0           81500.0  77.0

     fgr   win  loss       pct  runiform
0    0.0   5.0   7.0  0.416667  0.191519
5   52.0   6.0   3.0  0.666667  0.272593
6   39.0   1.0   7.0  0.125000  0.276464
17  39.0   5.0   7.0  0.416667  0.013768
22  59.0  12.0   2.0  0.857143  0.075381
```

In [58]:
```
#Model 1
# specify a simple model with all the variables
model1 = str('totalpay ~ bonus + stadium_capacity + gsr + fgr + win + loss + pct')

# fit the model to the training set
train_model_fit = smf.ols(model1, data = merge_train).fit()

# summary of model fit to the training set
print(train_model_fit.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                totalpay   R-squared:                       0.709
Model:                            OLS   Adj. R-squared:                  0.683
Method:                 Least Squares   F-statistic:                     28.14
Date:                Sun, 03 Feb 2019   Prob (F-statistic):           3.09e-19
Time:                        19:36:57   Log-Likelihood:                -1361.4
No. Observations:                  89   AIC:                             2739.
Df Residuals:                      81   BIC:                             2759.
Df Model:                           7
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept    7.403e+06    6.4e+06      1.157      0.250   -5.32e+06    2.01e+07
```

```
bonus                0.5468      0.215      2.546      0.013       0.119       0.974
stadium_capacity    49.9067      6.051      8.248      0.000      37.868      61.946
gsr               -325.7472   1.22e+04     -0.027      0.979   -2.45e+04    2.39e+04
fgr                1.903e+04   1.26e+04      1.514      0.134   -5978.621     4.4e+04
win                7.272e+05   2.95e+05      2.467      0.016    1.41e+05    1.31e+06
loss              -7.859e+05   5.23e+05     -1.502      0.137   -1.83e+06    2.55e+05
pct               -1.769e+07   9.47e+06     -1.868      0.065   -3.65e+07    1.15e+06
==============================================================================
Omnibus:                        1.262   Durbin-Watson:                   2.112
Prob(Omnibus):                  0.532   Jarque-Bera (JB):                1.041
Skew:                          -0.265   Prob(JB):                        0.594
Kurtosis:                       2.990   Cond. No.                     9.13e+07
==============================================================================

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 9.13e+07. This might indicate that there are
strong multicollinearity or other numerical problems.
```

In [59]:
```
#Model 1: Adjusted R-squared is OK. Try another model using the p-value which has <0.

#Model 2
# specify a simple model with all the variables
model2 = str('totalpay ~ stadium_capacity + win')

# fit the model to the training set
train_model_fit = smf.ols(model2, data = merge_train).fit()

# summary of model fit to the training set
print(train_model_fit.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:               totalpay   R-squared:                       0.651
Model:                           OLS   Adj. R-squared:                  0.643
Method:                Least Squares   F-statistic:                     80.25
Date:               Sun, 03 Feb 2019   Prob (F-statistic):           2.16e-20
Time:                       19:42:33   Log-Likelihood:                -1369.4
No. Observations:                 89   AIC:                             2745.
Df Residuals:                     86   BIC:                             2752.
Df Model:                          2
Covariance Type:           nonrobust
==============================================================================
                     coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      -1.422e+06    3.5e+05     -4.060      0.000   -2.12e+06   -7.26e+05
stadium_capacity    59.2240      5.619     10.539      0.000      48.053      70.395
```

```
win                1.084e+05   4.33e+04      2.506      0.014    2.24e+04    1.94e+05
==============================================================================
Omnibus:                        6.576   Durbin-Watson:                   1.911
Prob(Omnibus):                  0.037   Jarque-Bera (JB):                5.926
Skew:                          -0.578   Prob(JB):                       0.0517
Kurtosis:                       3.512   Cond. No.                     1.64e+05
==============================================================================

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 1.64e+05. This might indicate that there are
strong multicollinearity or other numerical problems.
```

In [70]:
```
#Model 2: Adjusted R squared decreases. Try adding 'conference' into Model 1

        #Model 3
        # specify a simple model with all the variables
        model3 = str('totalpay ~ conference + bonus + stadium_capacity + gsr + fgr + win + los

