eneskemal_HW

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1 Final Homework

Course: Data Mining

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Using Pokemon Dataset from Kaggle: Link

About Dataset:

This dataset contains a full set of in-game statistics for all 802 pokemon in the Sun and Moon. It also includes full information on which pokemon can learn which moves (movesets.csv), what moves can do (moves.csv), and how damage is modified by pokemon type (type-chart.csv). But for this project I am going to ignore them.

- **id:** unique id for each pokemon species
- **forme:** used to differentiate different forms of a single pokemon species
- **type1:** the first type of this pokemon
- **type2:** the secondary type of this pokemon (if it has one)
- **hp:** hit points, or health, defines how much damage a pokemon can withstand before fainting
- **attack:** the base modifier for physical attacks
- **defense:** the base damage resistance against physical attacks
- **spattack:** special attack, the base modifier for special attacks
- **spdefense:** the base damage resistance against special attacks
- **speed:** used in determining which pokemon attacks first each round
- **total:** the sum of hp, attack, defense, spattack, spdefense, and speed

Columns to ignore:

- **ndex:** the pokedex number for this pokemon
- **species:** the name of this pokemon
- **ability1:** the first ability this pokemon could have
- **ability2:** the second ability this pokemon could have
- **abilityH:** the hidden ability this pokemon could have instead of ability1 or ability2
- **weight:** the pokemon's weight in lbs

- **height:** the pokemon's height in feet and inches
- **dex1:** first pokedex description of this pokemon
- **dex2:** second pokedex description of this pokemon
- **class:** the thematic class of pokemon this species is (does not influence game mechanics)
- **percent-male:** the percentage of pokemon of this species which are male
- **percent-female:** the percentage of pokemon of this species which are female
- **pre-evolution:** the pokemon that evolves into this pokemon
- **egg-group1:** a pokemon can breed with any other pokemon in the same egg group
- **egg-group2:** a pokemon can breed with any other pokemon in the same egg group

1.1 Step 0 : Data Preparation

Reading and cleaning the data if necessary

```
In [1]: # Import the pandas library
        import pandas as pd
```

```
In [2]: # Read csv file from the path and store it in df
        df = pd.read_csv('./eneskemal_HW.csv', encoding="ISO-8859-1",
                         usecols=[3,4,5,9,10,11,12,13,14,15]) # Specific columns to use
        # Show the first 5 row of the data
        df.head()
        # Show the last 5 row of the data
        # df.tail()
```

```
Out[2]:         forme  type1   type2  hp  attack  defense  spattack  spdefense  speed  \
        0   Bulbasaur  Grass  Poison  45      49       49        65         65     45
        1     Ivysaur  Grass  Poison  60      62       63        80         80     60
        2    Venusaur  Grass  Poison  80      82       83       100        100     80
        3  Charmander   Fire     NaN  39      52       43        60         50     65
        4  Charmeleon   Fire     NaN  58      64       58        80         65     80

           total
        0    318
        1    405
        2    525
        3    309
        4    405
```

```
In [3]: # Check if missing values
        df.count(0)
```

```
Out[3]: forme        1061
        type1        1061
        type2         538
        hp           1061
        attack       1061
        defense      1061
        spattack     1061
```

```
spdefense    1061
speed        1061
total        1061
dtype: int64
```

1.2 Step 1: Data Information

Generate the information about your dataset: number of columns and rows, names and data types of the columns, memory usage of the dataset.

> *Hint: Pandas data frame info() function.*

```
In [4]: # Show the general information about the data
        df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1061 entries, 0 to 1060
Data columns (total 10 columns):
forme        1061 non-null object
type1        1061 non-null object
type2        538 non-null object
hp           1061 non-null int64
attack       1061 non-null int64
defense      1061 non-null int64
spattack     1061 non-null int64
spdefense    1061 non-null int64
speed        1061 non-null int64
total        1061 non-null int64
dtypes: int64(7), object(3)
memory usage: 83.0+ KB
```

1.3 Step 2 : Descriptive Statistics

Generate descriptive statistics of all columns (input and output) of your dataset. Descriptive statistics for numerical columns include: count, mean, std, min, 25 percentile (Q1), 50 percentile (Q2, median), 75 percentile (Q3), max values of the columns. For categorical columns, determine distinct values and their frequency in each categorical column.

> *Hint: Pandas, data frame describe() function.*

```
In [5]: # Descriptive information of the numerical columns
        df.describe()
```

```
Out[5]:                 hp       attack      defense     spattack    spdefense  \
        count  1061.000000  1061.000000  1061.000000  1061.000000  1061.000000
        mean     70.041470    79.602262    73.730443    74.550424    72.911404
        std      25.893508    31.378369    30.394899    31.975146    27.995681
        min       1.000000     5.000000     5.000000    10.000000    20.000000
```

```
25%      50.000000    55.000000    50.000000    50.000000    50.000000
50%      68.000000    75.000000    70.000000    70.000000    70.000000
75%      80.000000   100.000000    91.000000    95.000000    90.000000
max     255.000000   190.000000   230.000000   194.000000   230.000000

             speed        total
count  1061.000000  1061.000000
mean     70.321395   441.157399
std      29.328288   121.289505
min       5.000000   175.000000
25%      48.000000   336.000000
50%      68.000000   455.000000
75%      93.000000   520.000000
max     180.000000   780.000000
```

```
In [6]: # Categorical descriptive info for Type1 column
        df['type1'].describe()
```

```
Out[6]: count      1061
        unique       18
        top       Water
        freq        130
        Name: type1, dtype: object
```

```
In [7]: # Categorical descriptive info for Type2 column
        df['type2'].describe()
```

```
Out[7]: count        538
        unique        18
        top       Flying
        freq         140
        Name: type2, dtype: object
```

