In [101]:

```
# Jump-Start Example: Python analysis of MSPA Software Survey

# Update 2017-09-21 by Tom Miller and Kelsey O'Neill
# Update 2018-06-30 by Tom Miller v005 transformation code added

# tested under Python 3.6.1 :: Anaconda custom (x86_64)
# on Windows 10.0 and Mac OS Sierra 10.12.2

# shows how to read in data from a comma-delimited text file
# manipuate data, create new count variables, define categorical variables,
# work with dictionaries and lambda mapping functions for recoding data

# visualizations in this program are routed to external pdf files
# so they may be included in printed or electronic reports

# prepare for Python version 3x features and functions
# these two lines of code are needed for Python 2.7 only
# commented out for Python 3.x versions
# from __future__ import division, print_function
# from future_builtins import ascii, filter, hex, map, oct, zip

# external libraries for visualizations and data manipulation
# ensure that these packages have been installed prior to calls
import pandas as pd  # data frame operations
import numpy as np  # arrays and math functions
import matplotlib.pyplot as plt  # static plotting
import seaborn as sns  # pretty plotting, including heat map
```

In [102]:

```
# correlation heat map setup for seaborn
def corr_chart(df_corr):
    corr=df_corr.corr()
    #screen top half to get a triangle
    top = np.zeros_like(corr, dtype=np.bool)
    top[np.triu_indices_from(top)] = True
    fig=plt.figure()
    fig, ax = plt.subplots(figsize=(12,12))
    sns.heatmap(corr, mask=top, cmap='coolwarm',
        center = 0, square=True,
        linewidths=.5, cbar_kws={'shrink':.5},
        annot = True, annot_kws={'size': 9}, fmt = '.3f')
    plt.xticks(rotation=45) # rotate variable labels on columns (x axis)
    plt.yticks(rotation=0) # use horizontal variable labels on rows (y axis)
    plt.title('Correlation Heat Map')
    plt.savefig('plot-corr-map.pdf',
        bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
        orientation='portrait', papertype=None, format=None,
        transparent=True, pad_inches=0.25, frameon=None)

np.set_printoptions(precision=3)
```

In [103]:

```
# read in comma-delimited text file, creating a pandas DataFrame object
# note that IPAddress is formatted as an actual IP address
# but is actually a random-hash of the original IP address
valid_survey_input = pd.read_csv('mspa-survey-data.csv')
```

In [104]:
```
valid_survey_input.head()
```

Out[104]:

	RespondentID	Personal_JavaScalaSpark	Personal_JavaScriptHTMLCSS	Personal_Python	Personal_R	Perso
0	5135740122	0	0	0	50	
1	5133300037	10	10	50	30	
2	5132253300	20	0	40	40	
3	5132096630	10	10	25	35	
4	5131990362	20	0	0	70	

5 rows × 41 columns

In [105]:
```
# use the RespondentID as label for the rows... the index of DataFrame
valid_survey_input.set_index('RespondentID', drop = True, inplace = True)
```

In [106]:
```
# examine the structure of the DataFrame object
print('\nContents of initial survey data ---------------')
```

```
Contents of initial survey data ---------------
```

In [107]:
```
# could use len() or first index of shape() to get number of rows/observations
print('\nNumber of Respondents =', len(valid_survey_input))
```

```
Number of Respondents = 207
```

In [108]:
```
# show the column/variable names of the DataFrame
# note that RespondentID is no longer present
print(valid_survey_input.columns)
```

```
Index(['Personal_JavaScalaSpark', 'Personal_JavaScriptHTMLCSS',
       'Personal_Python', 'Personal_R', 'Personal_SAS',
       'Professional_JavaScalaSpark', 'Professional_JavaScriptHTMLCSS',
       'Professional_Python', 'Professional_R', 'Professional_SAS',
       'Industry_JavaScalaSpark', 'Industry_JavaScriptHTMLCSS',
       'Industry_Python', 'Industry_R', 'Industry_SAS',
       'Python_Course_Interest', 'Foundations_DE_Course_Interest',
       'Analytics_App_Course_Interest', 'Systems_Analysis_Course_Interest',
       'Courses_Completed', 'PREDICT400', 'PREDICT401', 'PREDICT410',
       'PREDICT411', 'PREDICT413', 'PREDICT420', 'PREDICT422', 'PREDICT450',
       'PREDICT451', 'PREDICT452', 'PREDICT453', 'PREDICT454', 'PREDICT455',
       'PREDICT456', 'PREDICT457', 'OtherPython', 'OtherR', 'OtherSAS',
       'Other', 'Graduate_Date'],
      dtype='object')
```

In [109]:

```
# abbreviated printing of the first five rows of the data frame
print(pd.DataFrame.head(valid_survey_input))
```

```
              Personal_JavaScalaSpark  Personal_JavaScriptHTMLCSS  \
RespondentID                                                        
5135740122                          0                           0   
5133300037                         10                          10   
5132253300                         20                           0   
5132096630                         10                          10   
5131990362                         20                           0   

              Personal_Python  Personal_R  Personal_SAS  \
RespondentID                                              
5135740122                  0          50            50   
5133300037                 50          30             0   
5132253300                 40          40             0   
5132096630                 25          35            20   
5131990362                  0          70            10   

              Professional_JavaScalaSpark  Professional_JavaScriptHTMLCSS  \
RespondentID                                                                
5135740122                              0                               0   
5133300037                             25                              25   
5132253300                              0                               0   
5132096630                             10                              10   
5131990362                             20                               0   

              Professional_Python  Professional_R  Professional_SAS  \
RespondentID                                                          
5135740122                      0              25                75   
5133300037                     30              20                 0   
5132253300                     40              40                20   
5132096630                     25              35                20   
5131990362                      0              80                 0   

                  ...        PREDICT453  PREDICT454  PREDICT455  PREDICT456  \
RespondentID      ...                                                         
5135740122        ...               NaN         NaN         NaN         NaN   
5133300037        ...               NaN         NaN         NaN         NaN   
5132253300        ...               NaN         NaN         NaN         NaN   
5132096630        ...               NaN         NaN         NaN         NaN   
5131990362        ...               NaN         NaN         NaN         NaN   

              PREDICT457  OtherPython  OtherR  OtherSAS             Other  \
RespondentID                                                                
5135740122           NaN          NaN     NaN       NaN               NaN   
5133300037           NaN          NaN     NaN       NaN               NaN   
5132253300           NaN          NaN     NaN       NaN               NaN   
5132096630           NaN          NaN     NaN       NaN               NaN   
5131990362           NaN          NaN     NaN       NaN  CS-435 with Weka   

              Graduate_Date  
RespondentID                 
5135740122              NaN  
5133300037      Spring 2018  
5132253300        Fall 2018  
5132096630        Fall 2017  
5131990362        Fall 2018  

[5 rows x 40 columns]
```

In [110]:

```
# shorten the variable/column names for software preference variables
survey_df = valid_survey_input.rename(index=str, columns={
    'Personal_JavaScalaSpark': 'My_Java',
    'Personal_JavaScriptHTMLCSS': 'My_JS',
    'Personal_Python': 'My_Python',
    'Personal_R': 'My_R',
    'Personal_SAS': 'My_SAS',
    'Professional_JavaScalaSpark': 'Prof_Java',
    'Professional_JavaScriptHTMLCSS': 'Prof_JS',
    'Professional_Python': 'Prof_Python',
    'Professional_R': 'Prof_R',
    'Professional_SAS': 'Prof_SAS',
    'Industry_JavaScalaSpark': 'Ind_Java',
    'Industry_JavaScriptHTMLCSS': 'Ind_JS',
    'Industry_Python': 'Ind_Python',
    'Industry_R': 'Ind_R',
    'Industry_SAS': 'Ind_SAS'})
```

In [117]:

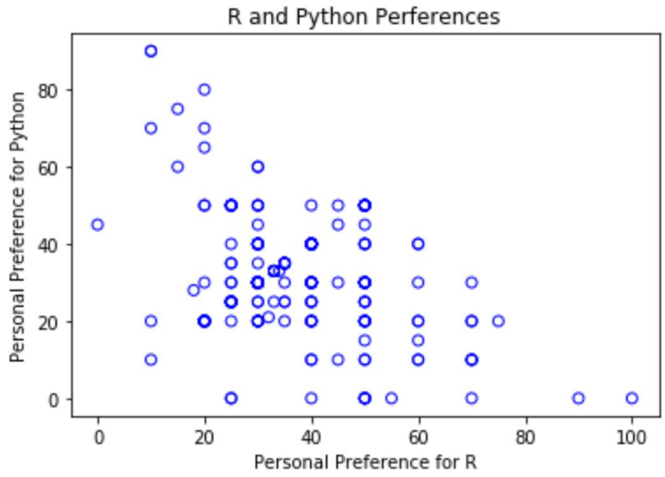
```
# define subset DataFrame for analysis of software preferences
software_df = survey_df.loc[:, 'My_Java':'Ind_SAS']
software_df.head()
```

Out[117]:

	My_Java	My_JS	My_Python	My_R	My_SAS	Prof_Java	Prof_JS	Prof_Python	Prof_R	Prof_
RespondentID										
5135740122	0	0	0	50	50	0	0	0	25	
5133300037	10	10	50	30	0	25	25	30	20	
5132253300	20	0	40	40	0	0	0	40	40	
5132096630	10	10	25	35	20	10	10	25	35	
5131990362	20	0	0	70	10	20	0	0	80	

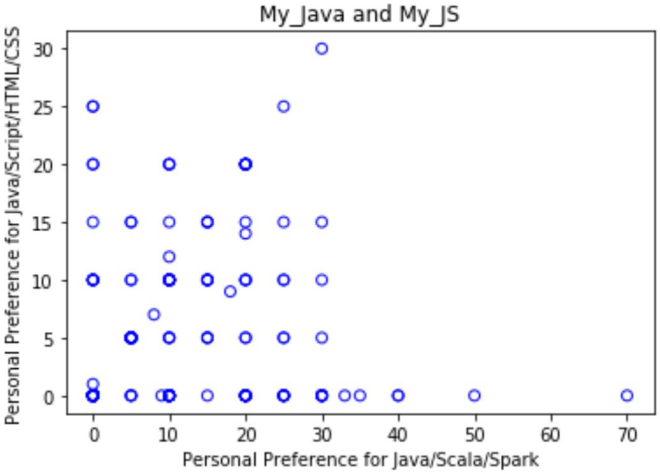
In [112]:

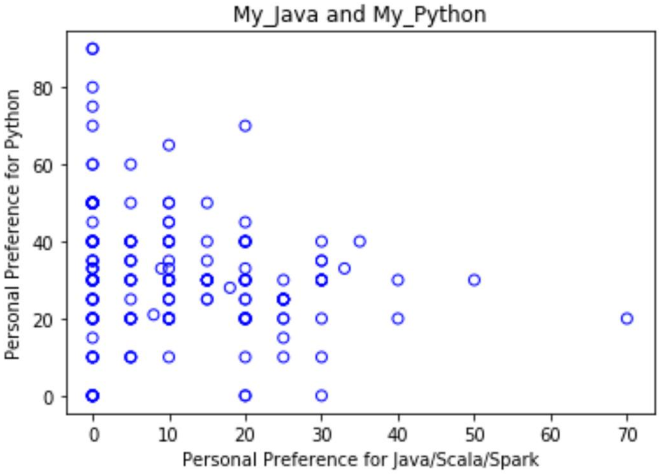
```
# single scatter plot example
fig, axis = plt.subplots()
axis.set_xlabel('Personal Preference for R')
axis.set_ylabel('Personal Preference for Python')
plt.title('R and Python Perferences')
scatter_plot = axis.scatter(survey_df['My_R'],
    survey_df['My_Python'],
    facecolors = 'none',
    edgecolors = 'blue')
plt.savefig('plot-scatter-r-python.pdf',
    bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
    orientation='portrait', papertype=None, format=None,
    transparent=True, pad_inches=0.25, frameon=None)

survey_df_labels = [
    'Personal Preference for Java/Scala/Spark',
    'Personal Preference for Java/Script/HTML/CSS',
    'Personal Preference for Python',
    'Personal Preference for R',
    'Personal Preference for SAS',
    'Professional Java/Scala/Spark',
    'Professional JavaScript/HTML/CSS',
    'Professional Python',
    'Professional R',
    'Professional SAS',
    'Industry Java/Scala/Spark',
    'Industry Java/Script/HTML/CSS',
    'Industry Python',
    'Industry R',
    'Industry SAS'
]
```



In [113]:

```
# create a set of scatter plots for personal preferences
for i in range(5):
    for j in range(5):
        if i != j:
            file_title = survey_df.columns[i] + '_and_' + survey_df.columns[j]
            plot_title = survey_df.columns[i] + ' and ' + survey_df.columns[j]
            fig, axis = plt.subplots()
            axis.set_xlabel(survey_df_labels[i])
            axis.set_ylabel(survey_df_labels[j])
            plt.title(plot_title)
            scatter_plot = axis.scatter(survey_df[survey_df.columns[i]],
            survey_df[survey_df.columns[j]],
            facecolors = 'none',
            edgecolors = 'blue')
            plt.savefig(file_title + '.pdf',
                bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
                orientation='portrait', papertype=None, format=None,
                transparent=True, pad_inches=0.25, frameon=None)
```


My_Java and My_JS
Personal Preference for Java/Script/HTML/CSS
0
5
10
15
20
25
30
Personal Preference for Java/Scala/Spark
0
10
20
30
40
50
60
70


My_Java and My_Python
Personal Preference for Python
0
20
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80
Personal Preference for Java/Scala/Spark
0
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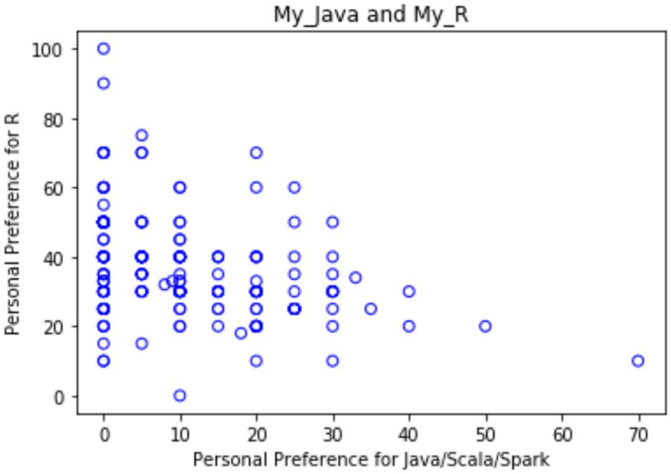
My_Java and My_R
Personal Preference for R
0
20
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Personal Preference for Java/Scala/Spark
0
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40
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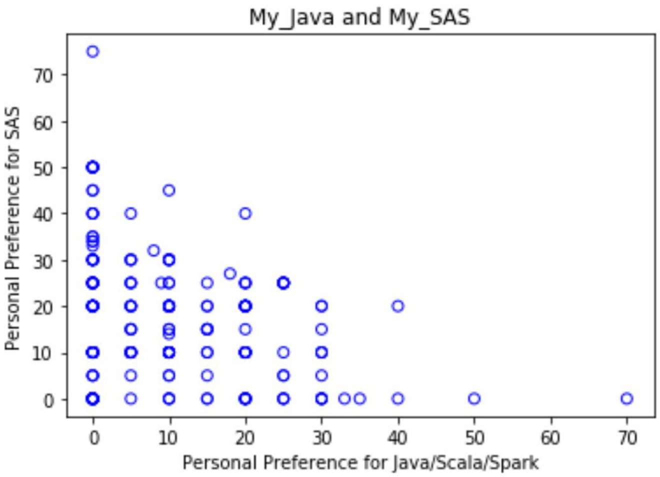
70