        # fit the model to the training set
        train_model_fit = smf.ols(model3, data = merge_train).fit()

        # summary of model fit to the training set
        print(train_model_fit.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                totalpay   R-squared:                       0.807
Model:                            OLS   Adj. R-squared:                  0.761
Method:                 Least Squares   F-statistic:                     17.50
Date:                Sun, 03 Feb 2019   Prob (F-statistic):           6.00e-19
Time:                        20:10:02   Log-Likelihood:                -1343.0
No. Observations:                  89   AIC:                             2722.
Df Residuals:                      71   BIC:                             2767.
Df Model:                          17
Covariance Type:            nonrobust
================================================================================================
                                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
Intercept                 4.866e+06   5.69e+06      0.854      0.396   -6.49e+06    1.62e+07
conference[T.acc]         1.663e+06   4.51e+05      3.690      0.000    7.65e+05    2.56e+06
conference[T.big 12]      1.482e+06   4.79e+05      3.095      0.003    5.27e+05    2.44e+06
conference[T.big ten]     2.062e+06   4.91e+05      4.203      0.000    1.08e+06    3.04e+06
conference[T.c-usa]       1.286e+05   5.43e+05      0.237      0.813   -9.54e+05    1.21e+06
conference[T.ind.]        6.587e+04   7.24e+05      0.091      0.928   -1.38e+06    1.51e+06
conference[T.mac]        -6.077e+04   4.72e+05     -0.129      0.898      -1e+06    8.81e+05
conference[T.mt. west] -1.588e+05    4.9e+05     -0.324      0.747   -1.14e+06    8.18e+05
```

```
conference[T.pac-12]    9.483e+05      5e+05      1.896      0.062   -4.91e+04    1.95e+06
conference[T.sec]       2.251e+06   5.22e+05      4.317      0.000    1.21e+06    3.29e+06
conference[T.sun belt]  4.644e+05   5.43e+05      0.856      0.395   -6.18e+05    1.55e+06
bonus                     0.3024      0.206      1.467      0.147      -0.109       0.713
stadium_capacity         26.4016      7.309      3.612      0.001      11.828      40.975
gsr                   -8631.4958   1.24e+04     -0.696      0.489   -3.34e+04    1.61e+04
fgr                    1.734e+04   1.28e+04      1.355      0.180   -8172.302    4.28e+04
win                    6.005e+05   2.68e+05      2.241      0.028    6.63e+04    1.13e+06
loss                   -5.06e+05   4.68e+05     -1.080      0.284   -1.44e+06    4.28e+05
pct                   -1.218e+07   8.48e+06     -1.435      0.156   -2.91e+07    4.74e+06
==============================================================================
Omnibus:                        0.502   Durbin-Watson:                   1.973
Prob(Omnibus):                  0.778   Jarque-Bera (JB):                0.162
Skew:                           0.067   Prob(JB):                        0.922
Kurtosis:                       3.160   Cond. No.                     9.39e+07
==============================================================================

Warnings:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 9.39e+07. This might indicate that there are
strong multicollinearity or other numerical problems.
```

```
In [66]: #Model 3: Adjusted R squared improved. Let's use model 3 as THE model
         #
         #Questions
         #
         # What is the recommended salary for the Syracuse football coach?
         target = merge[merge['school'] == 'syracuse']
         train_model_fit.predict(target[['conference', 'bonus', 'stadium_capacity', 'gsr', 'fg
```

```
Out[66]: 95    2.569177e+06
         dtype: float64
```

What would his salary be if we were still in the Big East? What if we went to the Big Ten?

Answer: The Big East does not include football. I assume it's a typo. If the Syracuse football coach went to the Big Ten... ... His salary will increase another 2.062e+06 in addition to the predicted value above (2.569177e+06). The increment value is obtained from the coeefficient value from the model above.

What schools did we drop from our data, and why?

Answer: Alabama at Birmingham, Coastal Carolina, Liberty, Miami (Fla.), Nevada, North Carolina State and Southern Mississippi because there schools are not found in the 'stadium' dataset.

What effect does graduation rate have on the projected salary?

Answer: The graduation rate will have a negative relation with the projected salary. For a unit for increment in graduation rate, there will be a decrease of $8631 in salary. This does not make sense as from the correlation maxtrix above, we see that total pay and graduation rate are positively correlated.

How good is our model?

Answer My model has an adjusted R squared of 76%.

What is the single biggest impact on salary size?

Answer: Based on the p-value on all the variables, it seems like stadium capacity plays a big role in determining salary size.