1.4 Step 3 : Analysis of the Output Column

If the output column is numerical then calculate the IQR (inter quartile range, Q3-Q1) and Range (difference between max and min value). If your output column is categorical then determine if the column is nominal or ordinal, why?. Is there a class imbalance problem? (check if there is big difference between the number of distinct values in your categorical output column)

```
In [8]: df['total'].describe()
```

```
Out[8]: count    1061.000000
        mean      441.157399
        std       121.289505
        min       175.000000
        25%       336.000000
        50%       455.000000
        75%       520.000000
        max       780.000000
        Name: total, dtype: float64
```

```
In [9]: # I want to just analyze the data but let's say my output
        #  is total column in this case:
        tot_info = df['total'].describe()
        print("(IQR)-Interquartile Range: ", tot_info['75%'] - tot_info['25%'])
        print("Range:", tot_info['max'] - tot_info['min'])
```

```
(IQR)-Interquartile Range:  184.0
Range: 605.0
```

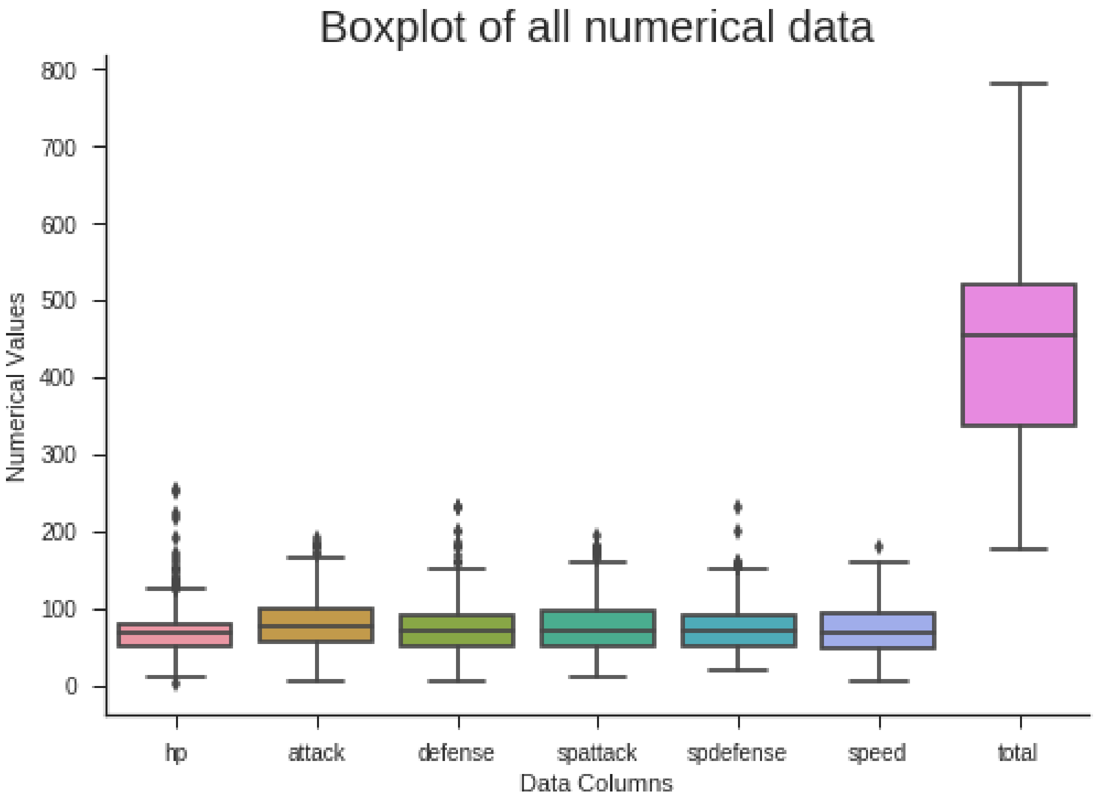
1.5 Step 4 : Box Plots

Generate box plots of all numerical columns and generate pie plots for all categorical columns.

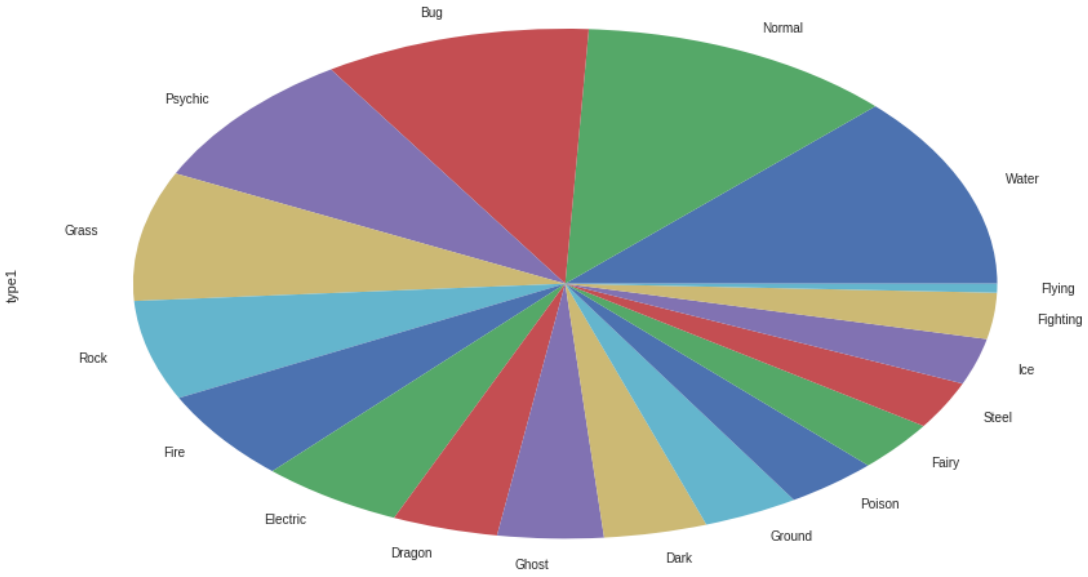
> *Hint: Pandas, Matplotlib, Seaborn, Bokeh libraries*