My_Java and My_SAS
Personal Preference for SAS
0
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Personal Preference for Java/Scala/Spark
0
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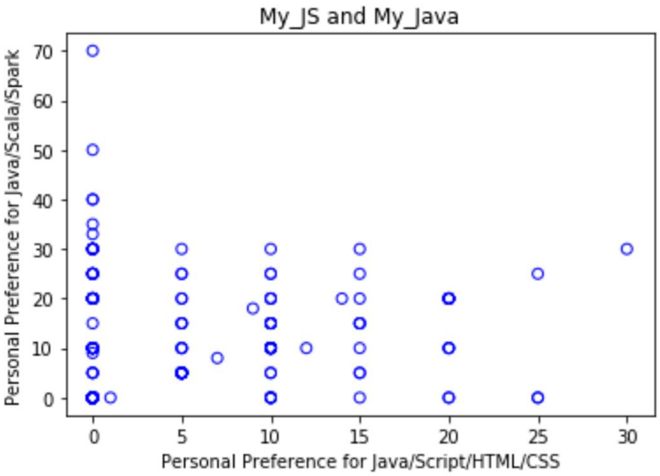
My_JS and My_Java
Personal Preference for Java/Scala/Spark
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Personal Preference for Java/Script/HTML/CSS
0
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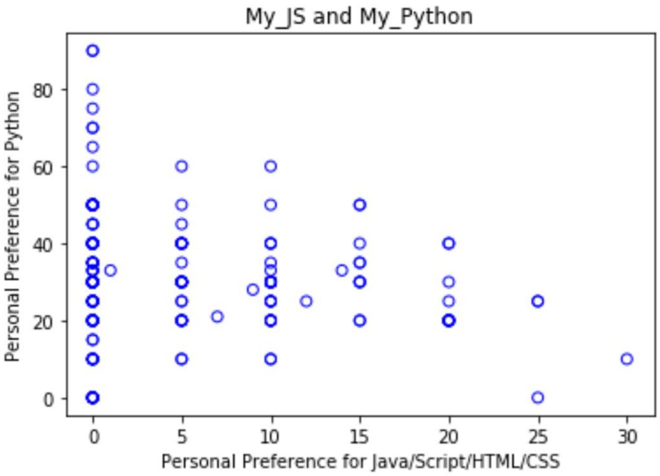
My_JS and My_Python
Personal Preference for Python
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Personal Preference for Java/Script/HTML/CSS
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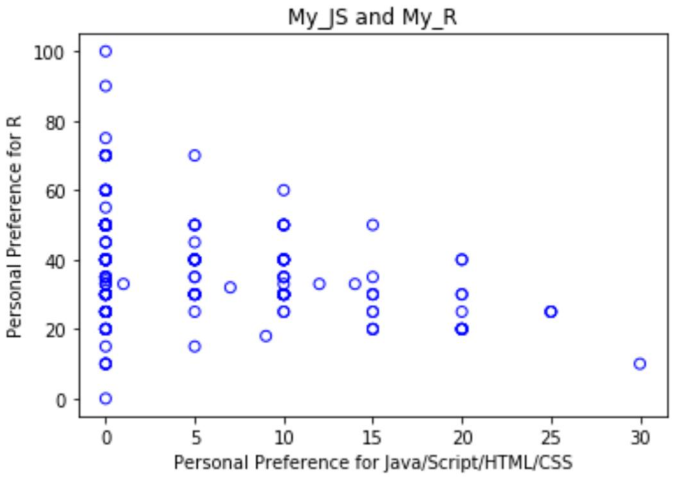
My_JS and My_R
Personal Preference for R
0
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Personal Preference for Java/Script/HTML/CSS
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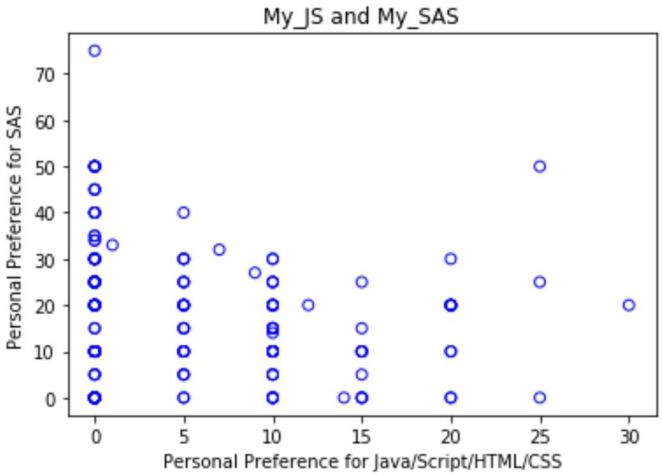
My_JS and My_SAS
Personal Preference for SAS
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Personal Preference for Java/Script/HTML/CSS
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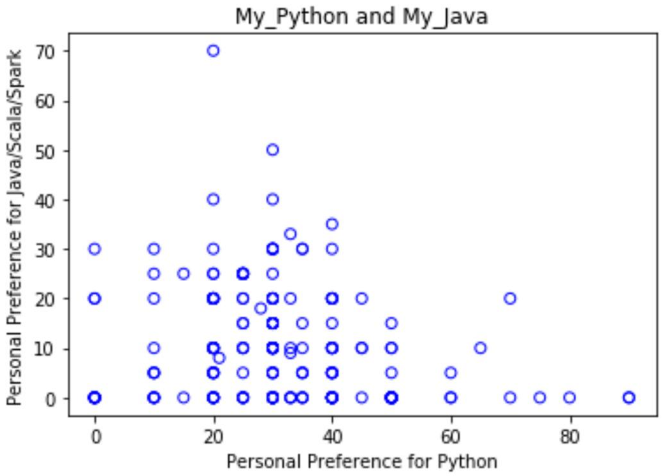
My_Python and My_Java
Personal Preference for Java/Scala/Spark
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60
70
Personal Preference for Python
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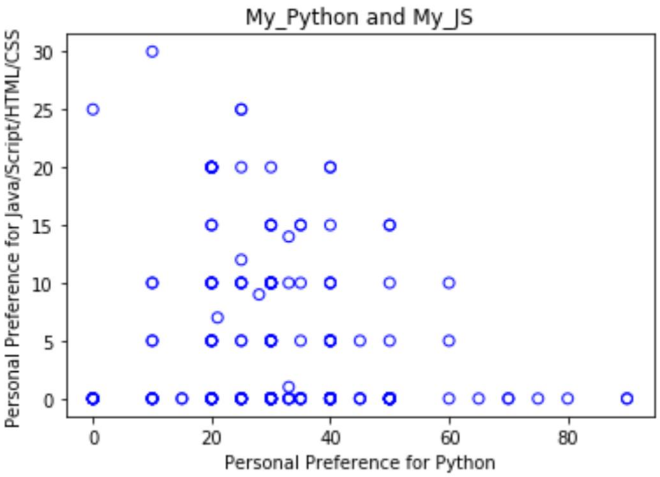
My_Python and My_JS
Personal Preference for Java/Script/HTML/CSS
0
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30
Personal Preference for Python
0
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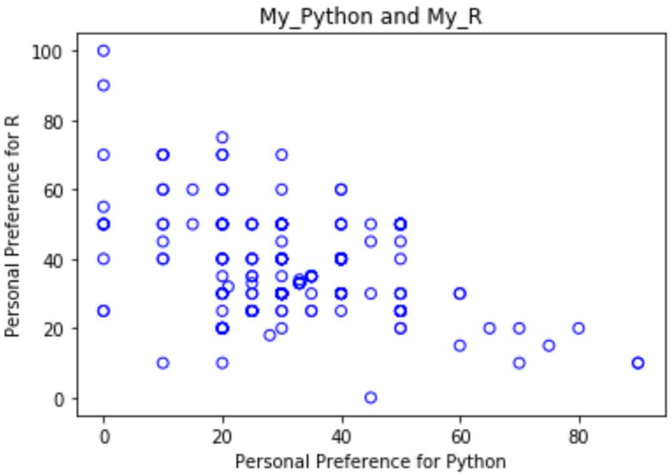
My_Python and My_R
Personal Preference for R
0
20
40
60
80
100
Personal Preference for Python
0
20
40
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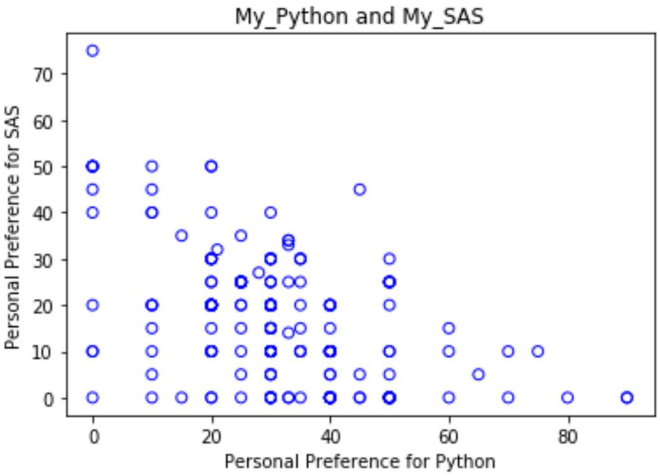
My_Python and My_SAS
Personal Preference for SAS
0
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70
Personal Preference for Python
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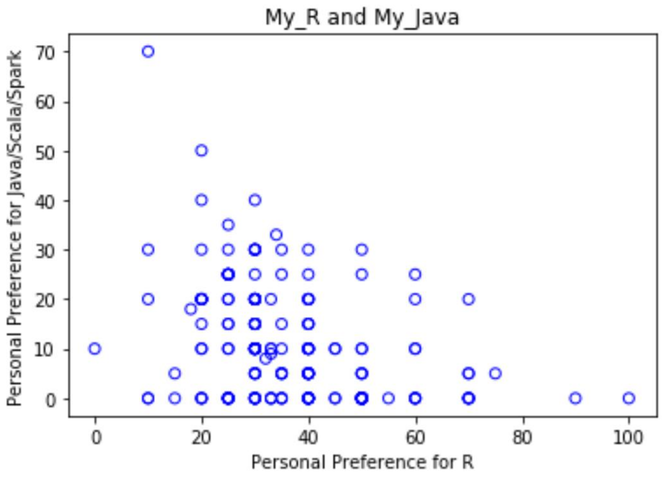
My_R and My_Java
Personal Preference for Java/Scala/Spark
70
60
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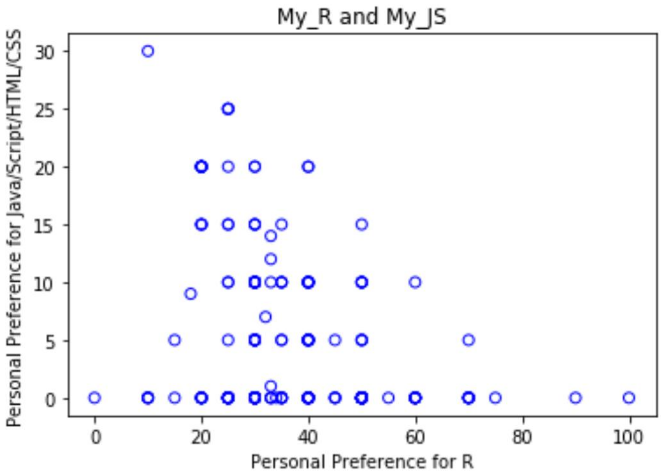
80
100
Personal Preference for R


My_R and My_JS
Personal Preference for Java/Script/HTML/CSS
30
25
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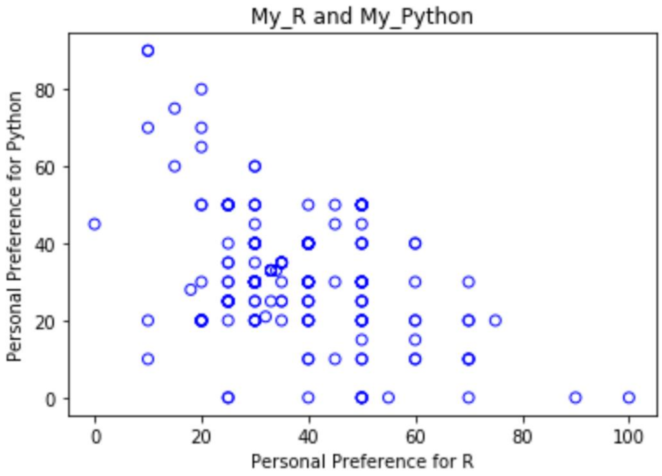
Personal Preference for R


My_R and My_Python
Personal Preference for Python
80
60
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20
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0
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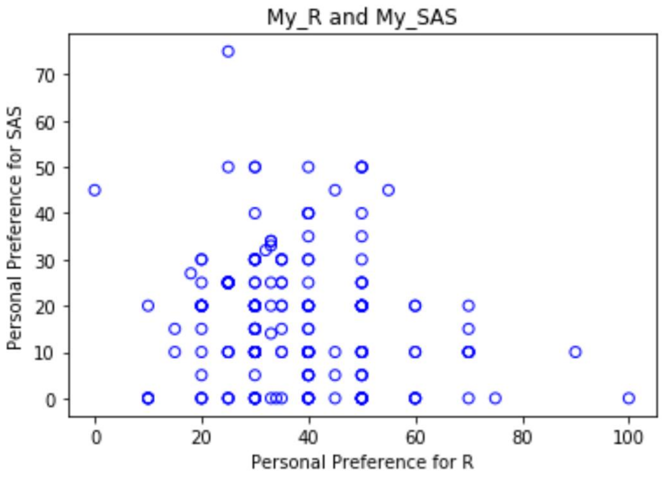
80
100
Personal Preference for R


My_R and My_SAS
Personal Preference for SAS
0
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Personal Preference for R
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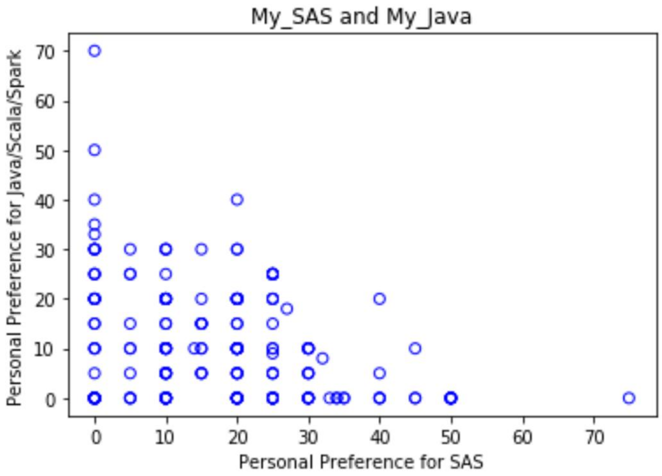
100