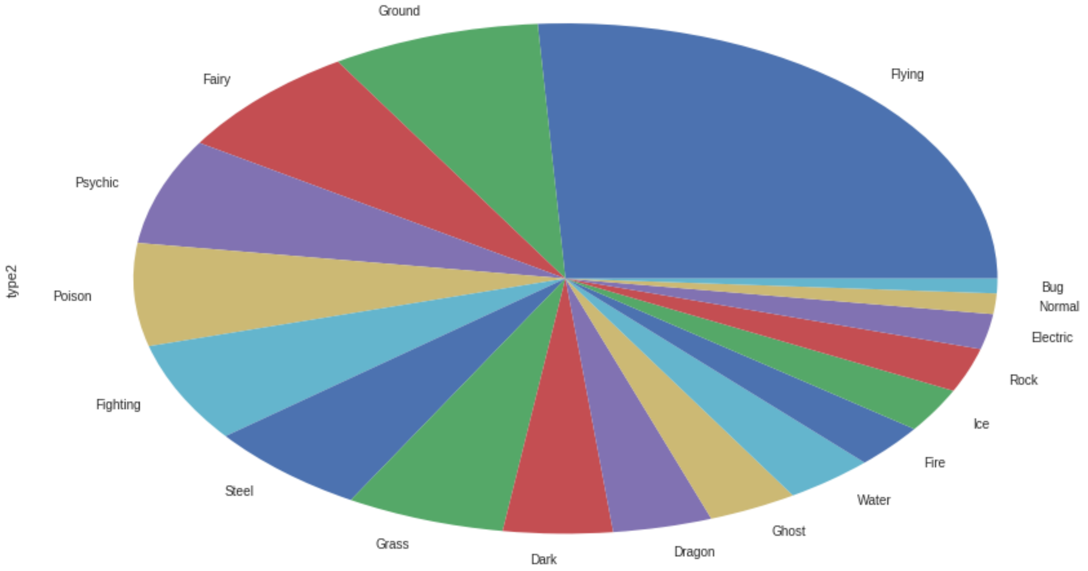
```
In [10]: # Matplotlib for additional customization
         from matplotlib import pyplot as plt
         %matplotlib inline
         # Seaborn for plotting and styling
         import seaborn as sns
         # Seaborn configurations
         sns.set(style="whitegrid", color_codes=True)
         sns.set_style("ticks")
```

```
In [11]: # Plotting all the numerical columns to combined boxplot
         sns.boxplot(data=df[(list(range(10))[3:])])
         plt.title("Boxplot of all numerical data", fontsize=20)
         plt.ylabel("Numerical Values")
         plt.xlabel("Data Columns")
         sns.despine()
         plt.show()
```



```
In [12]: # Plotting categorical type 1 and type2 data to pie plot
         fig = plt.figure(figsize=(15,20))
         ax1 = fig.add_subplot(211)
         df['type1'].value_counts().plot(kind='pie')
         ax2 = fig.add_subplot(212)
         df['type2'].value_counts().plot(kind='pie')
         plt.show()
```