My_SAS and My_Java
Personal Preference for Java/Scala/Spark
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Personal Preference for SAS
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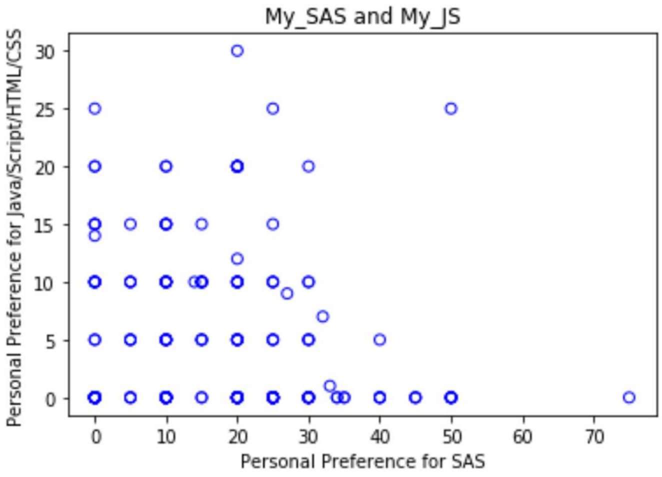
My_SAS and My_JS
Personal Preference for Java/Script/HTML/CSS
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Personal Preference for SAS
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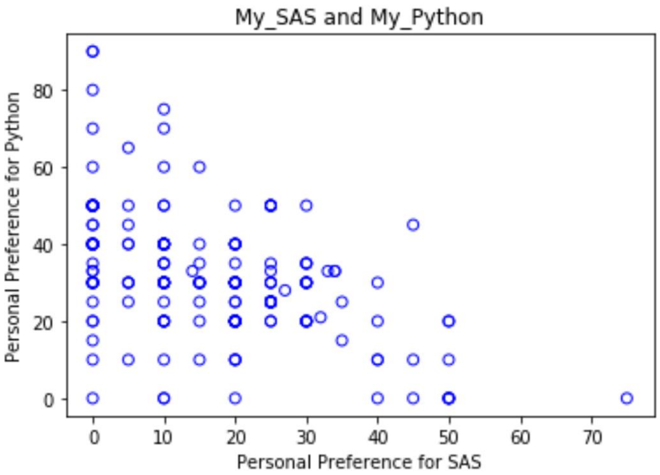
My_SAS and My_Python
Personal Preference for Python
0
20
40
60
80
Personal Preference for SAS
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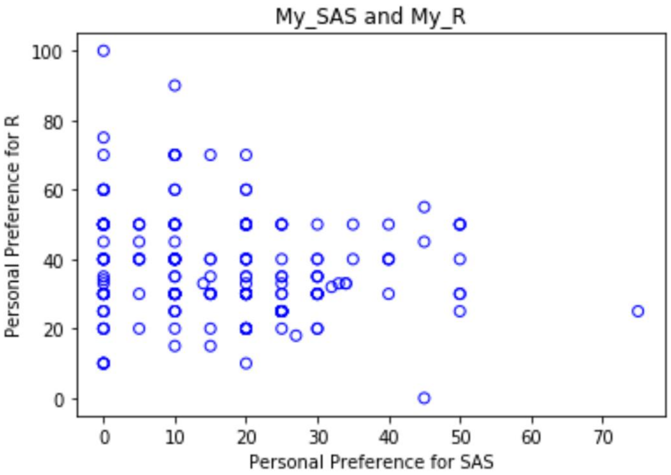
60
70


My_SAS and My_R
Personal Preference for R
0
20
40
60
80
100
Personal Preference for SAS
0
10
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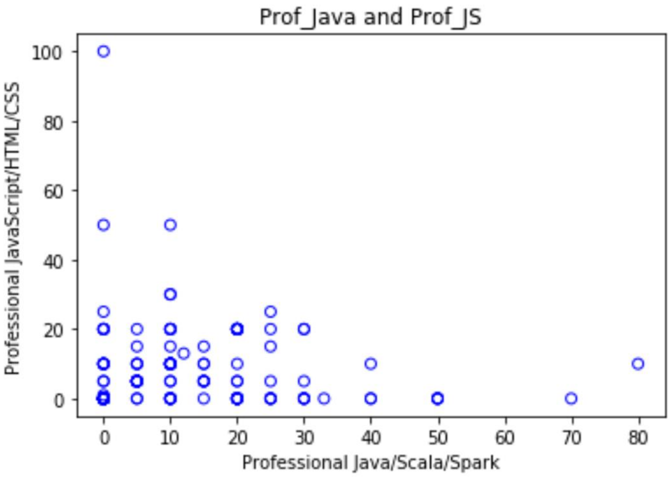
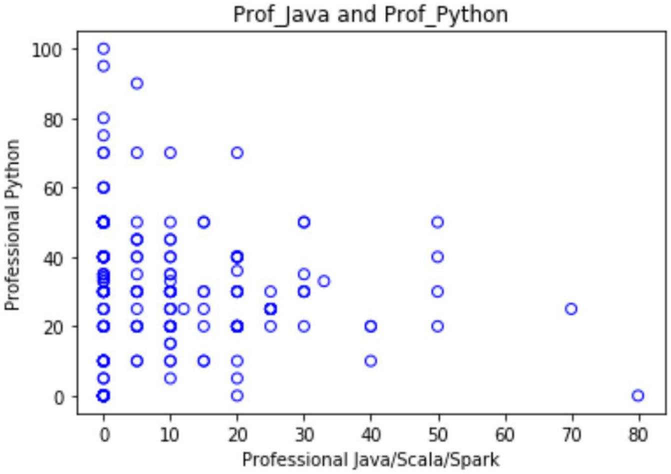
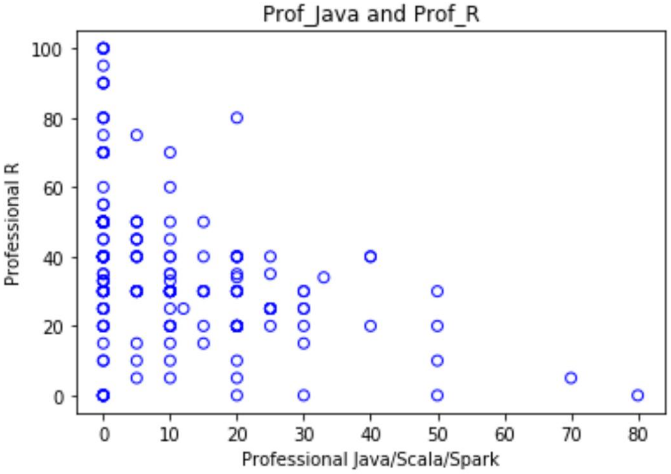
60
70

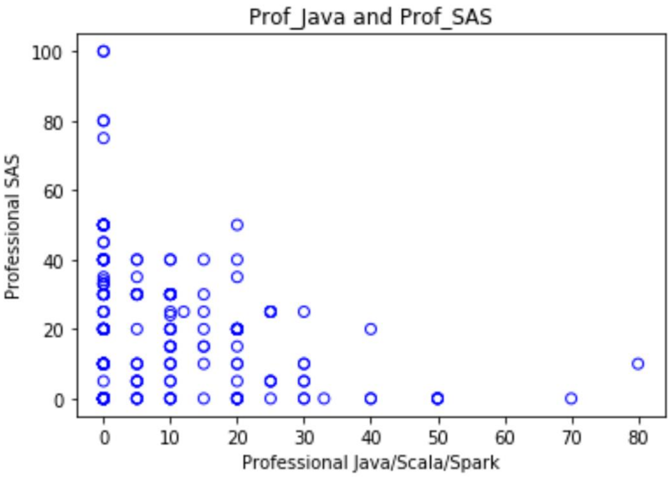
In [17]:

```
# create a set of scatter plots for professional preferences
for i in range(5,10):
    for j in range(5,10):
        if i != j:
            file_title = survey_df.columns[i] + '_and_' + survey_df.columns[j]
            plot_title = survey_df.columns[i] + ' and ' + survey_df.columns[j]
            fig, axis = plt.subplots()
            axis.set_xlabel(survey_df_labels[i])
            axis.set_ylabel(survey_df_labels[j])
            plt.title(plot_title)
            scatter_plot = axis.scatter(survey_df[survey_df.columns[i]],
            survey_df[survey_df.columns[j]],
            facecolors = 'none',
            edgecolors = 'blue')
            plt.savefig(file_title + '.pdf',
                bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
                orientation='portrait', papertype=None, format=None,
                transparent=True, pad_inches=0.25, frameon=None)
```


Prof_Java and Prof_JS


Prof_Java and Prof_Python


Prof_Java and Prof_R


Prof_Java and Prof_SAS
Professional SAS
0
20
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100
Professional Java/Scala/Spark
0
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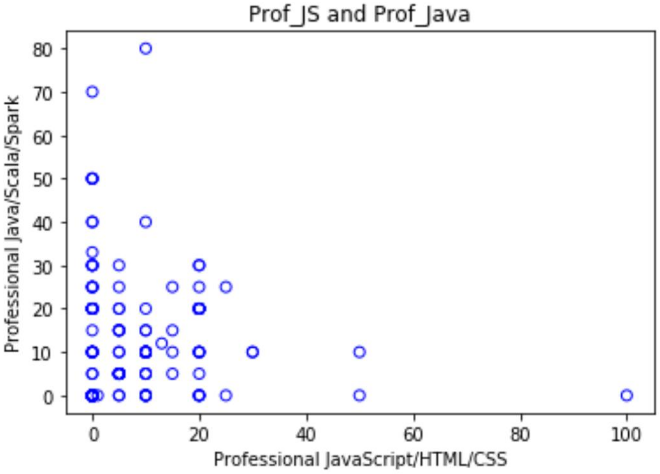
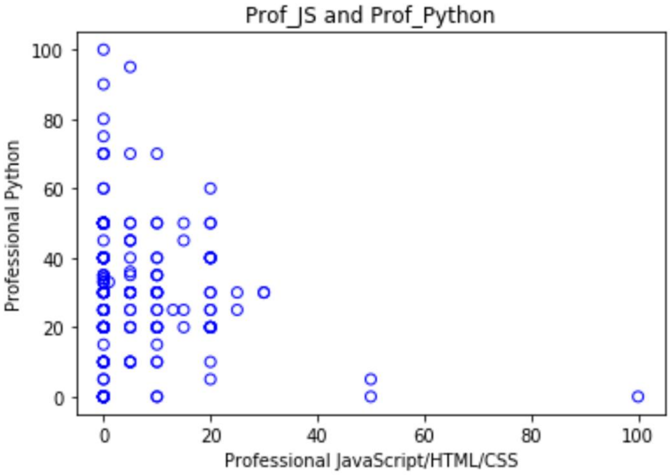
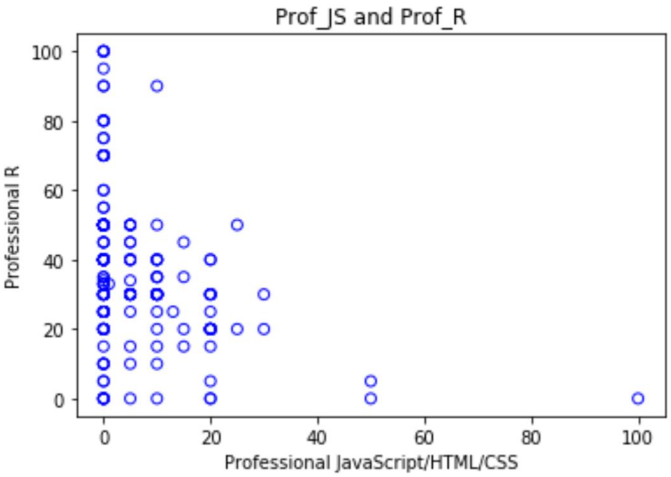
80


Prof_JS and Prof_Java
Professional Java/Scala/Spark
0
10
20
30
40
50
60
70
80
Professional JavaScript/HTML/CSS
0
20
40
60
80
100


Prof_JS and Prof_Python
Professional Python
0
20
40
60
80
100
Professional JavaScript/HTML/CSS
0
20
40
60
80
100