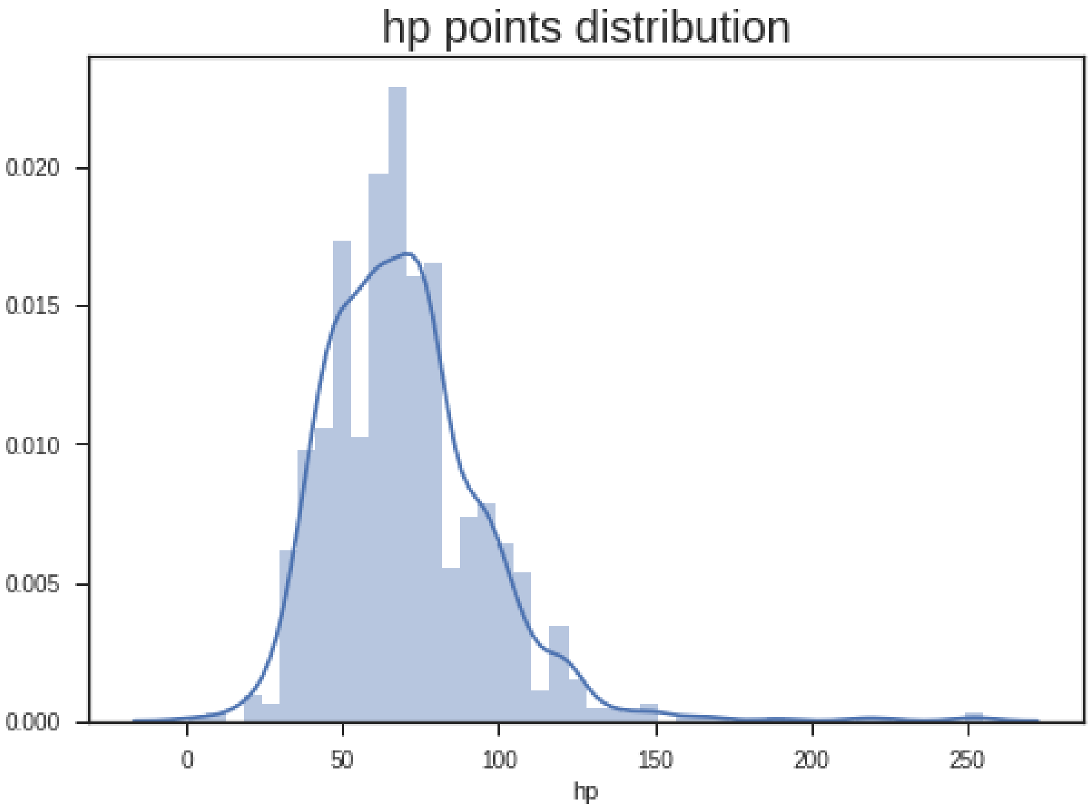
1.6 Step 5 : Distribution of Columns

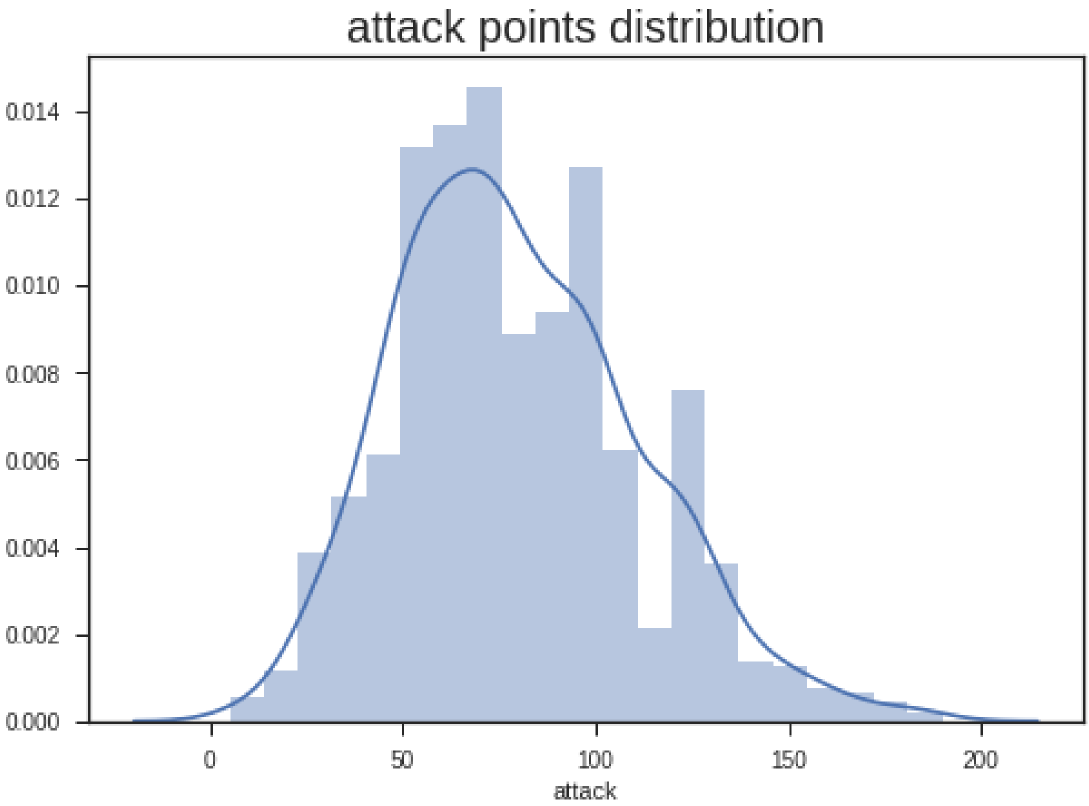
Generate plots for probability density function (pdf) or histogram of all numerical input and output columns.

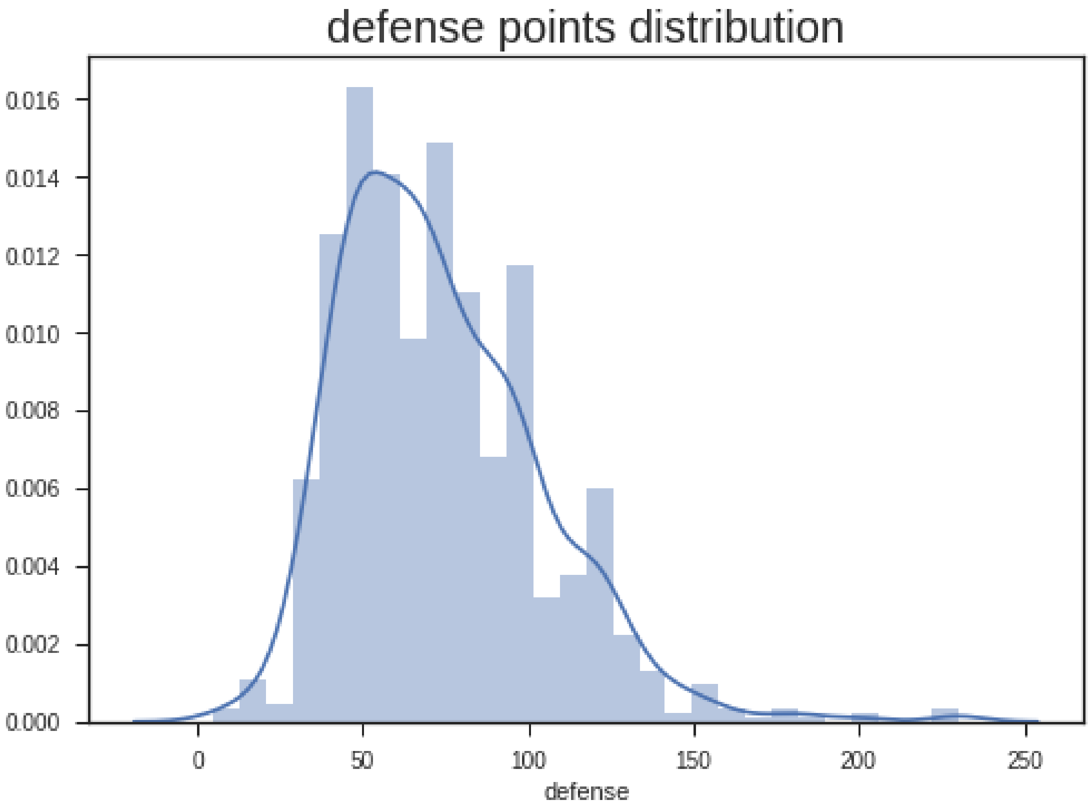
Hint: Pandas, Matplotlib, Seaborn, Bokeh libraries