Prof_JS and Prof_R
Professional R
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Professional JavaScript/HTML/CSS
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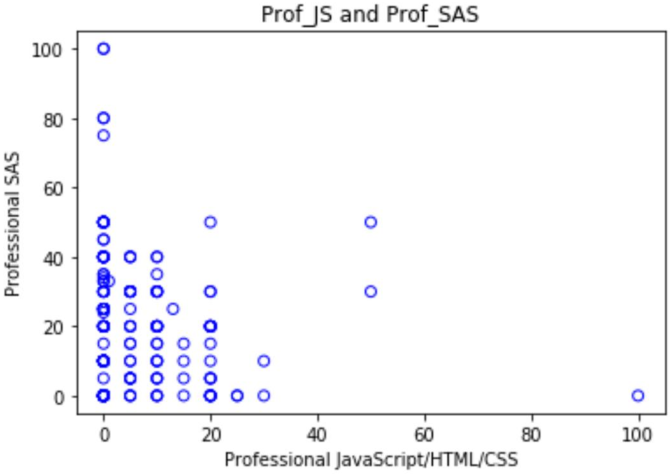
Prof_JS and Prof_SAS
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Professional JavaScript/HTML/CSS
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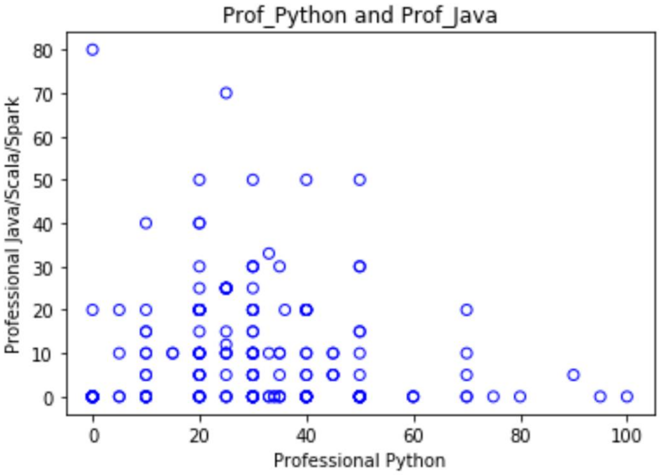
Prof_Python and Prof_Java
Professional Java/Scala/Spark
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Professional Python
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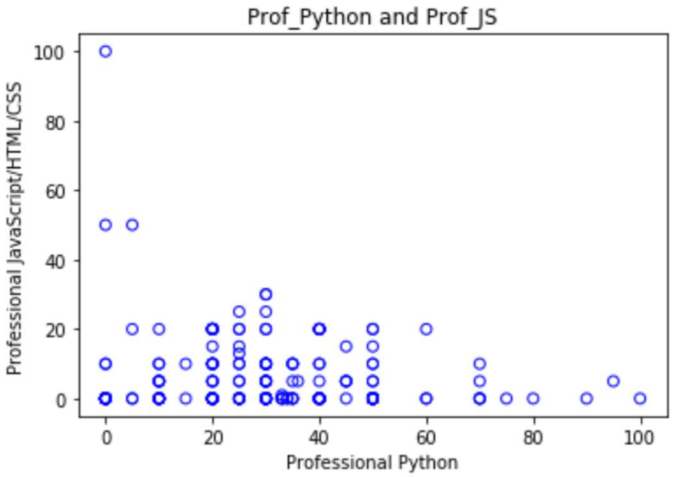
Prof_Python and Prof_JS
Professional JavaScript/HTML/CSS
Professional Python
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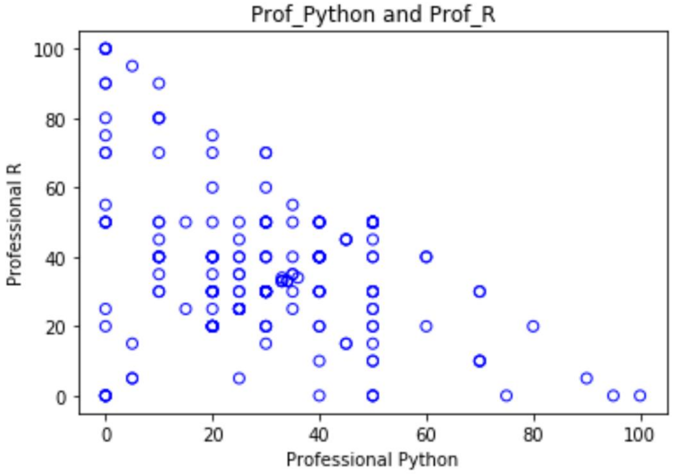
Prof_Python and Prof_R
Professional R
Professional Python
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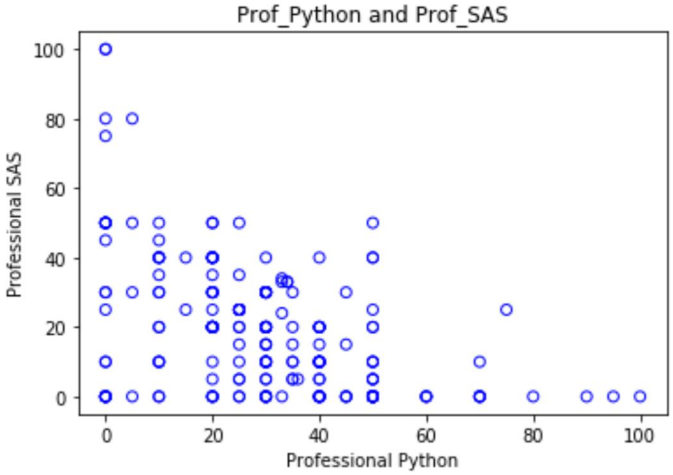
Prof_Python and Prof_SAS
Professional SAS
Professional Python
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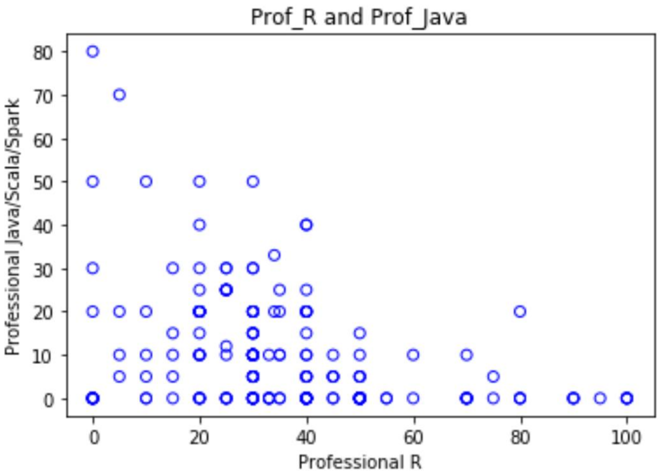
Prof_R and Prof_Java
Professional Java/Scala/Spark
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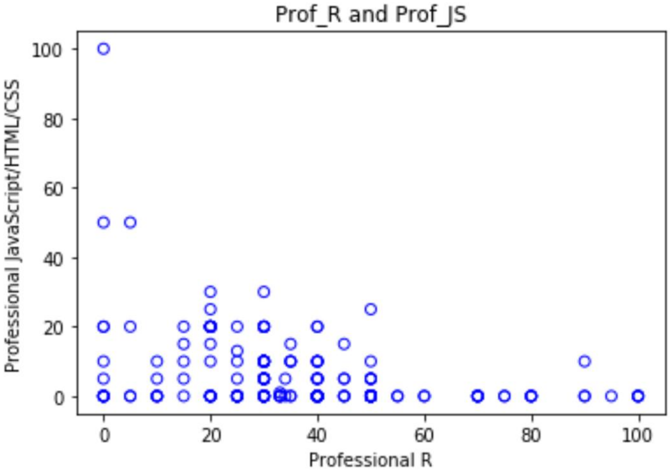
Prof_R and Prof_JS
Professional JavaScript/HTML/CSS
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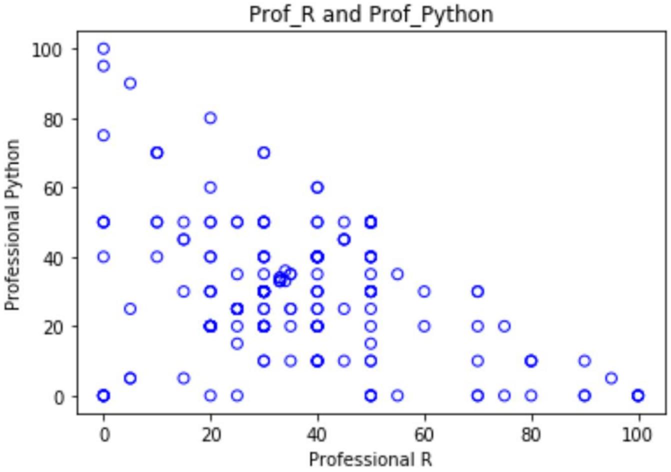
Prof_R and Prof_Python
Professional Python
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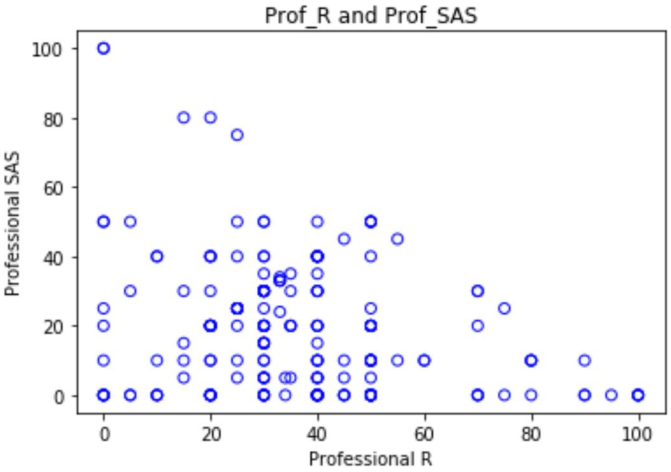
Prof_R and Prof_SAS
Professional SAS
Professional R
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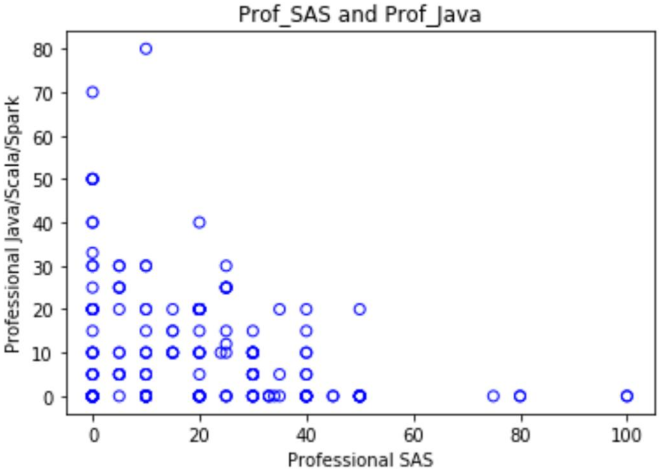
Prof_SAS and Prof_Java
Professional Java/Scala/Spark
Professional SAS
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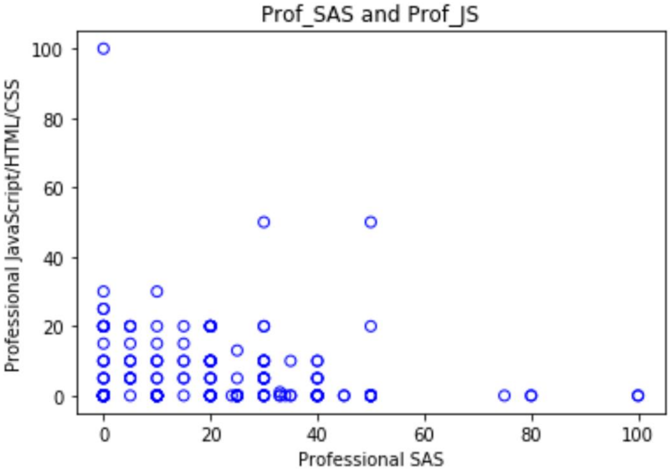
Prof_SAS and Prof_JS
Professional JavaScript/HTML/CSS
Professional SAS
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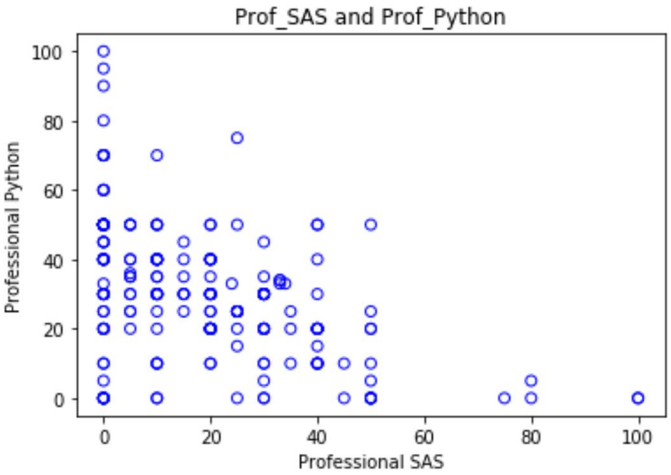
Prof_SAS and Prof_Python
Professional Python
Professional SAS
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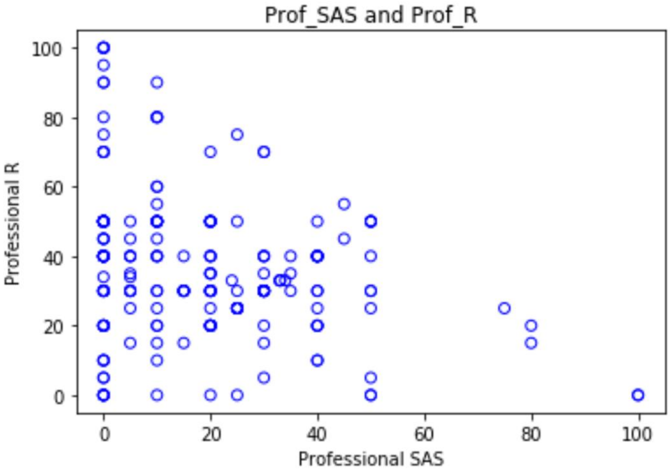
Prof_SAS and Prof_R
Professional R
Professional SAS
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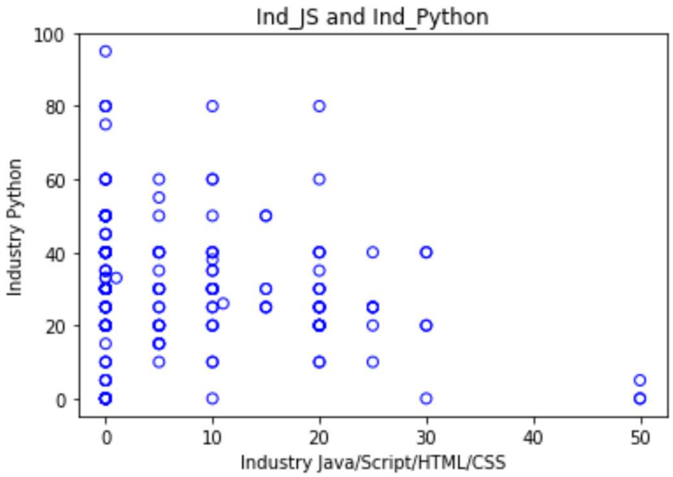
In [18]:

```
# create a set of scatter plots for industry preferences
for i in range(11,15):
    for j in range(11,15):
        if i != j:
            file_title = survey_df.columns[i] + '_and_' + survey_df.columns[j]
            plot_title = survey_df.columns[i] + ' and ' + survey_df.columns[j]
            fig, axis = plt.subplots()
            axis.set_xlabel(survey_df_labels[i])
            axis.set_ylabel(survey_df_labels[j])
            plt.title(plot_title)
            scatter_plot = axis.scatter(survey_df[survey_df.columns[i]],
            survey_df[survey_df.columns[j]],
            facecolors = 'none',
            edgecolors = 'blue')
            plt.savefig(file_title + '.pdf',
                bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
                orientation='portrait', papertype=None, format=None,
                transparent=True, pad_inches=0.25, frameon=None)
```


Ind_JS and Ind_Python
Industry Python
Industry Java/Script/HTML/CSS
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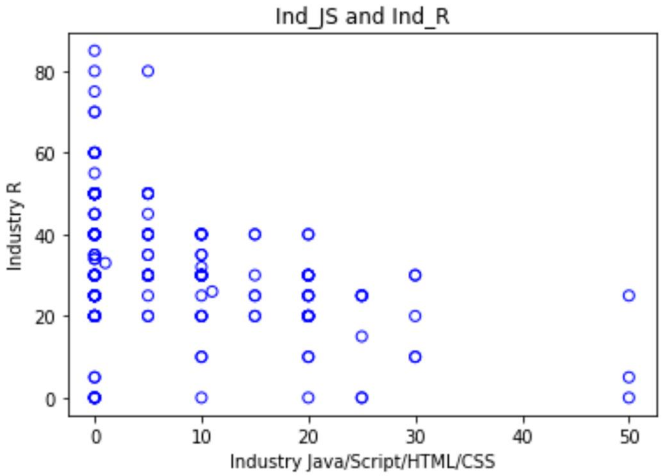
Ind_JS and Ind_R
Industry R
Industry Java/Script/HTML/CSS
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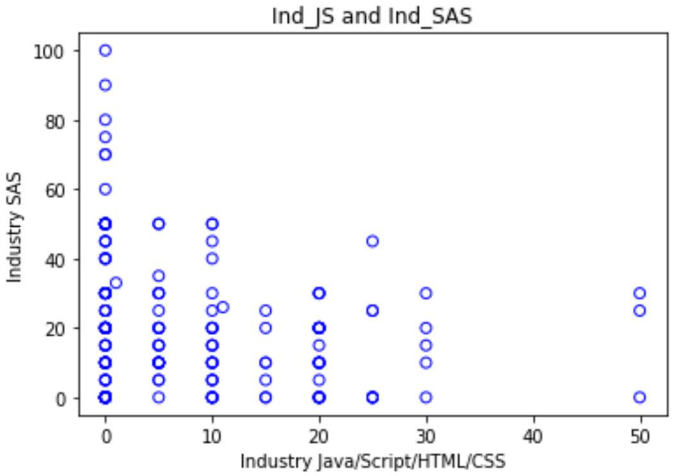
50