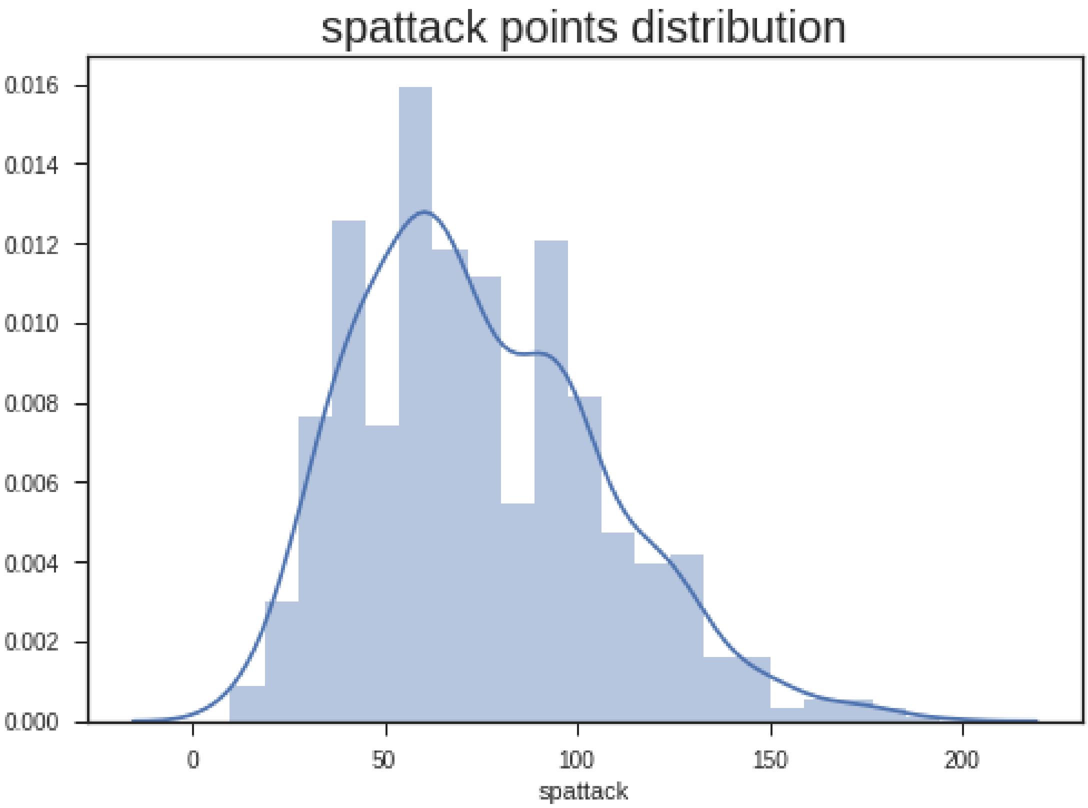
```
In [13]: # Defining a function to use 8 times
         def dist_hist_plot(name):
             sns.distplot(df[name])
             plt.title((name+" points distribution"), fontsize=20)
             plt.show()
```

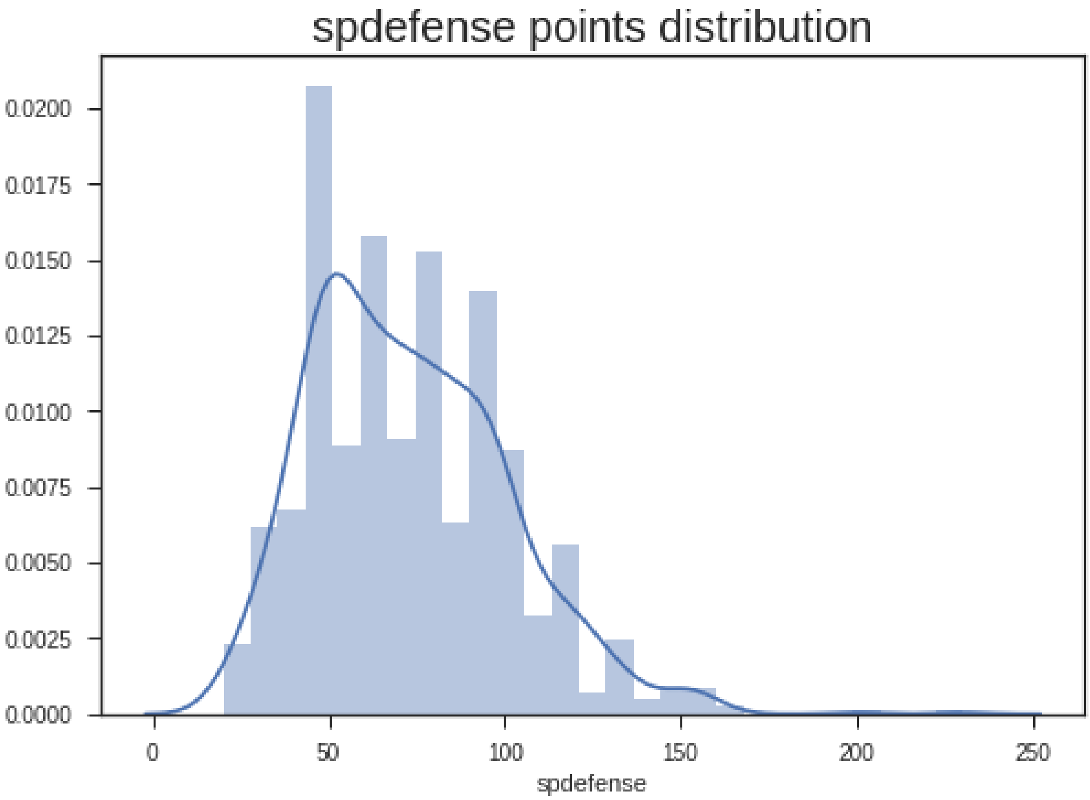
```
In [14]: lst_names = ["hp","attack","defense","spattack","spdefense","speed","total"]
         # Plotting distribution for all numerical columns
         for name in lst_names:
             dist_hist_plot(name)
```

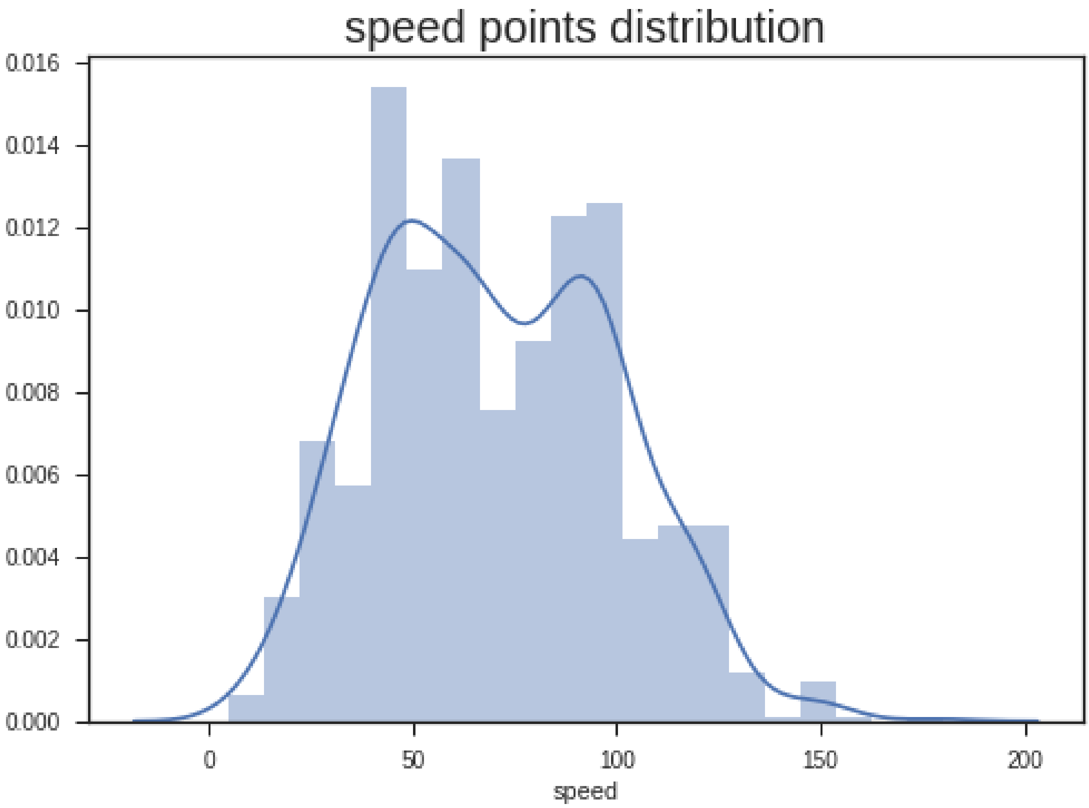


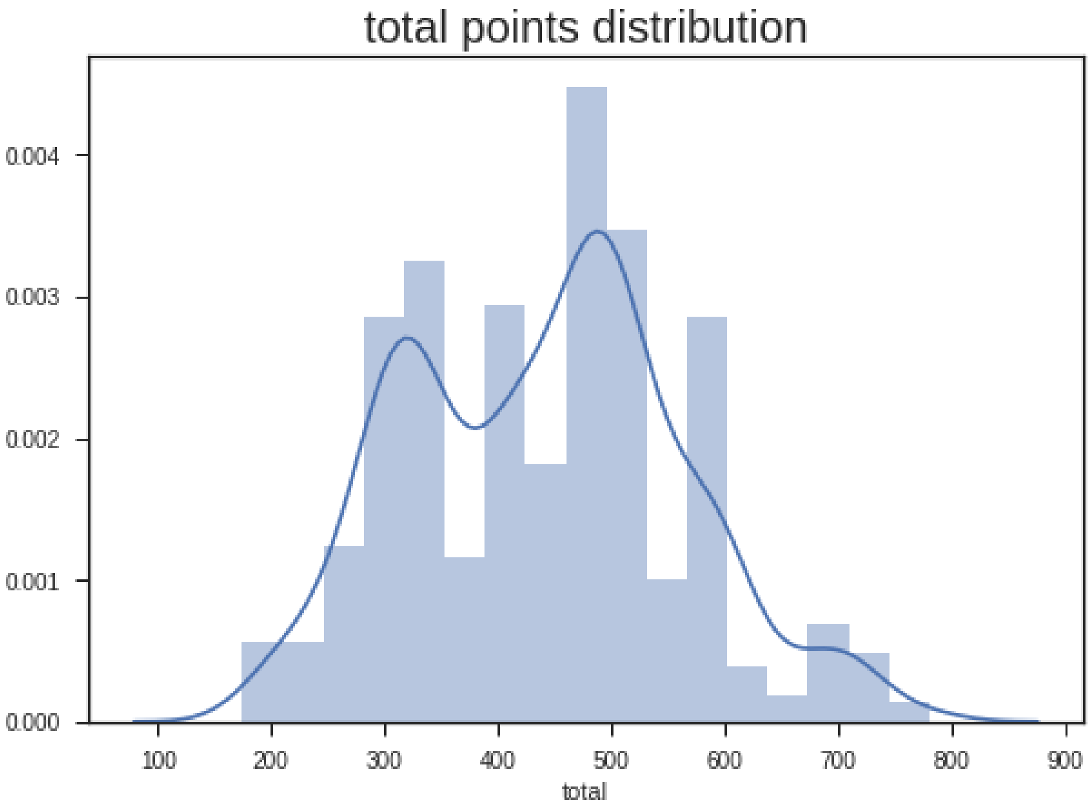

attack points distribution
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0
50
100
150
200
attack


defense points distribution
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0
50
100
150
200
250
defense


spattack points distribution
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0
50
100
150
200
spattack


spdefense points distribution
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0
50
100
150
200
250
spdefense