Ind_JS and Ind_SAS
Industry SAS
Industry Java/Script/HTML/CSS
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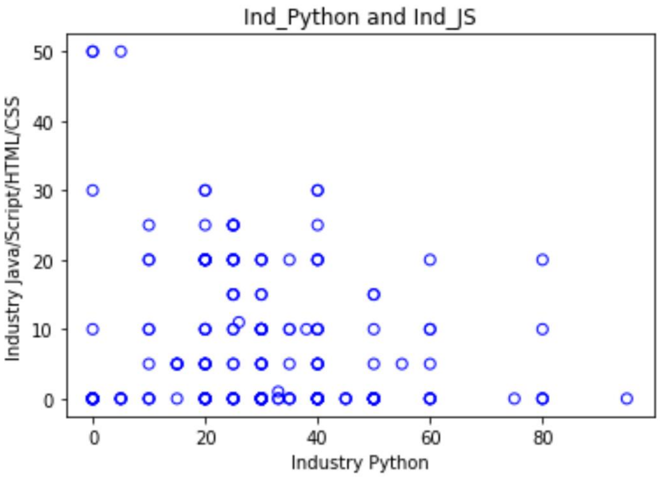
Ind_Python and Ind_JS
Industry Java/Script/HTML/CSS
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Industry Python
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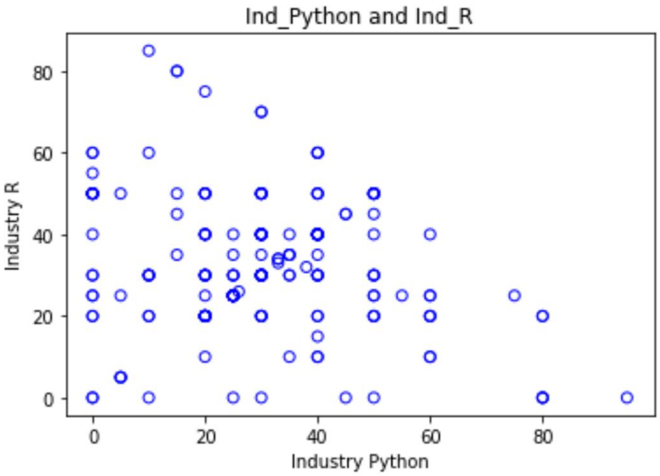
Ind_Python and Ind_R
Industry R
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Industry Python
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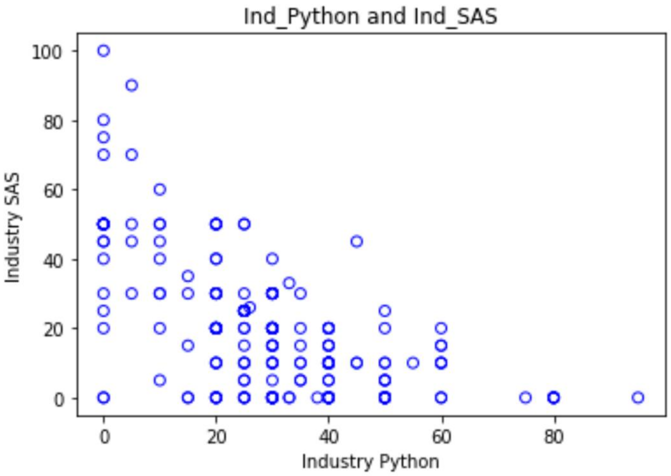
Ind_Python and Ind_SAS
Industry SAS
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Industry Python
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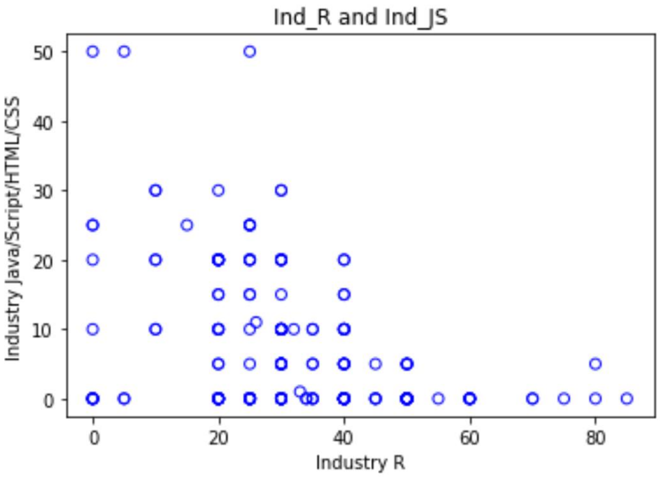
Ind_R and Ind_JS
Industry Java/Script/HTML/CSS
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Industry R
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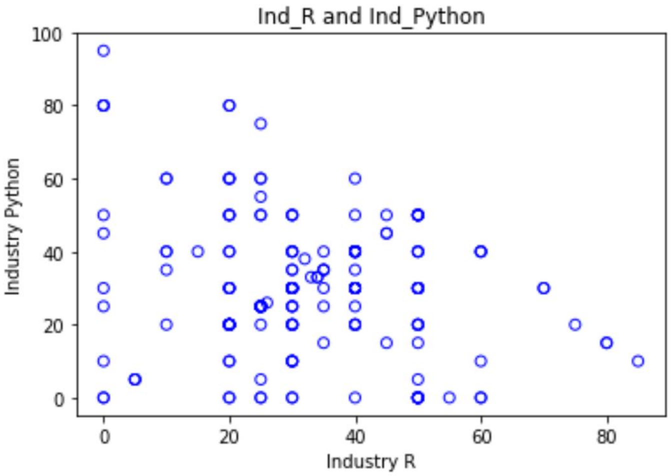
Ind_R and Ind_Python
Industry Python
0
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Industry R
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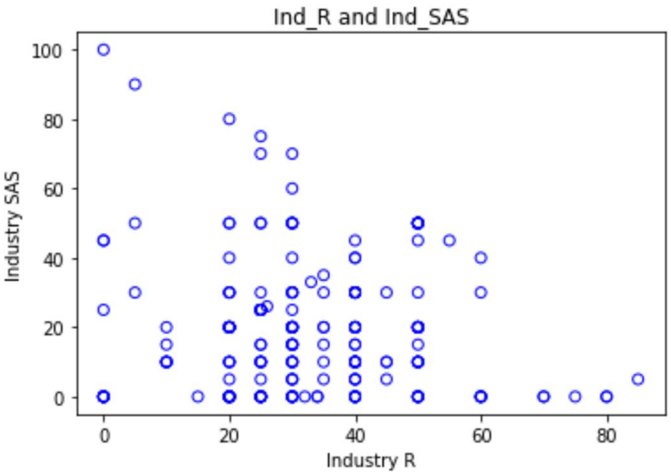
Ind_R and Ind_SAS
Industry SAS
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Industry R
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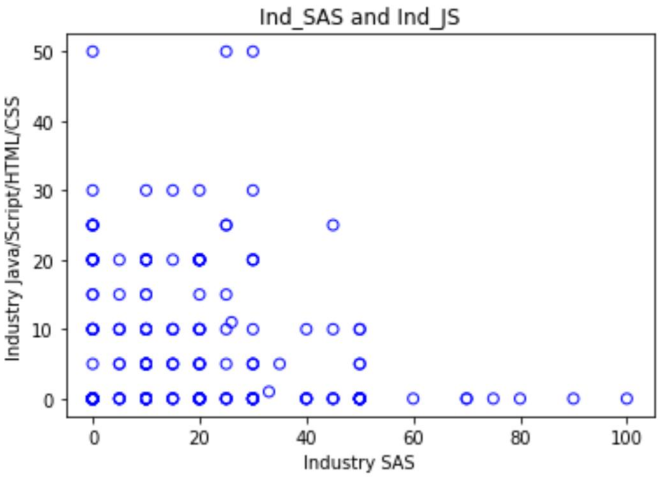
Ind_SAS and Ind_JS
Industry Java/Script/HTML/CSS
Industry SAS
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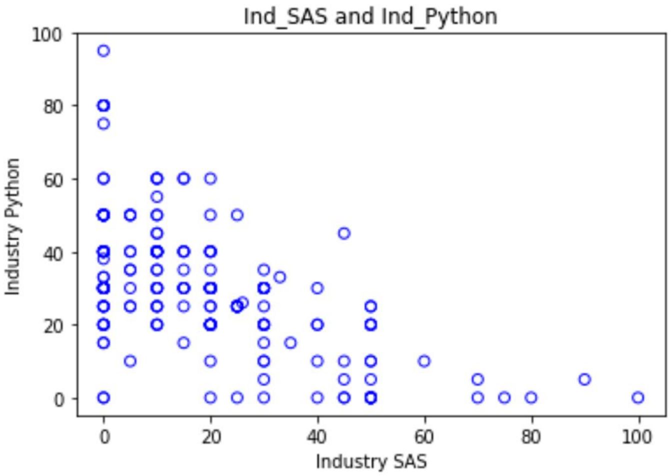
Ind_SAS and Ind_Python
Industry Python
Industry SAS
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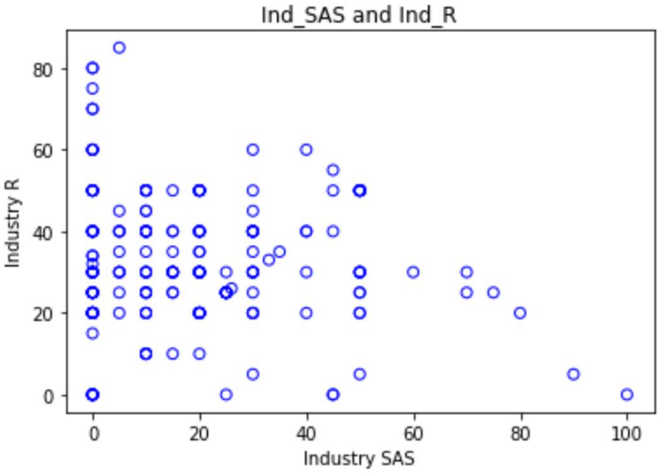
Ind_SAS and Ind_R
Industry R
Industry SAS
0
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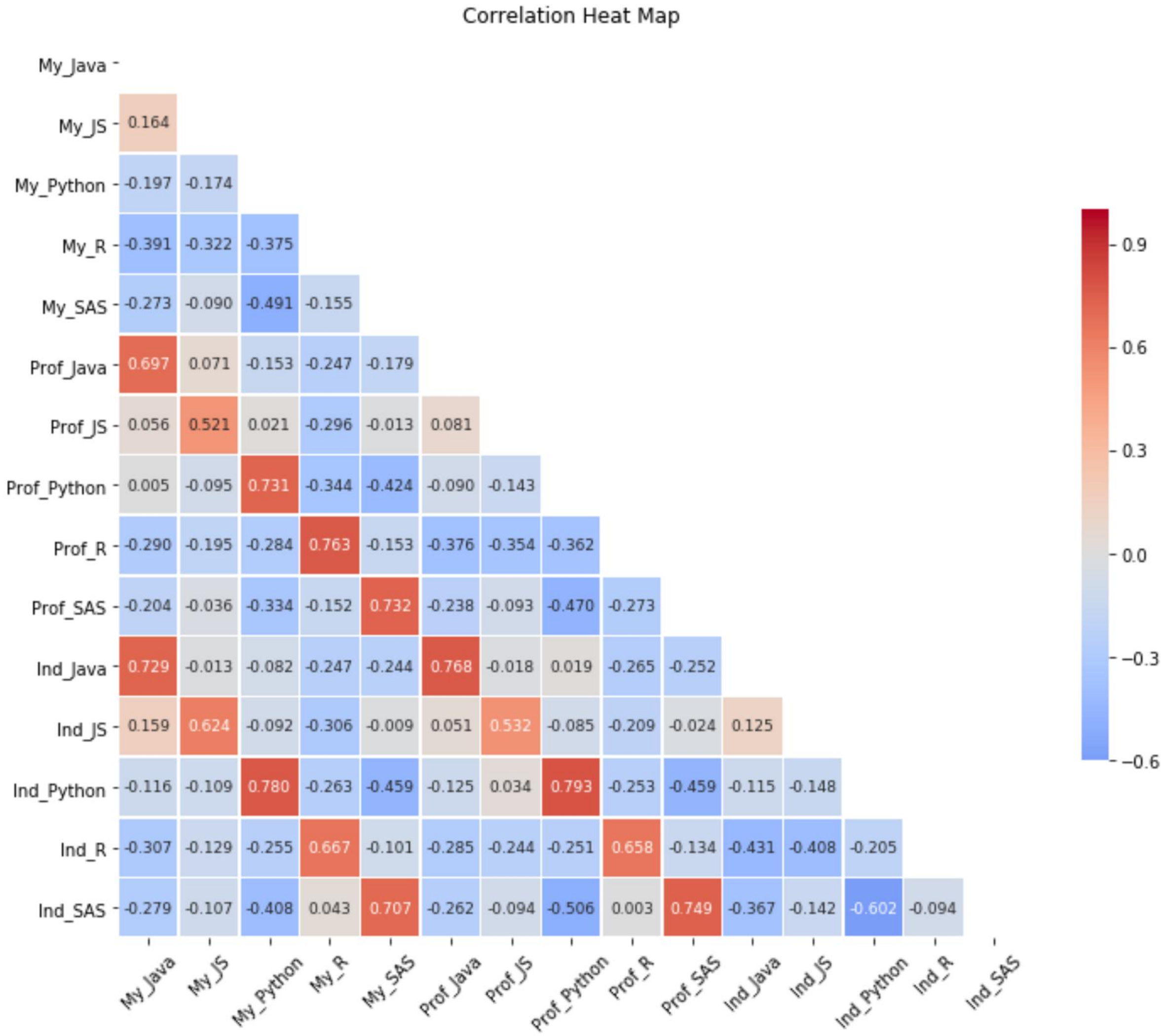
```
In [19]: # examine intercorrelations among software preference variables
         # with correlation matrix/heat map
         corr_chart(df_corr = software_df)
```

```
<Figure size 432x288 with 0 Axes>
```



	My_Java	My_JS	My_Python	My_R	My_SAS	Prof_Java	Prof_JS	Prof_Python	Prof_R	Prof_SAS	Ind_Java	Ind_JS	Ind_Python	Ind_R	Ind_SAS
My_Java															
My_JS	0.164														
My_Python	-0.197	-0.174													
My_R	-0.391	-0.322	-0.375												
My_SAS	-0.273	-0.090	-0.491	-0.155											
Prof_Java	0.697	0.071	-0.153	-0.247	-0.179										
Prof_JS	0.056	0.521	0.021	-0.296	-0.013	0.081									
Prof_Python	0.005	-0.095	0.731	-0.344	-0.424	-0.090	-0.143								
Prof_R	-0.290	-0.195	-0.284	0.763	-0.153	-0.376	-0.354	-0.362							
Prof_SAS	-0.204	-0.036	-0.334	-0.152	0.732	-0.238	-0.093	-0.470	-0.273						
Ind_Java	0.729	-0.013	-0.082	-0.247	-0.244	0.768	-0.018	0.019	-0.265	-0.252					
Ind_JS	0.159	0.624	-0.092	-0.306	-0.009	0.051	0.532	-0.085	-0.209	-0.024	0.125				
Ind_Python	-0.116	-0.109	0.780	-0.263	-0.459	-0.125	0.034	0.793	-0.253	-0.459	-0.115	-0.148			
Ind_R	-0.307	-0.129	-0.255	0.667	-0.101	-0.285	-0.244	-0.251	0.658	-0.134	-0.431	-0.408	-0.205		
Ind_SAS	-0.279	-0.107	-0.408	0.043	0.707	-0.262	-0.094	-0.506	0.003	0.749	-0.367	-0.142	-0.602	-0.094	

In [20]:
```
# descriptive statistics for software preference variables
print('\nDescriptive statistics for survey data ----------------')
print(software_df.describe())
```

```
Descriptive statistics for survey data ----------------
          My_Java       My_JS   My_Python        My_R      My_SAS   Prof_Java  \
count  207.000000  207.000000  207.000000  207.000000  207.000000  207.000000
mean    10.135266    4.797101   31.304348   37.125604   16.637681    9.251208
std     11.383477    6.757764   15.570982   14.576003   13.626400   13.167505
min      0.000000    0.000000    0.000000    0.000000    0.000000    0.000000
25%      0.000000    0.000000   20.000000   30.000000    5.000000    0.000000
50%      9.000000    0.000000   30.000000   35.000000   15.000000    5.000000
75%     20.000000   10.000000   40.000000   50.000000   25.000000   15.000000
max     70.000000   30.000000   90.000000  100.000000   75.000000   80.000000

          Prof_JS  Prof_Python      Prof_R    Prof_SAS    Ind_Java  \
count  207.000000   207.000000  207.000000  207.000000  207.000000
mean     5.840580    30.028986   36.415459   18.463768   11.942029
std     10.812555    19.144802   20.847606   18.831841   14.706399
min      0.000000     0.000000    0.000000    0.000000    0.000000
25%      0.000000    20.000000   25.000000    0.000000    0.000000
50%      0.000000    30.000000   33.000000   15.000000    5.000000
75%     10.000000    40.000000   50.000000   30.000000   20.000000
max    100.000000   100.000000  100.000000  100.000000   70.000000

           Ind_JS  Ind_Python       Ind_R     Ind_SAS
count  207.000000  207.000000  207.000000  207.000000
mean     6.966184   29.772947   32.434783   18.884058
std     10.030721   17.959816   15.912209   19.137623
min      0.000000    0.000000    0.000000    0.000000
25%      0.000000   20.000000   22.500000    0.000000
50%      0.000000   30.000000   30.000000   15.000000
75%     10.000000   40.000000   40.000000   30.000000
max     50.000000   95.000000   85.000000  100.000000
```