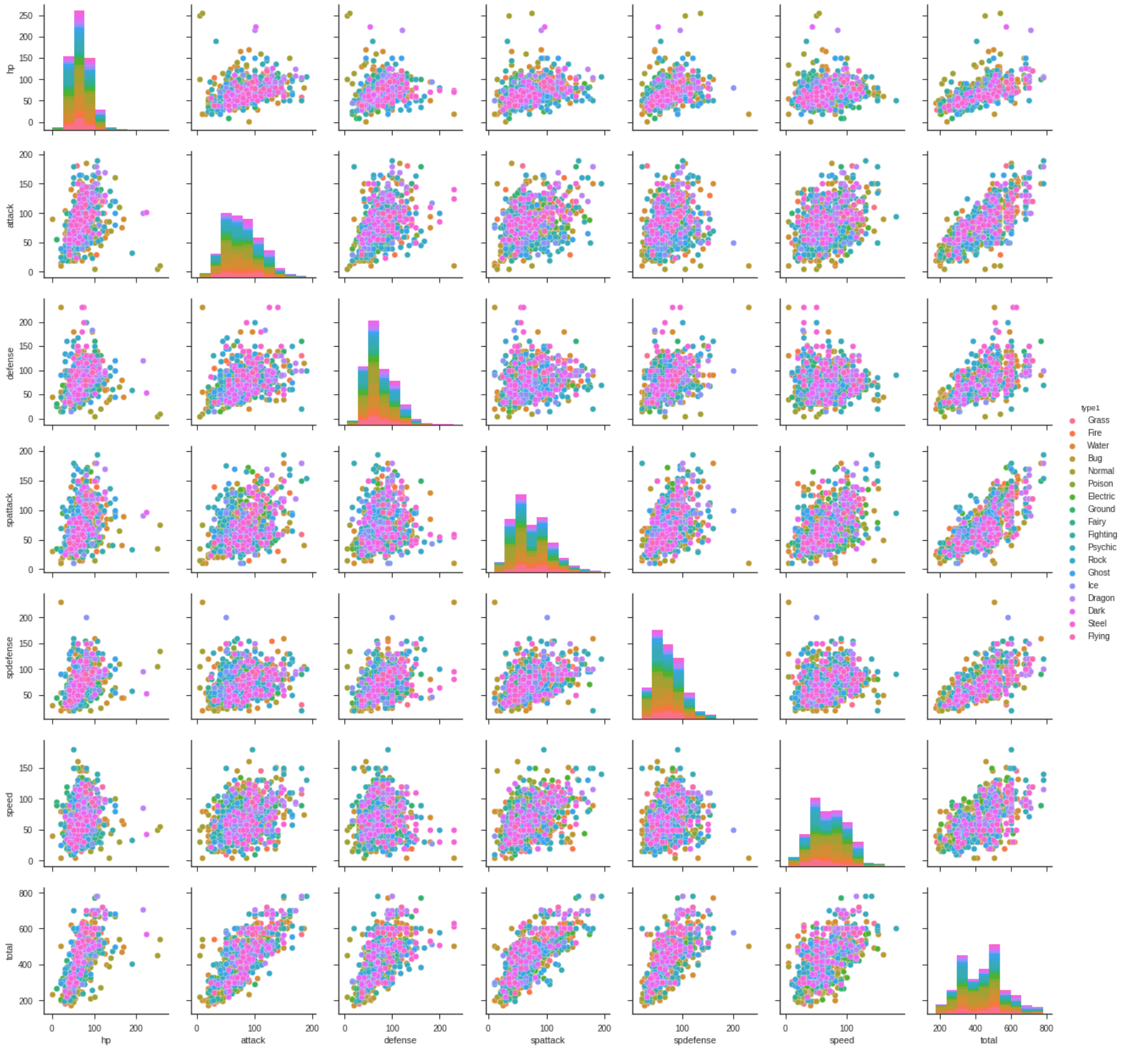

speed points distribution
0.016
0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
0
50
100
150
200
speed



1.7 Step 6 : Pairwise Plot

Generate pairwise scatter plot of all numerical input and output columns. *Hint: Seaborn pairwise plot function*

```
In [15]: # num_df = df[(list(range(10))[3:])] # Selecting numerical data only
         # pairwising with type1 categorical data
         sns.pairplot(df, hue="type1", palette="husl")
         plt.show()
```



1.8 Step 7 : Cross-Correlation of Input Columns

Generate the cross-correlation matrix for input columns. Use pearson correlation coefficient.

Hint: Pandas Seaborn corr() function

```
In [16]: df.corr()
```

```
Out[16]:                  hp    attack   defense  spattack  spdefense     speed  \
         hp         1.000000  0.444764  0.308623  0.405636   0.409281  0.230426
         attack     0.444764  1.000000  0.472564  0.398984   0.281151  0.386692
         defense    0.308623  0.472564  1.000000  0.250037   0.548948  0.046982
         spattack   0.405636  0.398984  0.250037  1.000000   0.505796  0.479303
         spdefense  0.409281  0.281151  0.548948  0.505796   1.000000  0.259481
         speed      0.230426  0.386692  0.046982  0.479303   0.259481  1.000000
```

```
total      0.663013  0.735661  0.642723  0.748746   0.724578  0.589060

              total
hp         0.663013
attack     0.735661
defense    0.642723
spattack   0.748746
spdefense  0.724578
speed      0.589060
total      1.000000
```

1.9 Step 8 : Identify Correlated Columns

Those input columns with pearson coefficient greater than or equal to 0.8 *Hint: Pandas, Seaborn corr() function*

```
In [17]: df.corr() > 0.8
         # As you can see not really useful data which gives me
         #  not useful correlations
```

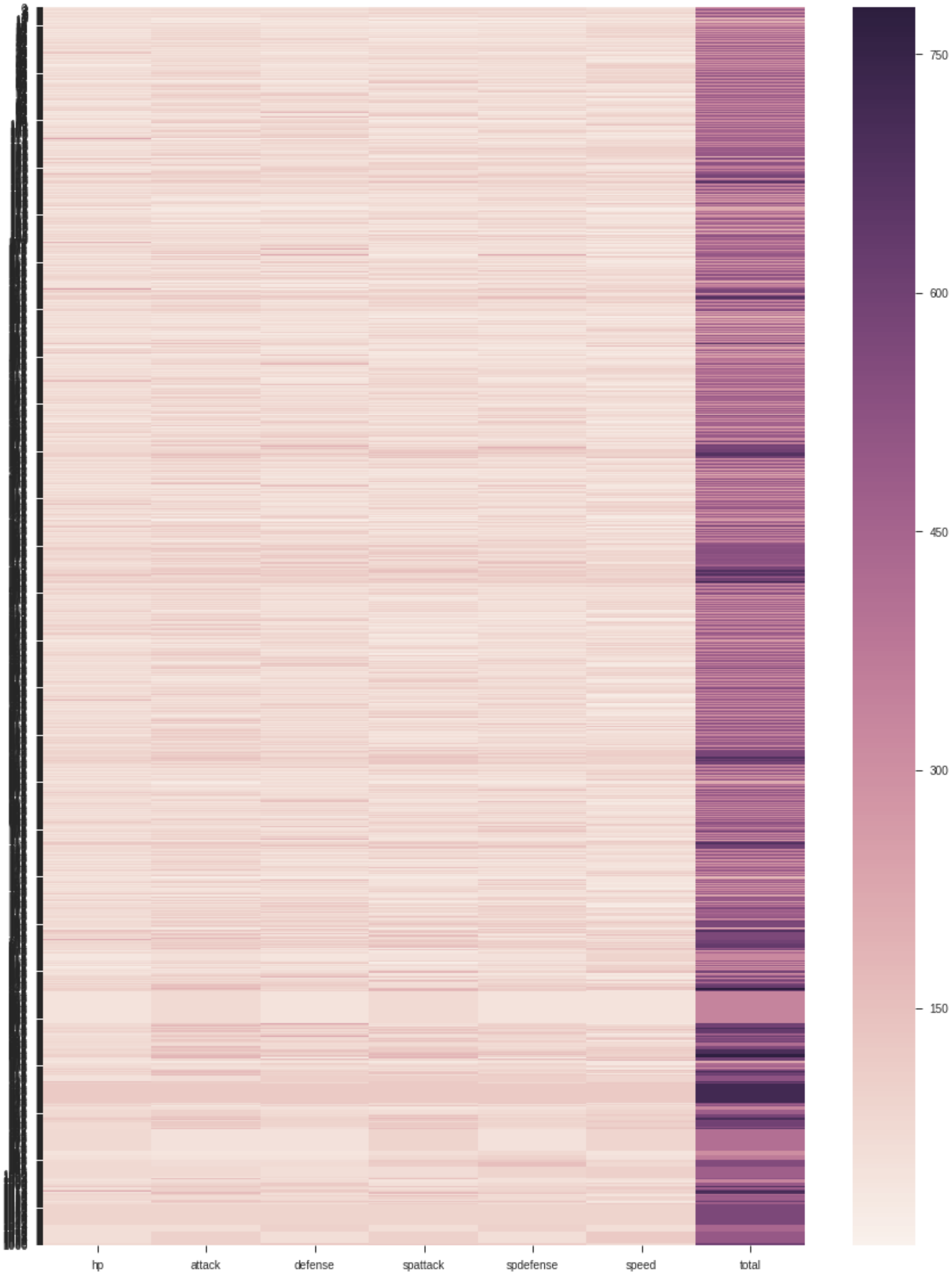
```
Out[17]:               hp attack defense spattack spdefense  speed  total
         hp          True  False   False    False     False  False  False
         attack     False   True   False    False     False  False  False
         defense    False  False    True    False     False  False  False
         spattack   False  False   False     True     False  False  False
         spdefense  False  False   False    False      True  False  False
         speed      False  False   False    False     False   True  False
         total      False  False   False    False     False  False   True
```

1.10 Step 9 : Cross-Correlation Heatmap

Generate heatmap plot for cross-correlation matrix of input columns.

> *Hint: Pandas, Seaborn heatmap() function*

```
In [18]: num_df = df[(list(range(10))[3:])] # Selecting numerical data only
         fig = plt.figure(figsize=(15,20))
         sns.heatmap(num_df)
         plt.show()
```

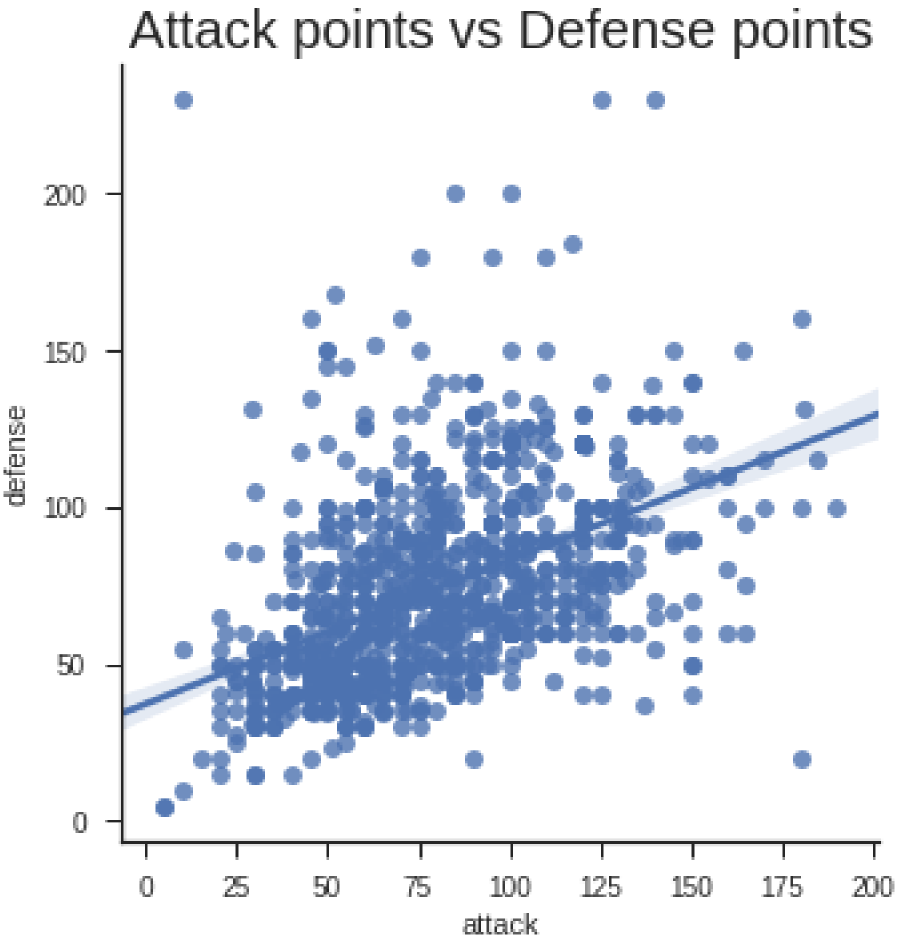

hp
attack
defense
spattack
spdefense
speed
total
750
600
450
300
150

1.11 Step 10 : Output versus Input Plot

Select one of the numerical input columns in your dataset, and generate scatter plot of output column versus the input column. If the output column is categorical then generate the box plot of the input column for each distinct value of the output column. Let's say if your output has three distinct categorical values, plot one box plot of the input column for each value (three) in the output column.

> *Hint: check examples in Pandas, Matplotlib, plot(), scatter(), groupby() getgroup() functions*

```
In [19]: sns.lmplot(x='attack', y='defense', data=df)
         plt.title("Attack points vs Defense points", fontsize=20)
         plt.show()
```


Attack points vs Defense points
defense
attack