In [22]:
```
# descriptive statistics for one variable
print('\nDescriptive statistics for courses completed ----------------')
print(survey_df['Courses_Completed'].describe())
```

```
Descriptive statistics for courses completed ----------------
count    187.000000
mean       6.342246
std        3.170849
min        1.000000
25%        4.000000
50%        6.000000
75%        9.000000
max       12.000000
Name: Courses_Completed, dtype: float64
```

In [24]:

```
# graduation date counts
grad_date= list(valid_survey_input.Graduate_Date)
from collections import Counter
Counter(grad_date)
```

Out[24]:

```
Counter({nan: 3,
         'Spring 2018': 30,
         'Fall 2018': 20,
         'Fall 2017': 14,
         'Summer 2019': 3,
         'Summer 2018': 11,
         'Winter 2019': 11,
         '2020 or Later': 5,
         'Winter 2018': 25,
         'Fall 2019': 5,
         'Fall 2016': 13,
         'Summer 2017': 14,
         'Spring 2019': 9,
         'Spring 2017': 19,
         'Winter 2017': 25})
```

In [145]:

```
# descriptive statistics for interest in new courses
newcourse_df = survey_df.loc[:, 'Python_Course_Interest':'Systems_Analysis_Course_
Interest']

print('\nDescriptive statistics for new courses  ---------------')
print(newcourse_df.describe())
```

```
Descriptive statistics for new courses  ---------------
       Python_Course_Interest  Foundations_DE_Course_Interest  \
count              206.000000                      200.000000
mean                73.529126                       58.045000
std                 29.835429                       32.588079
min                  0.000000                        0.000000
25%                 53.000000                       29.500000
50%                 82.500000                       60.000000
75%                100.000000                       89.250000
max                100.000000                      100.000000

       Analytics_App_Course_Interest  Systems_Analysis_Course_Interest
count                     203.000000                        200.000000
mean                       55.201970                         53.630000
std                        34.147954                         33.539493
min                         0.000000                          0.000000
25%                        25.000000                         21.500000
50%                        60.000000                         51.500000
75%                        85.000000                         80.250000
max                       100.000000                        100.000000
```

In [28]:

```
# ----------------------------------------------------------
# transformation code added with version v005
# ----------------------------------------------------------
# transformations a la Scikit Learn
# documentation at http://scikit-learn.org/stable/auto_examples/
#                  preprocessing/plot_all_scaling.html#sphx-glr-auto-
#                  examples-preprocessing-plot-all-scaling-py
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import MinMaxScaler
```

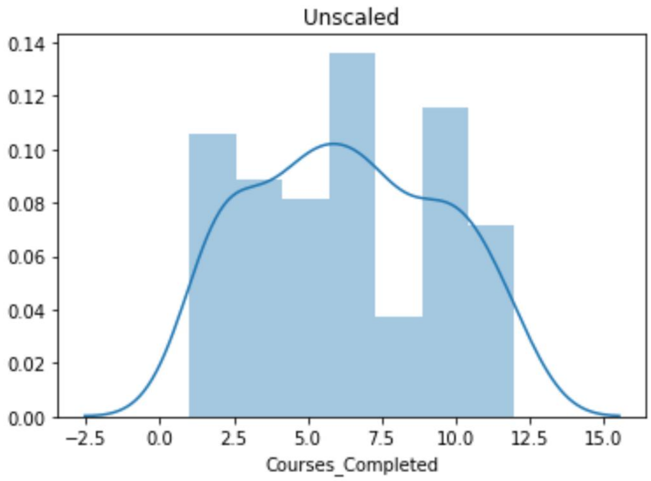
In [29]:

```
# transformations a la Scikit Learn
# select variable to examine, eliminating missing data codes
X = survey_df['Courses_Completed'].dropna()
```

In [30]:

```
# Seaborn provides a convenient way to show the effects of transformations
# on the distribution of values being transformed
# Documentation at https://seaborn.pydata.org/generated/seaborn.distplot.html

unscaled_fig, ax = plt.subplots()
sns.distplot(X).set_title('Unscaled')
unscaled_fig.savefig('Transformation-Unscaled' + '.pdf',
    bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
    orientation='portrait', papertype=None, format=None,
    transparent=True, pad_inches=0.25, frameon=None)
```

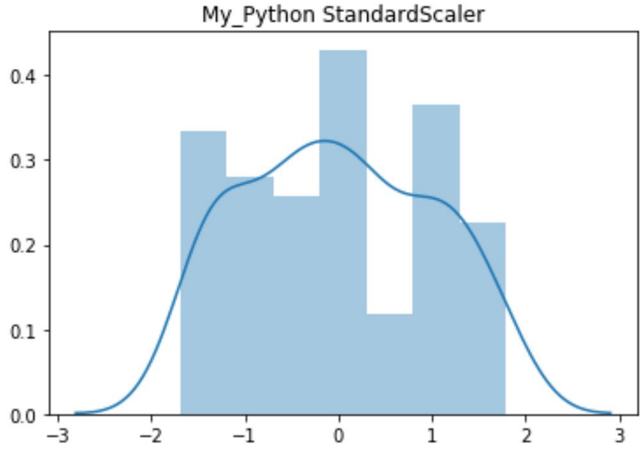
```
C:\Users\Jimmy\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWarn
ing: Using a non-tuple sequence for multidimensional indexing is deprecated; use
`arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted
as an array index, `arr[np.array(seq)]`, which will result either in an error or
a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```



In [32]:

```
standard_fig, ax = plt.subplots()
sns.distplot(StandardScaler().fit_transform(np.array(X).reshape(-1,1))).set_title('
My_Python StandardScaler')
standard_fig.savefig('Transformation-StandardScaler' + '.pdf',
    bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
    orientation='portrait', papertype=None, format=None,
    transparent=True, pad_inches=0.25, frameon=None)
```

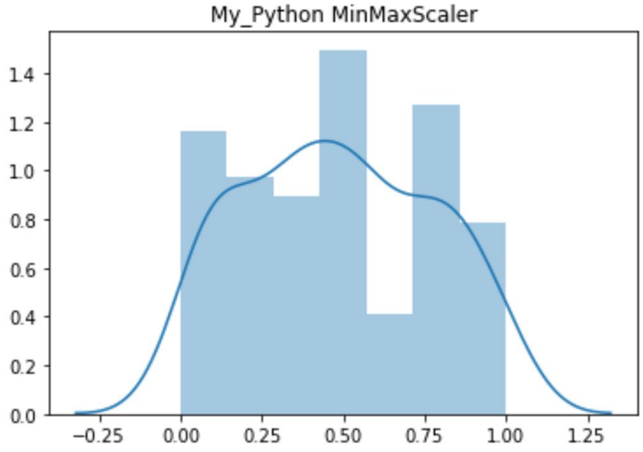
```
C:\Users\Jimmy\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWarn
ing: Using a non-tuple sequence for multidimensional indexing is deprecated; use
`arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted
as an array index, `arr[np.array(seq)]`, which will result either in an error or
a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```



In [33]:

```
minmax_fig, ax = plt.subplots()
sns.distplot(MinMaxScaler().fit_transform(np.array(X).reshape(-1,1))).set_title('My
_Python MinMaxScaler')
minmax_fig.savefig('Transformation-MinMaxScaler' + '.pdf',
    bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
    orientation='portrait', papertype=None, format=None,
    transparent=True, pad_inches=0.25, frameon=None)
```

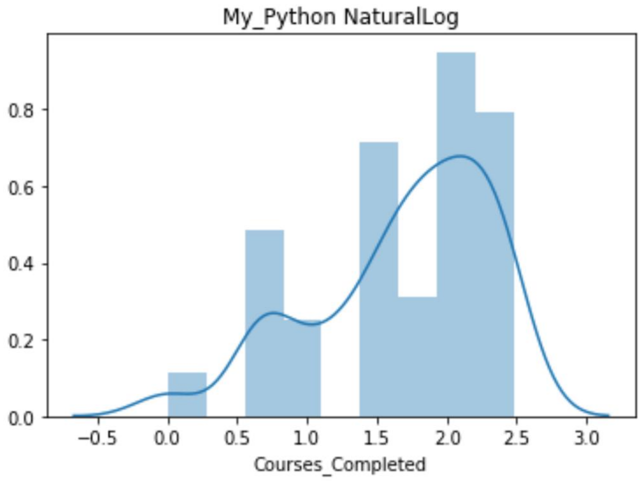
```
C:\Users\Jimmy\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWarn
ing: Using a non-tuple sequence for multidimensional indexing is deprecated; use
`arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted
as an array index, `arr[np.array(seq)]`, which will result either in an error or
a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```



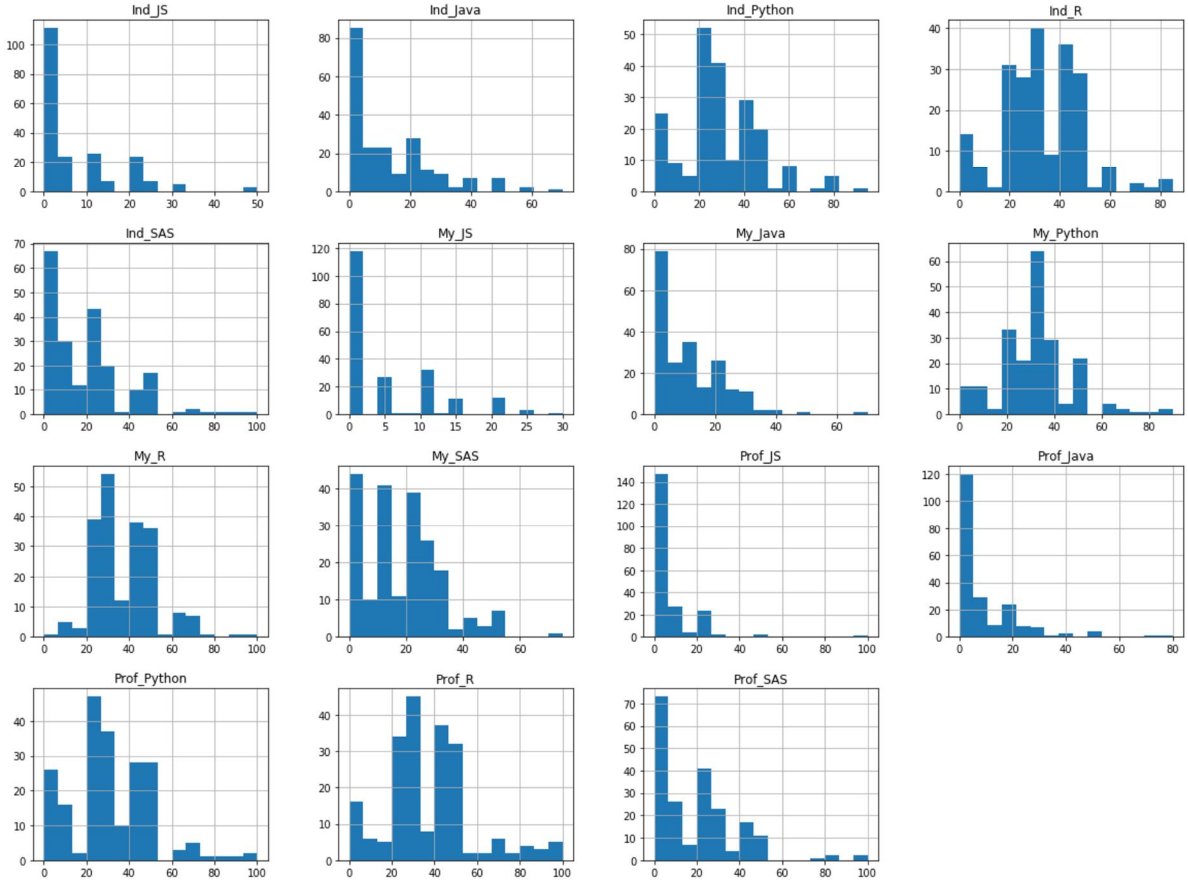
In [34]:

```
log_fig, ax = plt.subplots()
sns.distplot(np.log(X)).set_title('My_Python NaturalLog')
log_fig.savefig('Transformation-NaturalLog' + '.pdf',
    bbox_inches = 'tight', dpi=None, facecolor='w', edgecolor='b',
    orientation='portrait', papertype=None, format=None,
    transparent=True, pad_inches=0.25, frameon=None)
```

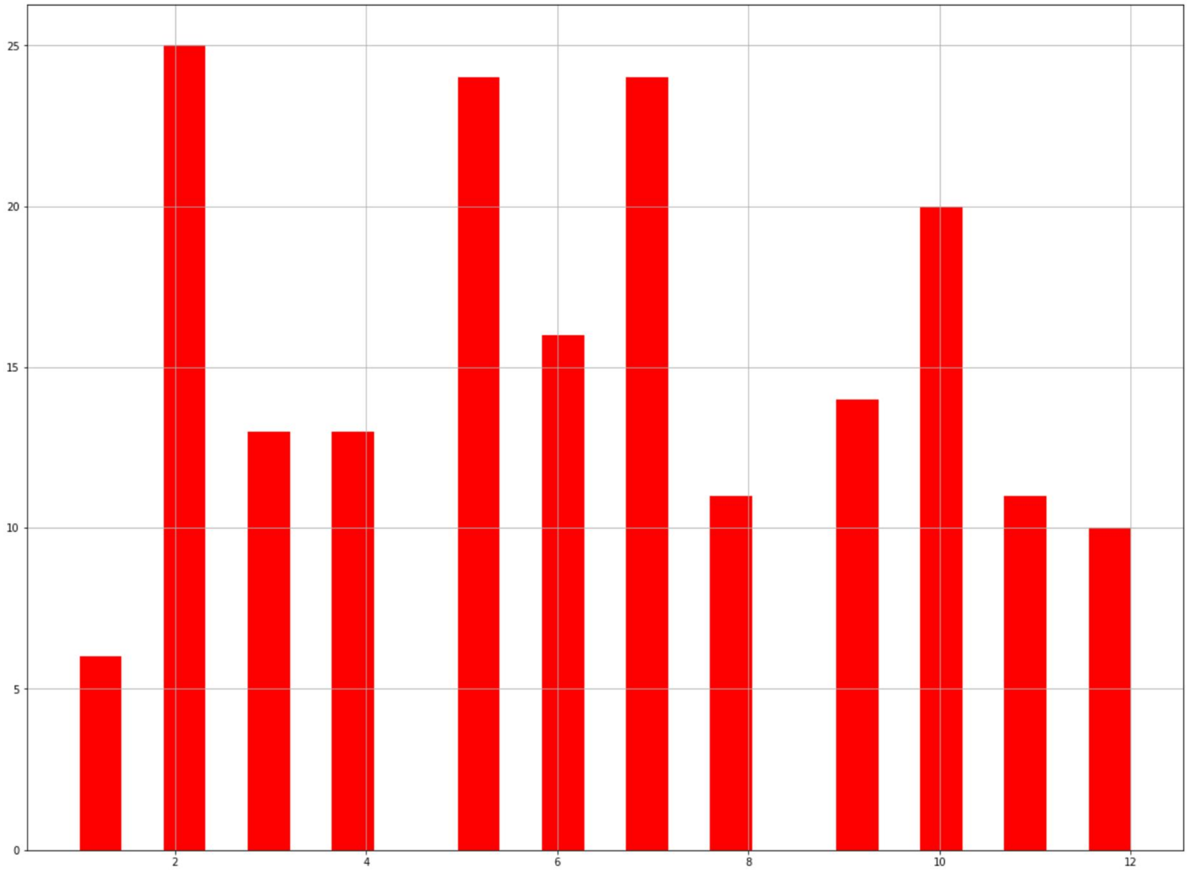
```
C:\Users\Jimmy\Anaconda3\lib\site-packages\scipy\stats\stats.py:1713: FutureWarn
ing: Using a non-tuple sequence for multidimensional indexing is deprecated; use
`arr[tuple(seq)]` instead of `arr[seq]`. In the future this will be interpreted
as an array index, `arr[np.array(seq)]`, which will result either in an error or
a different result.
  return np.add.reduce(sorted[indexer] * weights, axis=axis) / sumval
```



In [43]:
```
# histogram of score distribution for each software
software_df.hist(bins = 15, figsize = (20, 15))
plt.show()
```

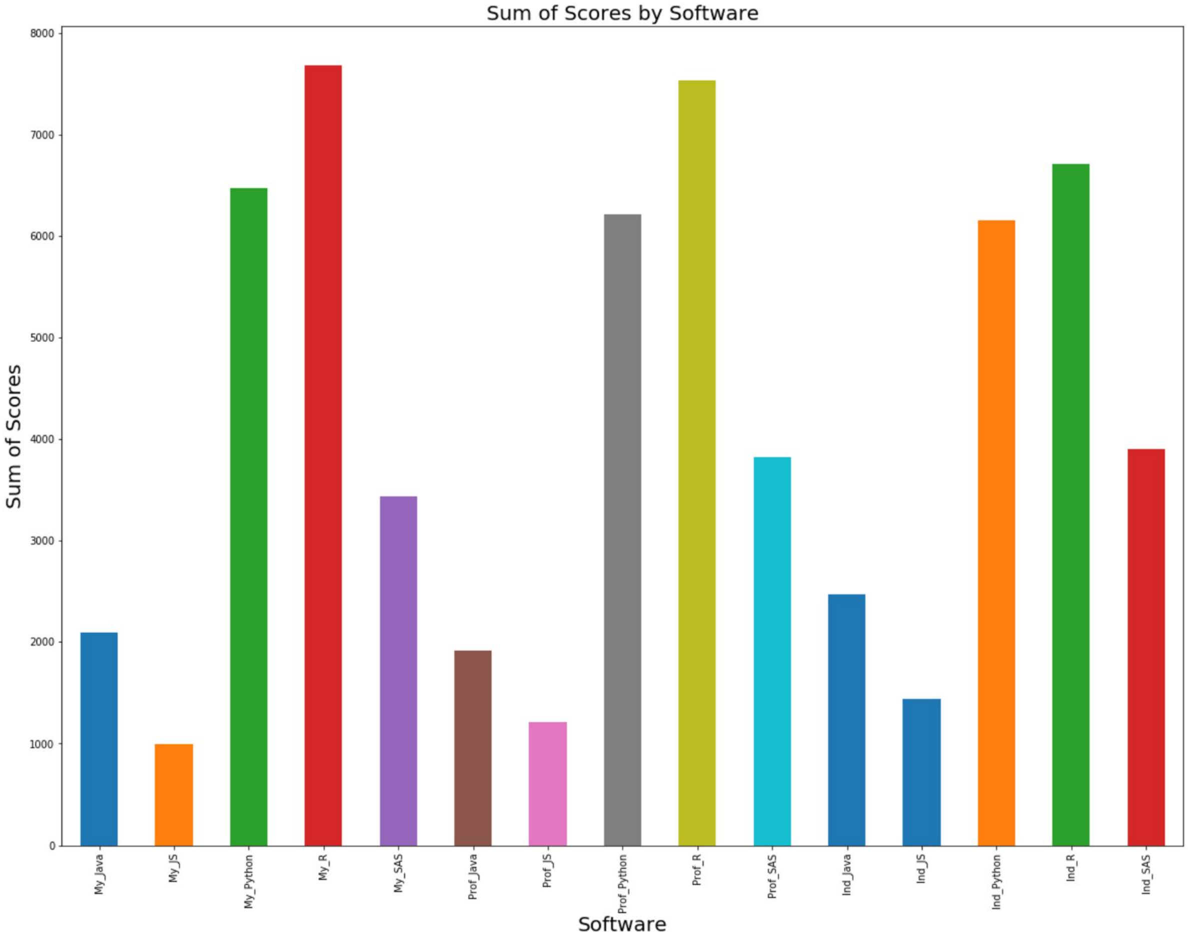


```
In [41]: survey_df['Courses_Completed'].hist(bins = 25, figsize = (20, 15),color="red")
         plt.show()
```



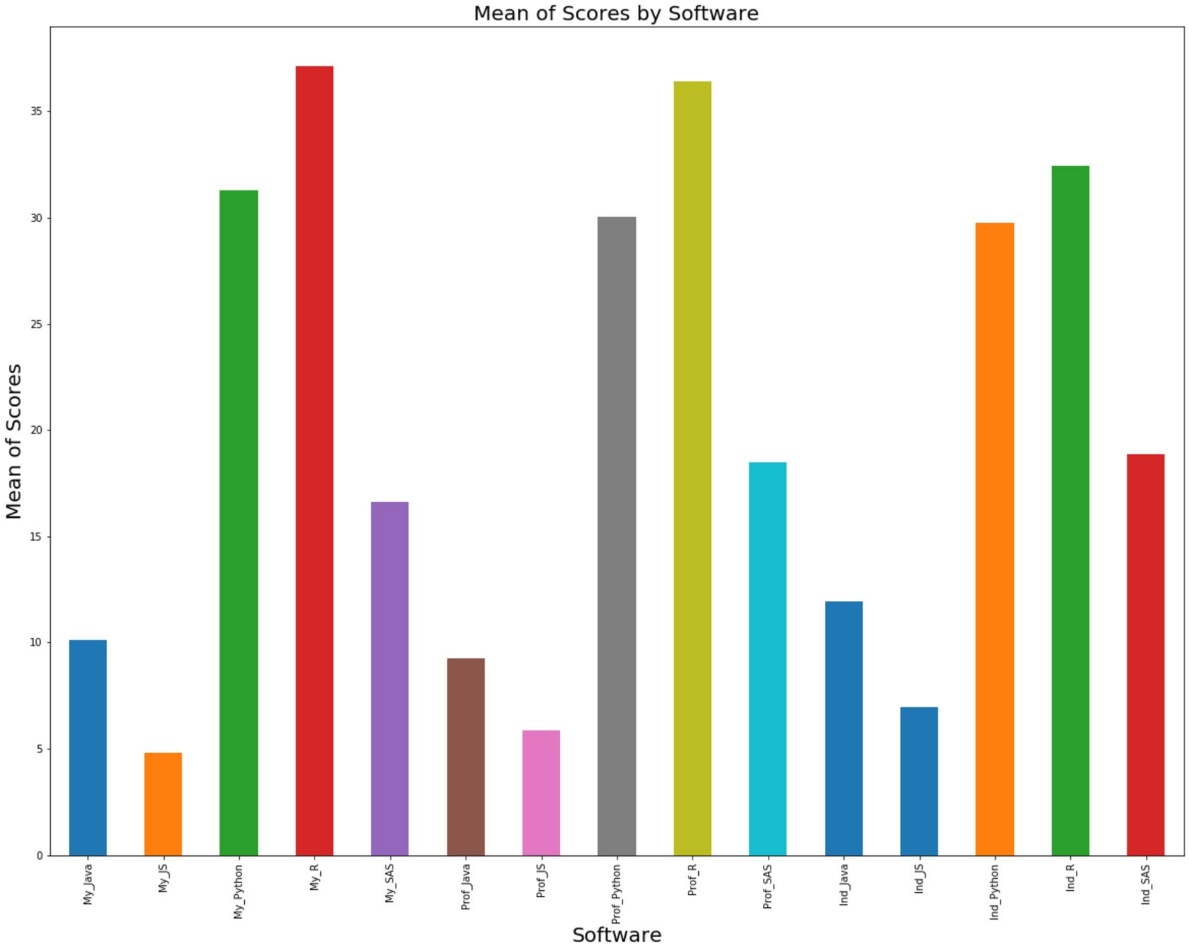
In [57]:

```
# bar plot that shows sum of scores given to software
software_df.sum().plot( kind='bar', figsize = (20, 15) )
plt.title("Sum of Scores by Software", fontsize=20)
plt.xlabel('Software', fontsize=20)
plt.ylabel('Sum of Scores', fontsize=20)

plt.show()
```



In [84]:

```
# bar plot that shows mean of scores given to software
software_df.mean().plot( kind='bar', figsize = (20, 15) )
plt.title("Mean of Scores by Software", fontsize=20)
plt.xlabel('Software', fontsize=20)
plt.ylabel('Mean of Scores', fontsize=20)

plt.show()
```



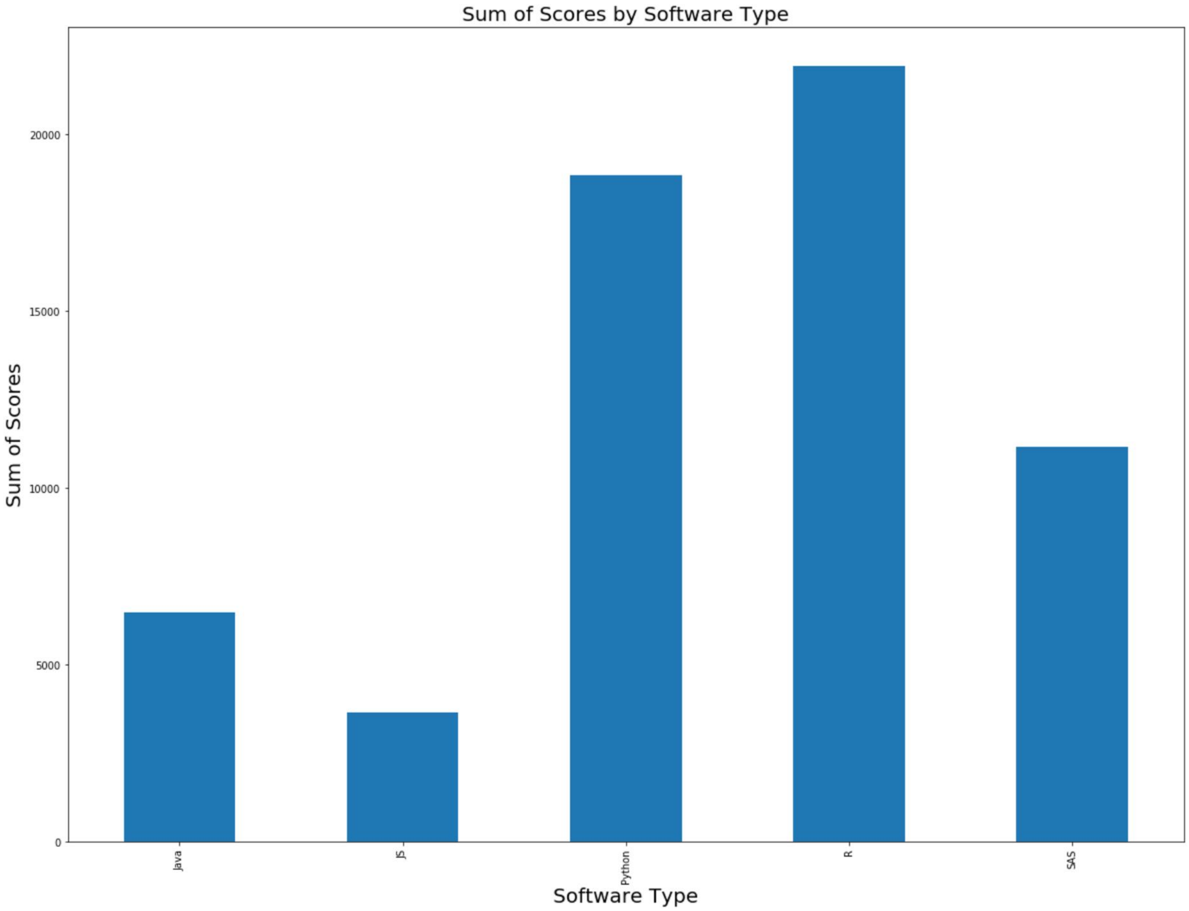
In [78]:

```
#Sum of software type
Java_sum= software_df.My_Java.sum() + software_df.Prof_Java.sum()+ software_df.Ind_
Java.sum()
JS_sum= software_df.My_JS.sum() + software_df.Prof_JS.sum()+ software_df.Ind_JS.sum
()
Python_sum= software_df.My_Python.sum() + software_df.Prof_Python.sum()+ software_d
f.Ind_Python.sum()
R_sum= software_df.My_R.sum() + software_df.Prof_R.sum()+ software_df.Ind_R.sum()
SAS_sum= software_df.My_SAS.sum() + software_df.Prof_SAS.sum()+ software_df.Ind_SA
S.sum()

list={'Name':['Java','JS','Python','R','SAS'],
      'Sum':[Java_sum,JS_sum,Python_sum,R_sum,SAS_sum]}
software_type_df= (pd.DataFrame(list))
software_type_df
```

Out[78]:

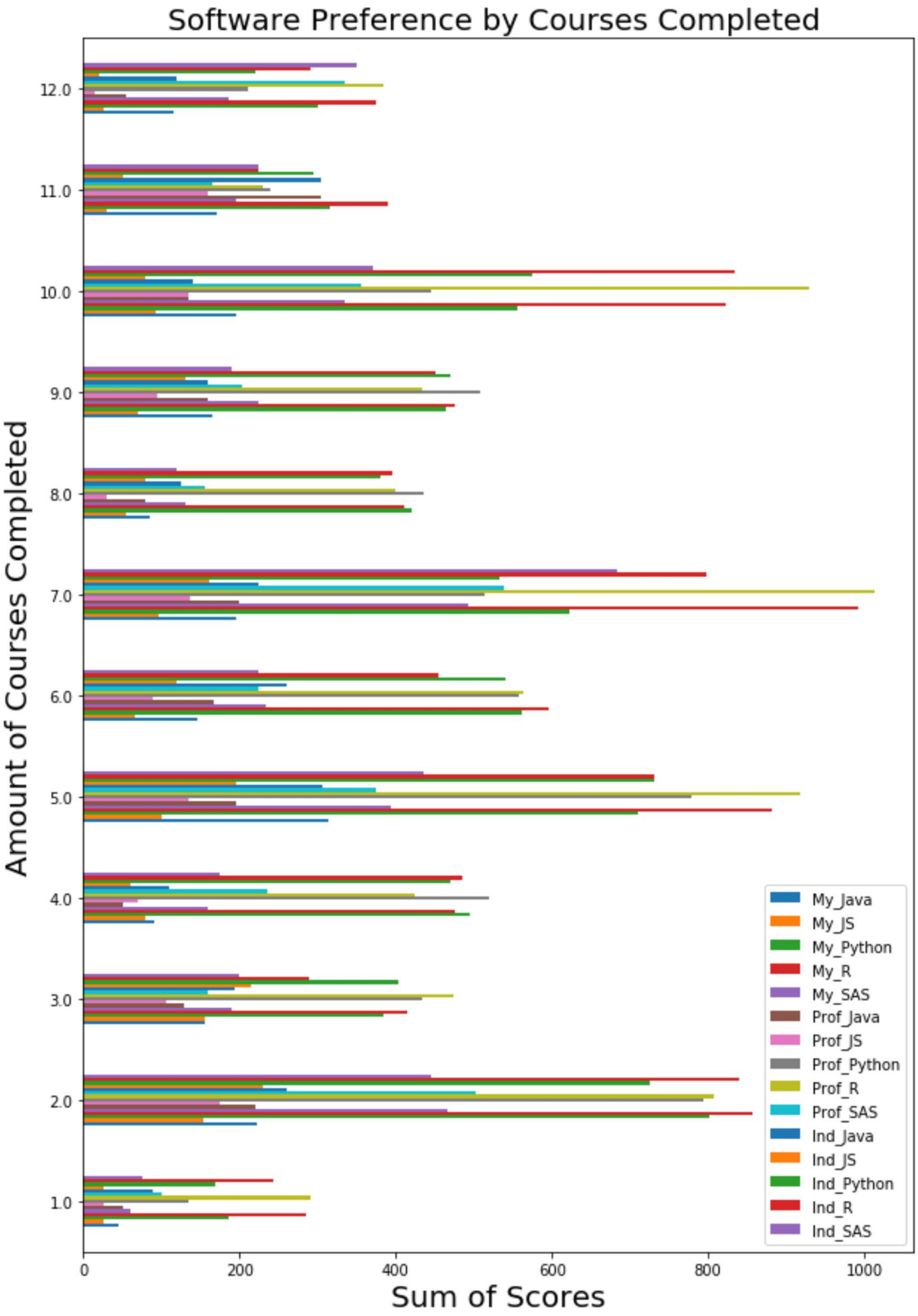
	Name	Sum
0	Java	6485
1	JS	3644
2	Python	18859
3	R	21937
4	SAS	11175

In [87]:
```
#plot of sum by type of software
software_type_df.plot( kind='bar', figsize = (20, 15),legend = False  )
plt.title("Sum of Scores by Software Type", fontsize=20)
plt.xlabel('Software Type', fontsize=20)
plt.ylabel('Sum of Scores', fontsize=20)
plt.xticks(np.arange(5), ('Java','JS','Python','R','SAS'))

plt.show()
```

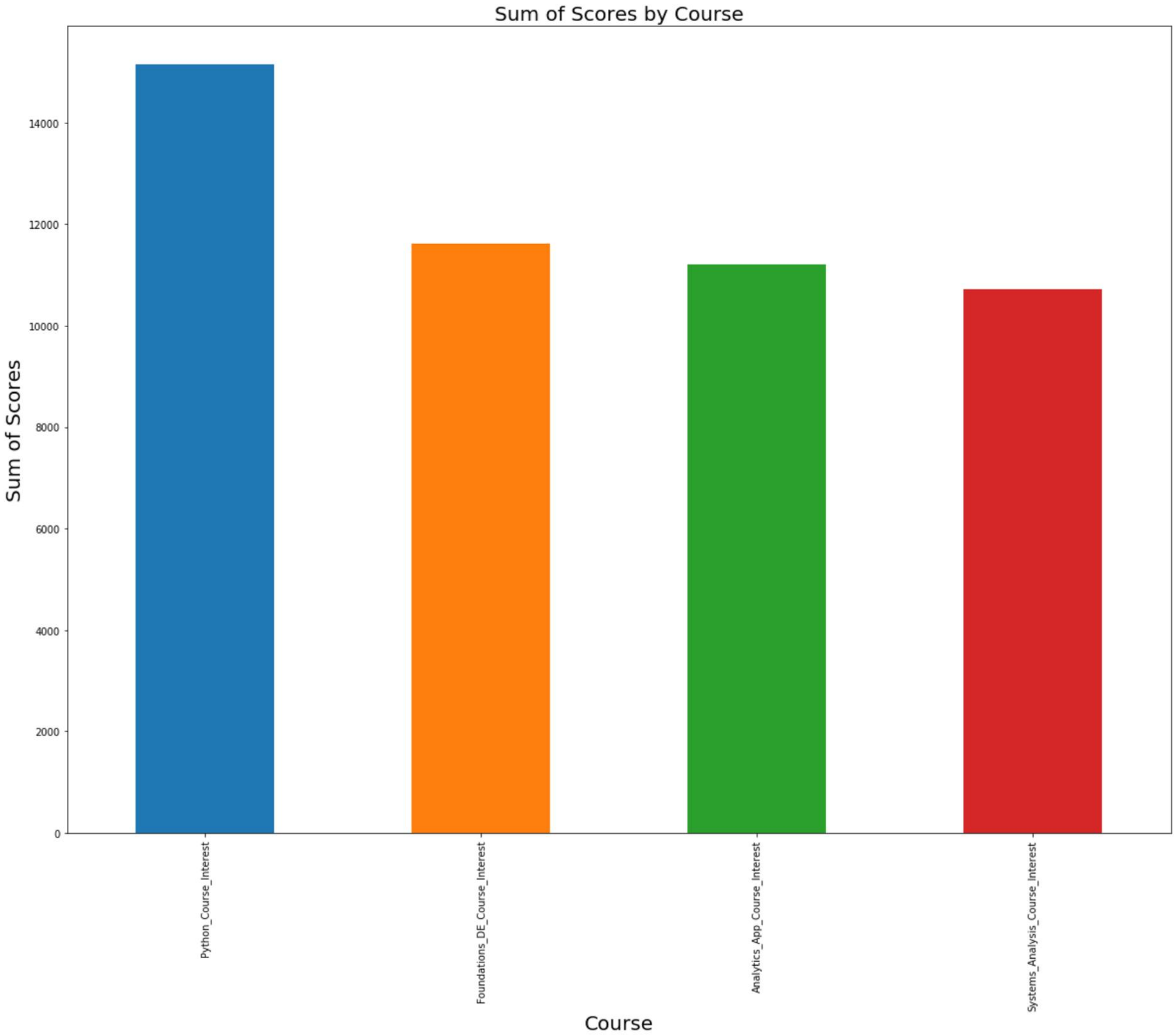


In [135]:
```
# define subset DataFrame for analysis of software preferences and courses completed
course_comp_df = survey_df.loc[:,'My_Java':'Courses_Completed']
cc_software=course_comp_df.groupby("Courses_Completed").sum().loc[:,'My_Java':'Ind_SAS']
```

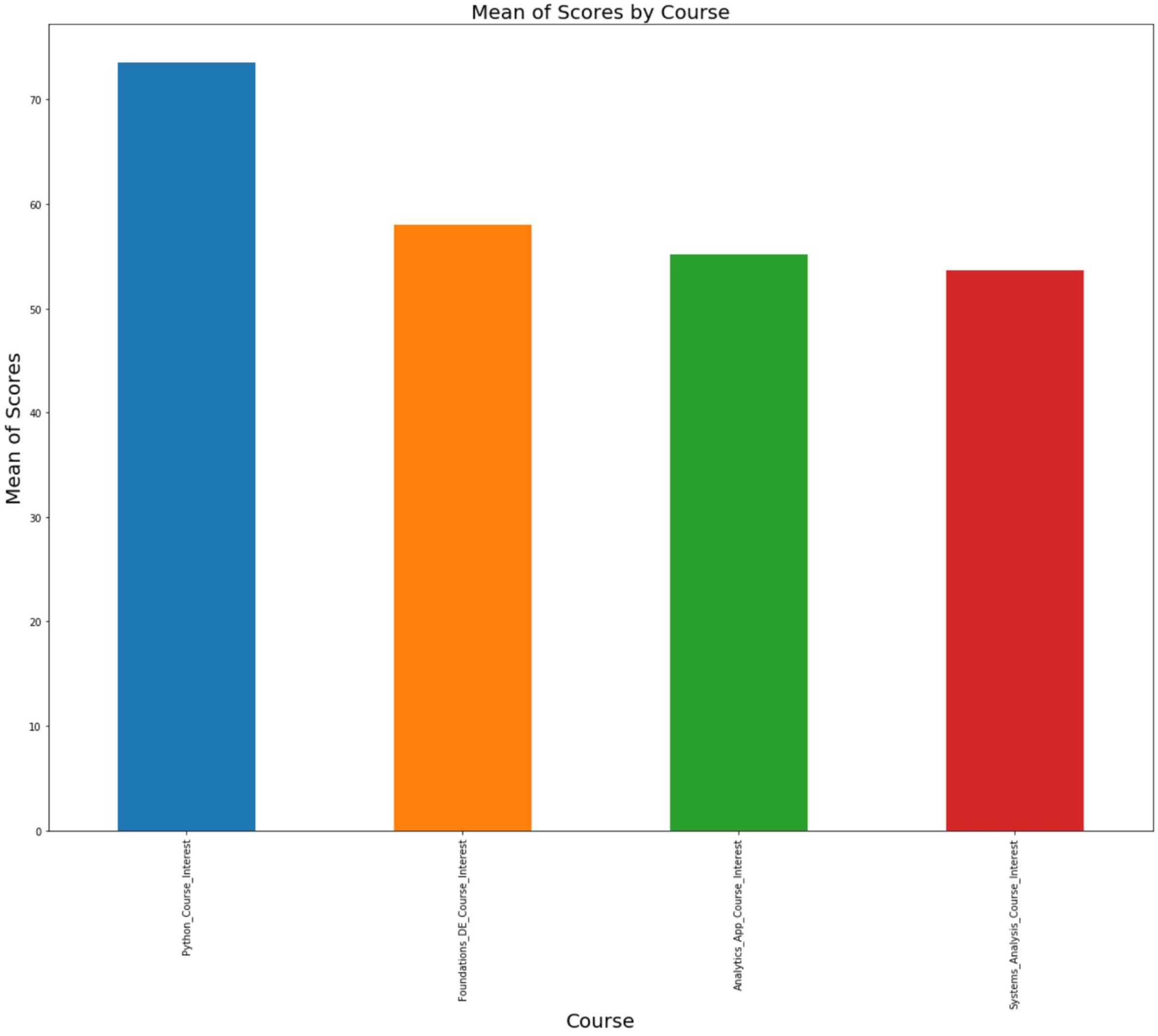
```
In [137]: cc_software.plot( kind='barh', figsize = (10,15),legend = True  )
          plt.title("Software Preference by Courses Completed ", fontsize=20)
          plt.xlabel('Sum of Scores', fontsize=20)
          plt.ylabel('Amount of Courses Completed', fontsize=20)

          plt.show()
```



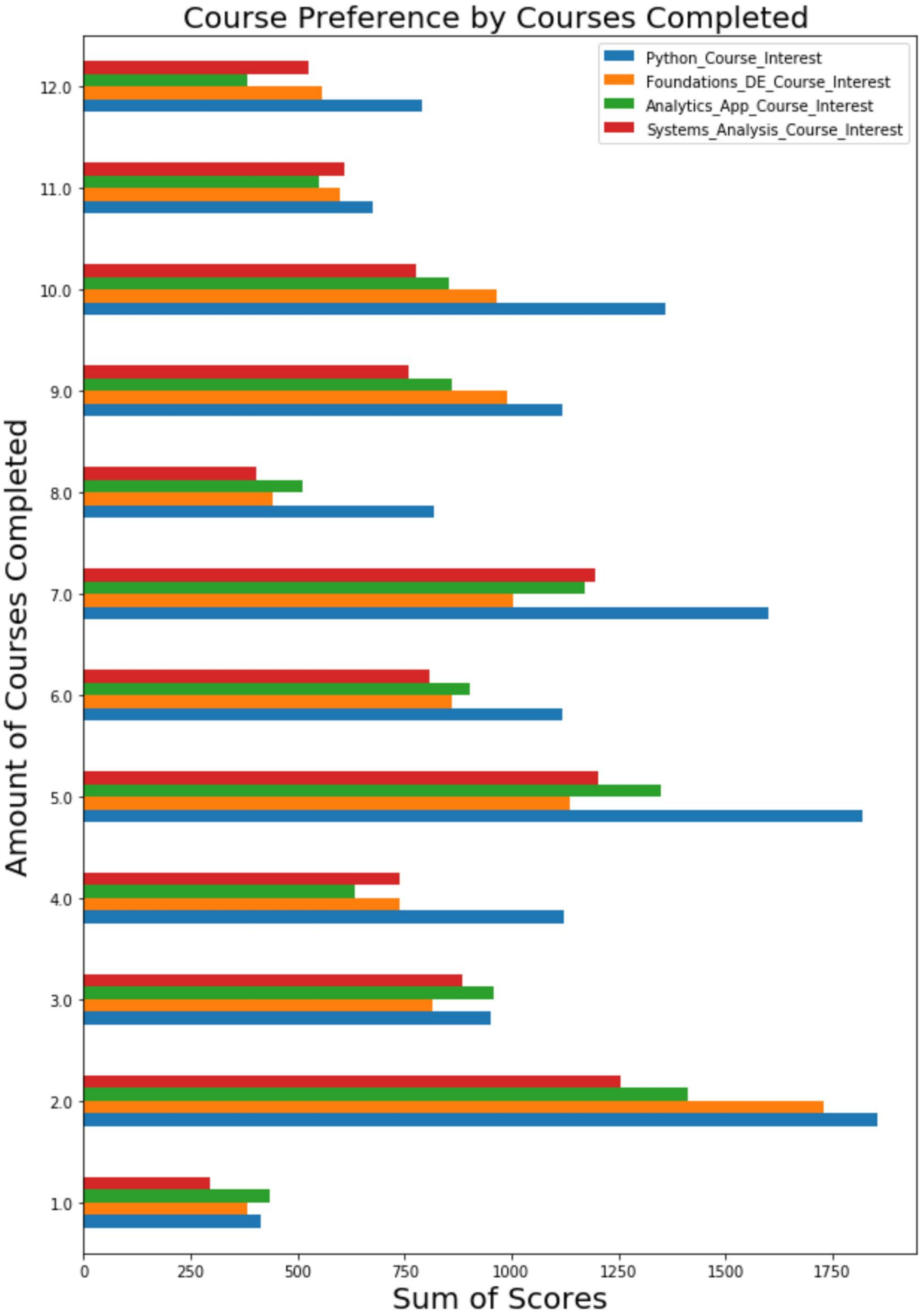
In [146]:
```
#Analysis of course preference

newcourse_df.sum().plot( kind='bar', figsize = (20, 15) )
plt.title("Sum of Scores by Course", fontsize=20)
plt.xlabel('Course', fontsize=20)
plt.ylabel('Sum of Scores', fontsize=20)

plt.show()
```



```
In [147]: newcourse_df.mean().plot( kind='bar', figsize = (20, 15) )
          plt.title("Mean of Scores by Course", fontsize=20)
          plt.xlabel('Course', fontsize=20)
          plt.ylabel('Mean of Scores', fontsize=20)

          plt.show()
```



```
In [148]: cc_preference=course_comp_df.groupby("Courses_Completed").sum().loc[:,
                              'Python_Course_Interest':'Systems_Analysis_Course_Interest']
          cc_preference.plot( kind='barh', figsize = (10,15),legend = True  )
          plt.title("Course Preference by Courses Completed ", fontsize=20)
          plt.xlabel('Sum of Scores', fontsize=20)
          plt.ylabel('Amount of Courses Completed', fontsize=20)

          plt.show()
```



In [ ]: