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1 contributor

```
1163 lines (1163 sloc)   795 KB
```

Raw Blame

```
In [1]: import pandas as pd
        import matplotlib.pyplot as plt
        import numpy as np
```

```
In [2]: df = pd.read_csv('data.csv')
```

```
In [3]: df.rename({'Device Category':'device_category',
                   'In-Market Segment':'in_market_segment',
                   'Affinity Category (reach)':'affinity_category_reach',
                   'Day of Week':'day_of_week',
                   'Source / Medium':'source_medium',
                   'Avg. % Conversion Probability':'avg_conversion_probability',
                   'New Users':'new_users',
                   'sessions':'sessions',
                   'Avg. Session Duration':'avg_session_duration',
                   'Avg. Order Value':'avg_order_value',
                   'Avg. QTY':'avg_qty'},inplace = True, axis = 1)
```

```
In [4]: def calc_seconds(x):
            x=x.replace('<','')
            x = x.split(':')
            x = [int(i) for i in x]
            secs = x[0]*3600 + x[1]* 60 + x[2]
            return secs
```

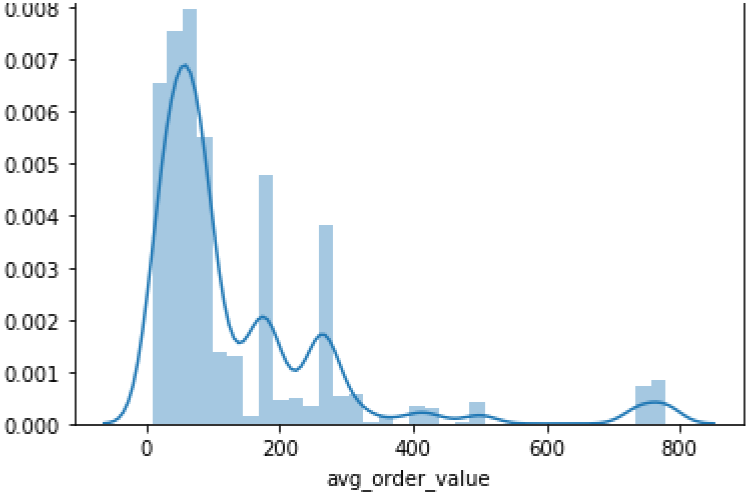
```
In [5]: df['avg_session_duration'] = df['avg_session_duration'].apply(lambda x:calc_seconds(x))
```

```
In [6]: df['avg_order_value'] = df['avg_order_value'].str.replace('$', '').astype('float64')
```

Univariate Analysis

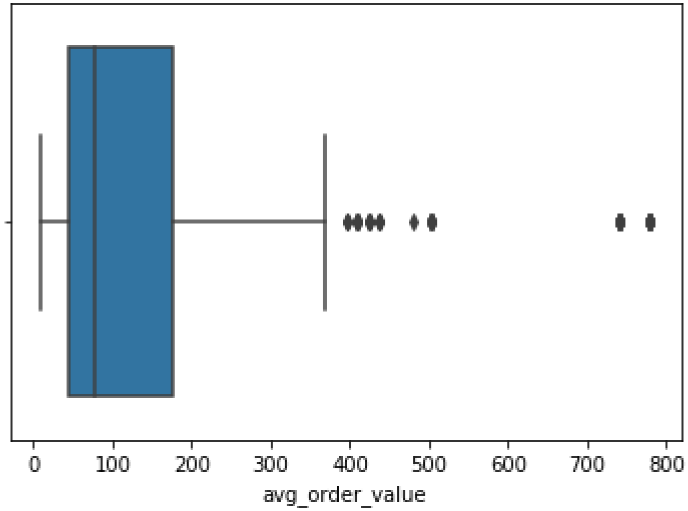
```
In [7]: import seaborn as sns
        sns.distplot(df.loc[df['avg_order_value']>0.0]['avg_order_value'])
```

```
Out[7]: <matplotlib.axes._subplots.AxesSubplot at 0x228348797b8>
```



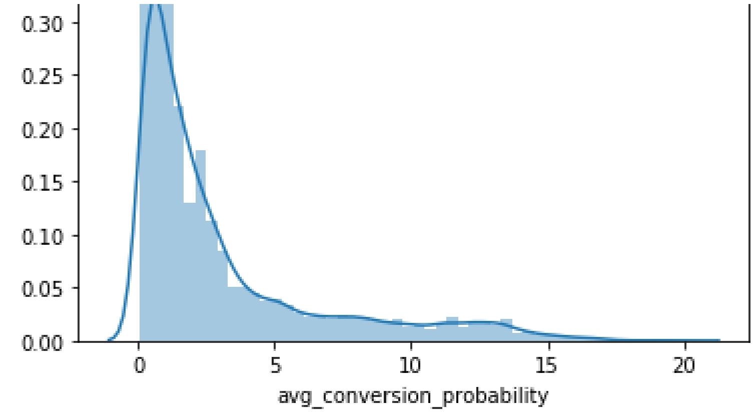
```
In [8]: sns.boxplot(df.loc[df['avg_order_value']>0.0]['avg_order_value'])
```

```
Out[8]: <matplotlib.axes._subplots.AxesSubplot at 0x22835bef1d0>
```



```
In [9]: sns.distplot(df.loc[df['avg_conversion_probability']>0.0]['avg_conversion_probability'])
```

```
Out[9]: <matplotlib.axes._subplots.AxesSubplot at 0x22835c6b0b8>
```



```
In [10]: df['avg_conversion_probability']
```

```
Out[10]: 0        20.1
         1        19.8
         2        19.3
         3        18.8
         4        18.4
         5        17.8
         6        17.5
         7        17.5
         8        17.3
         9        17.1
         10       17.0
         11       17.0
         12       17.0
         13       16.9
         14       16.9
         15       16.8
         16       16.7
         17       16.7
         18       16.6
         19       16.5
         20       16.5
         21       16.5
         22       16.5
         23       16.5
         24       16.4
         25       16.4
         26       16.4
```

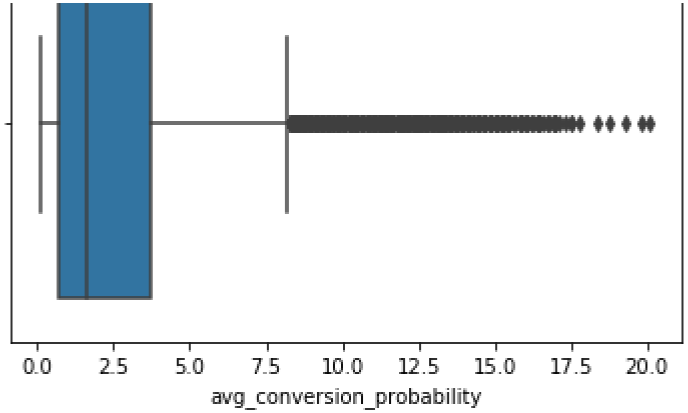
```
27      16.4
28      16.3
29      16.2
        ...
8356     0.1
8357     0.1
8358     0.1
8359     0.1
8360     0.1
8361     0.1
8362     0.1
8363     0.1
8364     0.1
8365     0.1
8366     0.1
8367     0.1
8368     0.1
8369     0.1
8370     0.1
8371     0.1
8372     0.1
8373     0.1
8374     0.1
8375     0.1
8376     0.1
8377     0.1
8378     0.1
8379     0.0
8380     0.0
8381     0.0
8382     0.0
8383     0.0
8384     0.0
8385     0.0
Name: avg_conversion_probability, Length: 8386, dtype: float64
```

In [11]:

```
sns.boxplot(df.loc[df['avg_conversion_probability']>0.0]['avg_conversion_probability'])
```

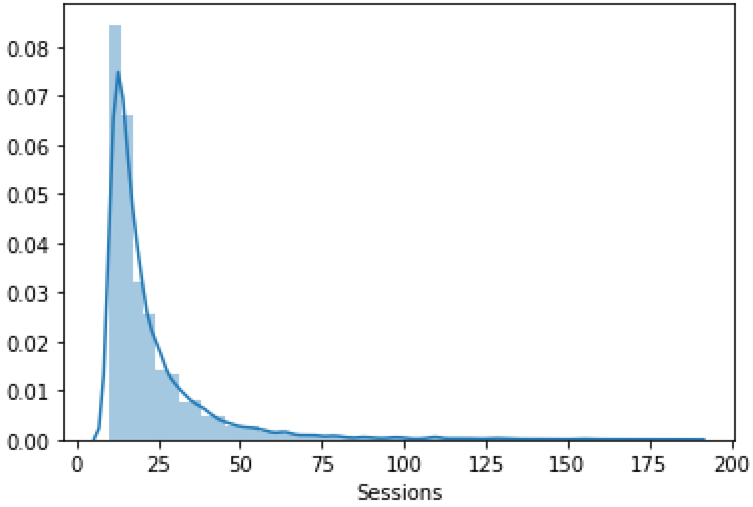
Out[11]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x22835d4be48>
```



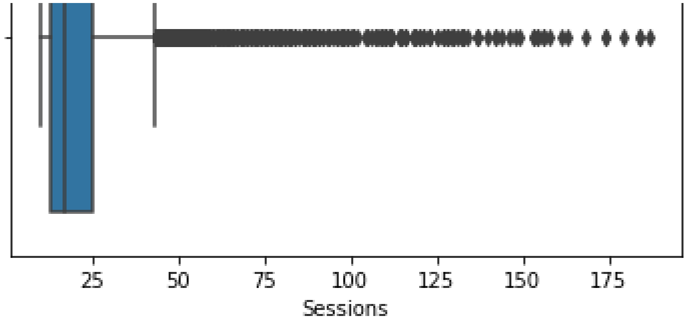
In [12]:
```
sns.distplot(df[df['Sessions']>0.0]['Sessions'])
```

Out[12]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x22835dc1f28>
```



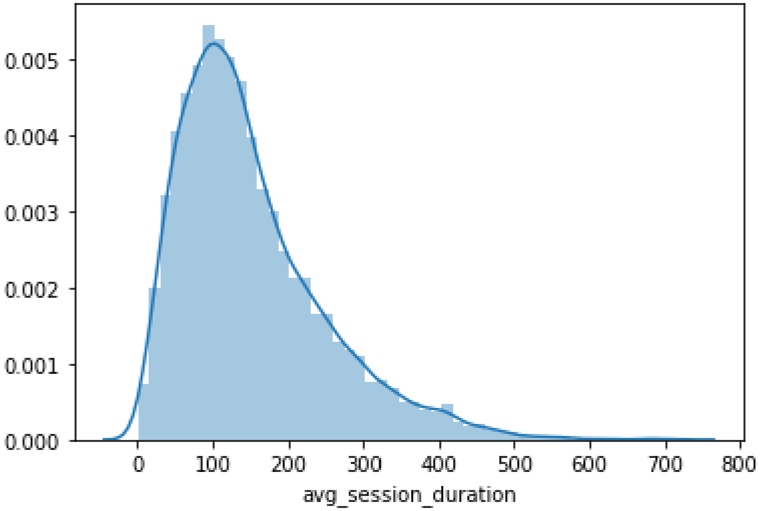
In [13]:
```
sns.boxplot(df[df['Sessions']>0.0]['Sessions'])
```

Out[13]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x22835ec8198>
```



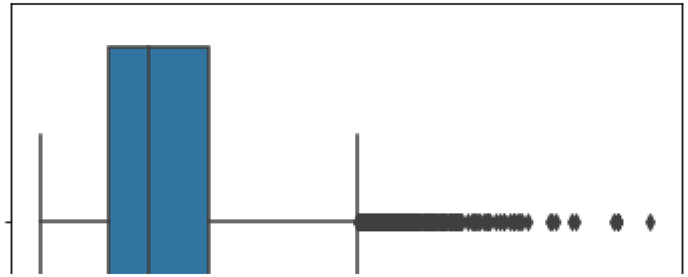
In [14]:
```
sns.distplot(df[df['avg_session_duration']>0.0]['avg_session_duration'])
```

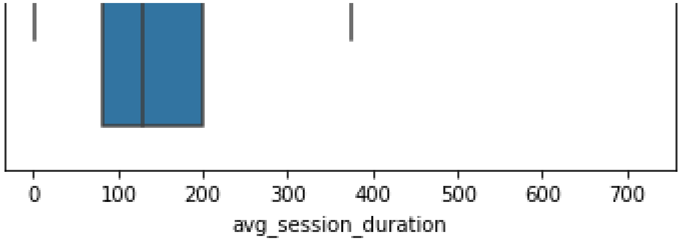
Out[14]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x22835dccdd8>
```



In [15]:
```
sns.boxplot(df.loc[df['avg_session_duration']>0.0]['avg_session_duration'])
```

Out[15]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x22835ed4550>
```



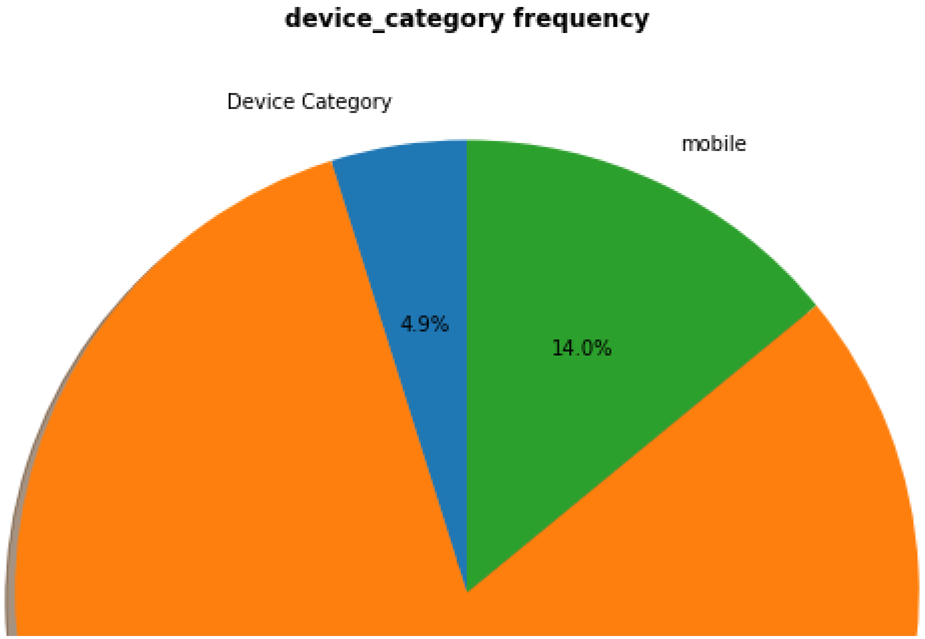


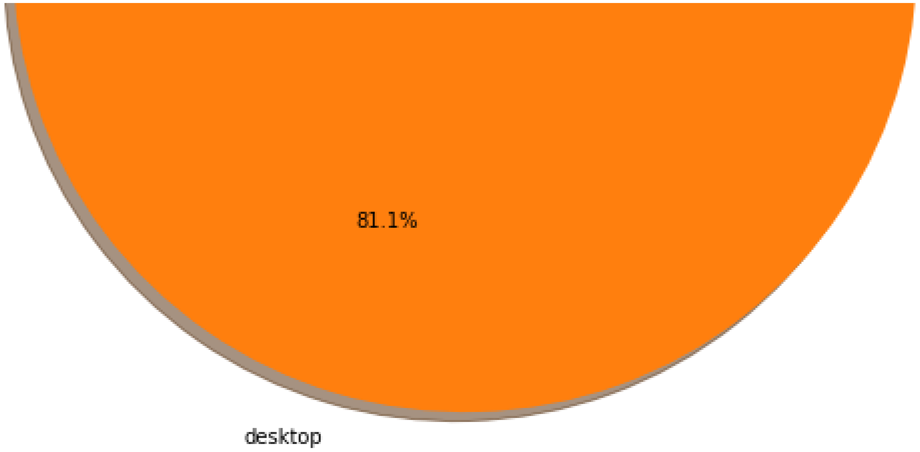
In [16]:

```
def plot_pie_num(data,x,s):
    data['ones']  = np.ones(data.shape[0])
    grouped_data = data.groupby([str(x)]).agg({'ones':'sum'})/data.shape[0]*100
    grouped_data2 = grouped_data.reset_index()
    grouped_data2.rename({'ones':'frequency'},inplace = True, axis = 1)
    #plotting default ratios
    fig1, ax1 =plt.subplots(figsize=s)
    ax1.pie(grouped_data2['frequency'],labels= grouped_data2[str(x)] , autopct='%1.1f%%',
        shadow=True, startangle=90)# Equal aspect ratio ensures that pie is drawn as a circle
    ax1.axis('equal')
    plt.tight_layout()
    plt.title(str(x)+" frequency",fontweight = "bold")
```

In [17]:

```
plot_pie_num(df,'device_category',s =(7,8))
```





```
In [18]: df['affinity_category_reach'].value_counts().head(30).sum()/df.shape[0]
```

```
Out[18]: 0.7683043167183401
```

```
In [19]: len(df['affinity_category_reach'].unique())
```

```
Out[19]: 87
```

Bivariate Analysis

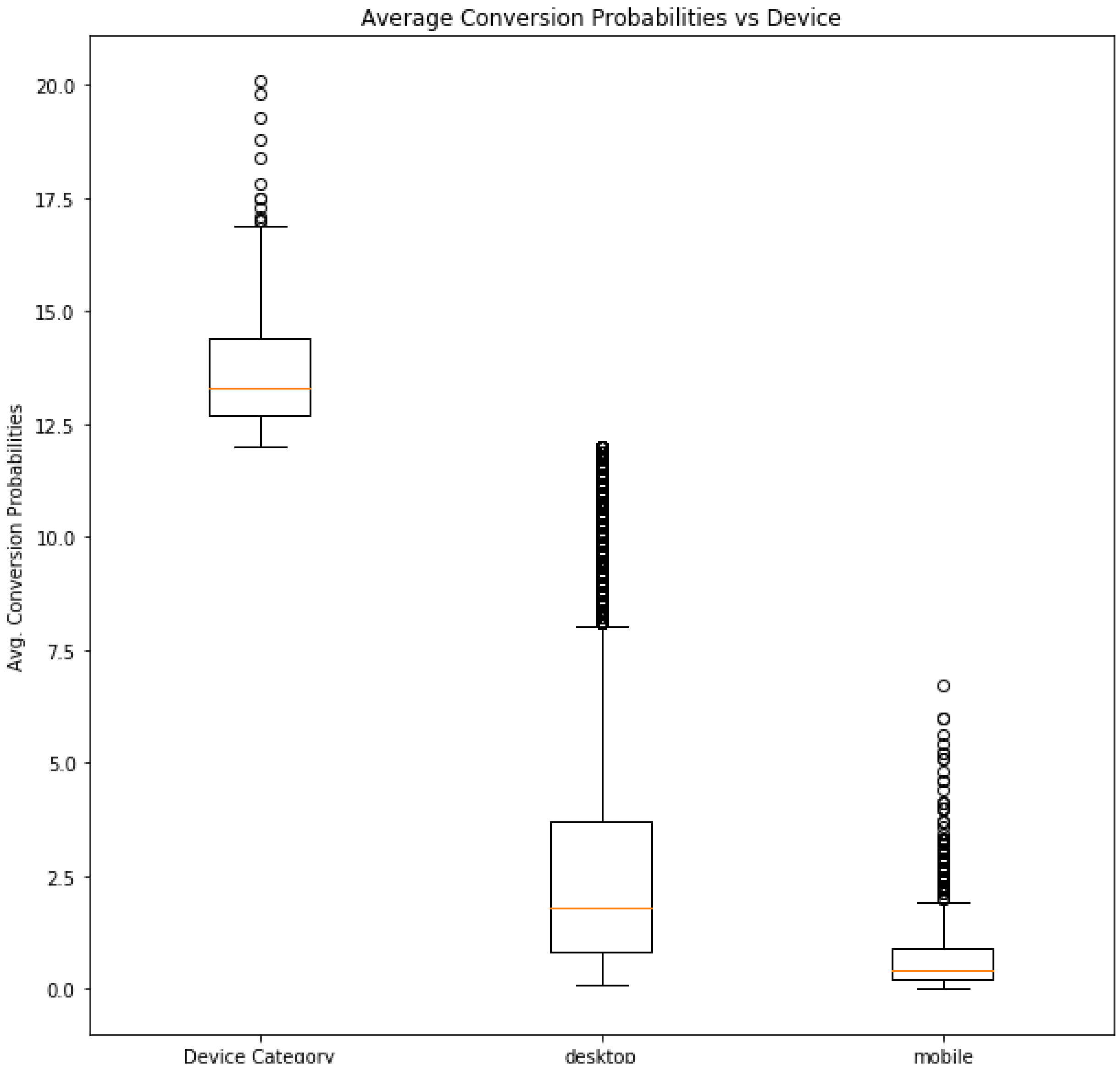
Conversion Probability Vs Device

```
In [20]: df.shape
```

```
Out[20]: (8386, 12)
```

```
In [21]: device_categories = df['device_category'].unique()
         mydct = {}
         for i in  device_categories:
             mydct[i] = df[df['device_category']==i]['avg_conversion_probability'].values
```

```
In [22]: plt.figure(figsize=(10,10))
         plt.boxplot(mydct.values())
         #plt.set_xticklabels(mydct.keys())
         plt.xticks([1,2,3],labels = mydct.keys())
         plt.ylabel('Avg. Conversion Probabilities')
         plt.title('Average Conversion Probabilities vs Device')

Out[22]: Text(0.5, 1.0, 'Average Conversion Probabilities vs Device')
```



Avg. Session Duration vs Device

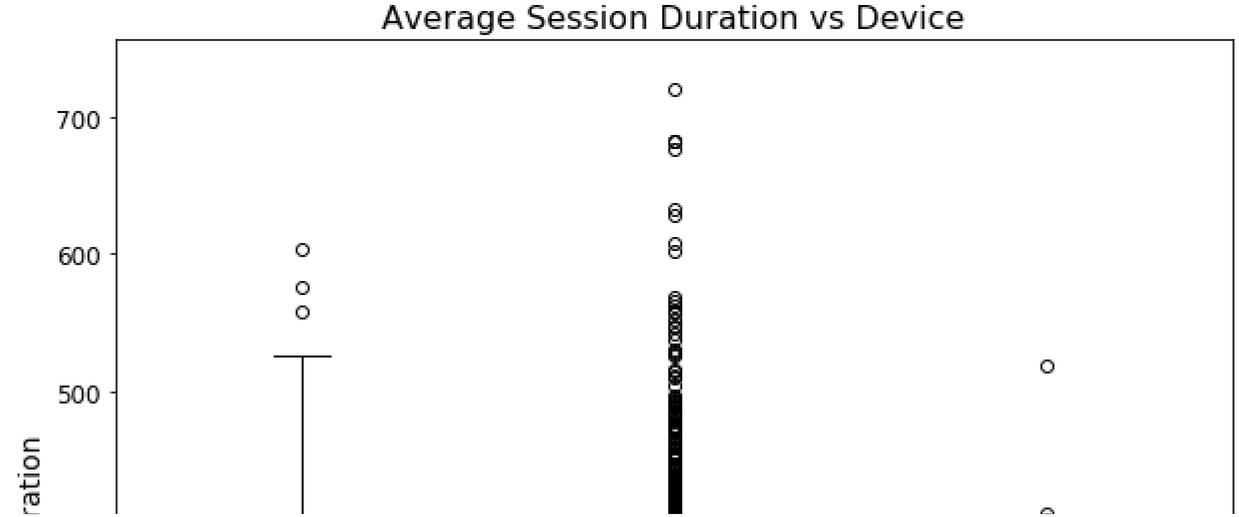
```
In [23]: df.shape
```

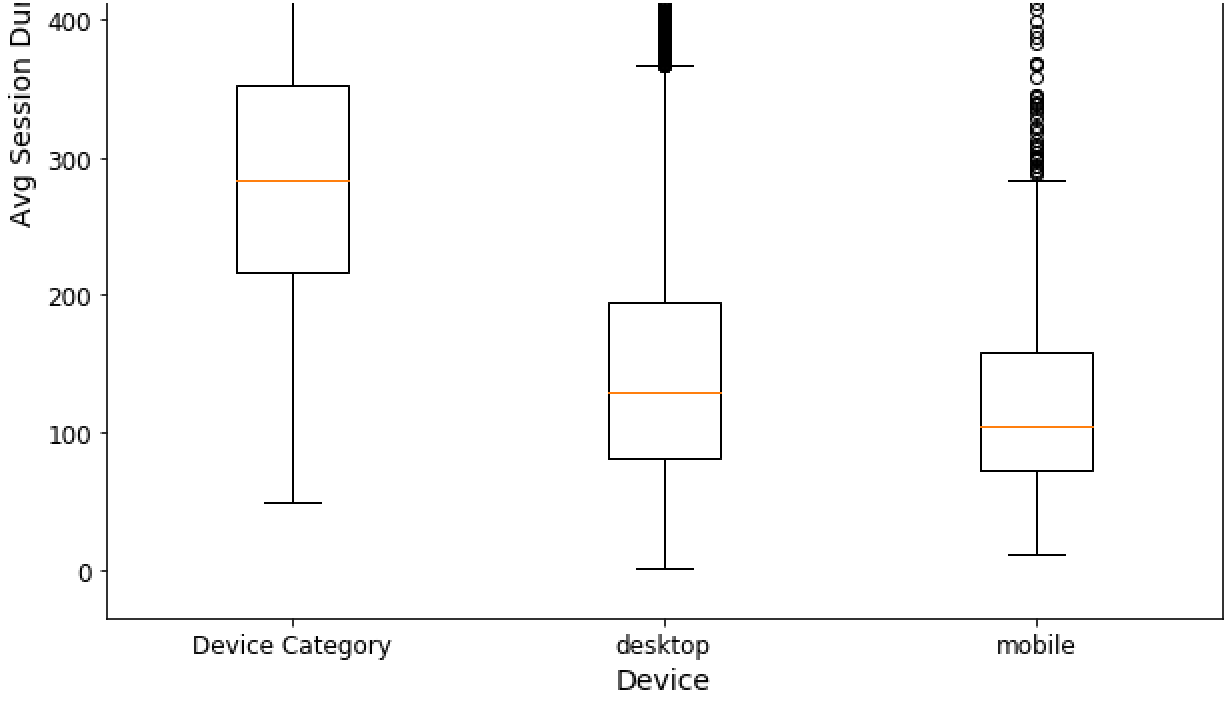
```
Out[23]: (8386, 12)
```

```
In [24]: dfp = df[df['avg_session_duration']>0]
         device_categories = dfp['device_category'].unique()
         dct_duration = {}
         for i in  device_categories:
             dct_duration[i] = dfp[dfp['device_category']==i]['avg_session_duration'].values
```

```
In [25]: plt.figure(figsize=(10,10))
         plt.boxplot(dct_duration.values())
         plt.xticks([1,2,3],labels = dct_duration.keys())
         plt.ylabel('Avg Session Duration', fontsize = 14)
         plt.xlabel('Device', fontsize = 14)
         plt.title('Average Session Duration vs Device', fontsize = 16)
         plt.xticks(fontsize = 12)
         plt.yticks(fontsize= 12)
```

```
Out[25]: (array([-100.,    0.,  100.,  200.,  300.,  400.,  500.,  600.,  700.,
                  800.]), <a list of 10 Text yticklabel objects>)
```





New Users vs Device

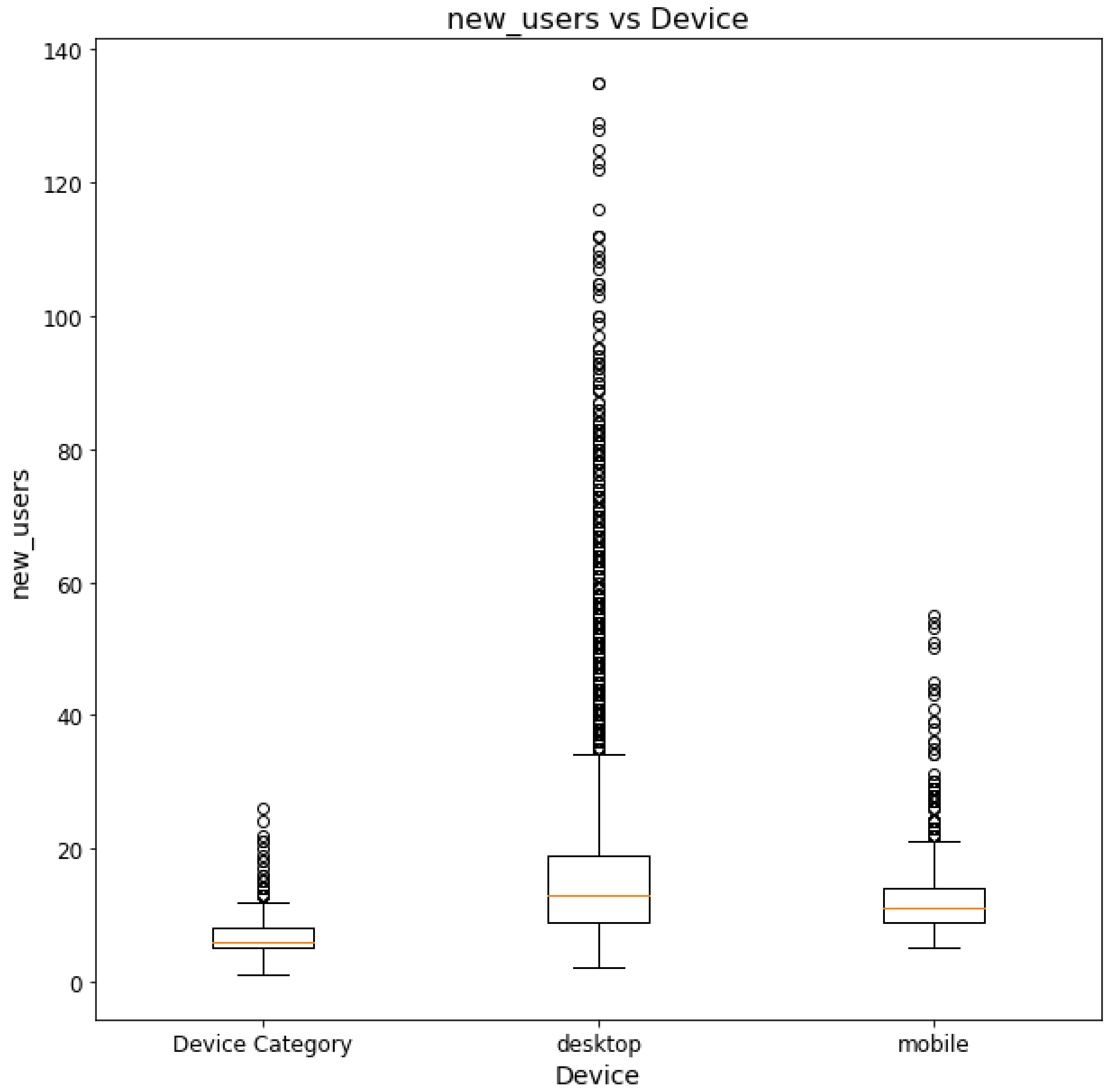
```
In [26]: df.shape
```

```
Out[26]: (8386, 12)
```

```
In [27]: dfp = df[df['new_users']>0]
         device_categories = dfp['device_category'].unique()
         dct = {}
         for i in  device_categories:
             dct[i] = dfp[dfp['device_category']==i]['new_users'].values
```

```
In [28]: plt.figure(figsize=(10,10))
         plt.boxplot(dct.values())
         plt.xticks([1,2,3],labels = dct.keys())
         plt.ylabel('new_users', fontsize = 14)
         plt.xlabel('Device', fontsize = 14)
         plt.title('new_users vs Device', fontsize = 16)
         plt.xticks(fontsize = 12)
         plt.yticks(fontsize= 12)
```

```
Out[28]: (array([-20.,   0.,  20.,  40.,  60.,  80., 100., 120., 140., 160.]),
          <a list of 10 Text yticklabel objects>)
```



Avg Order Value vs Device

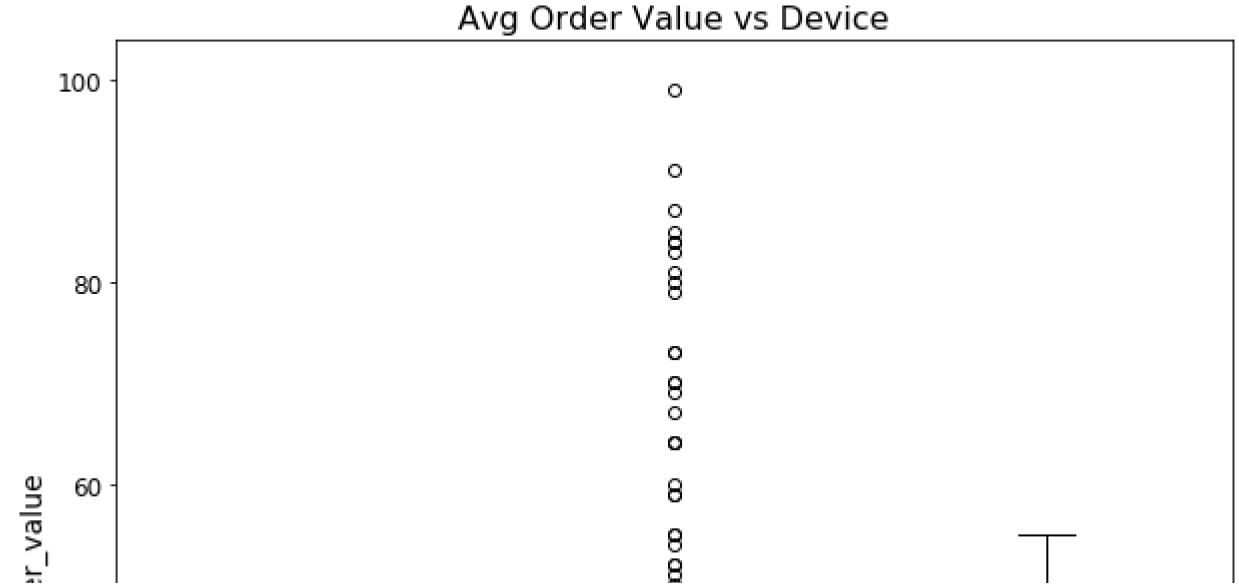
```
In [29]: df.shape
```

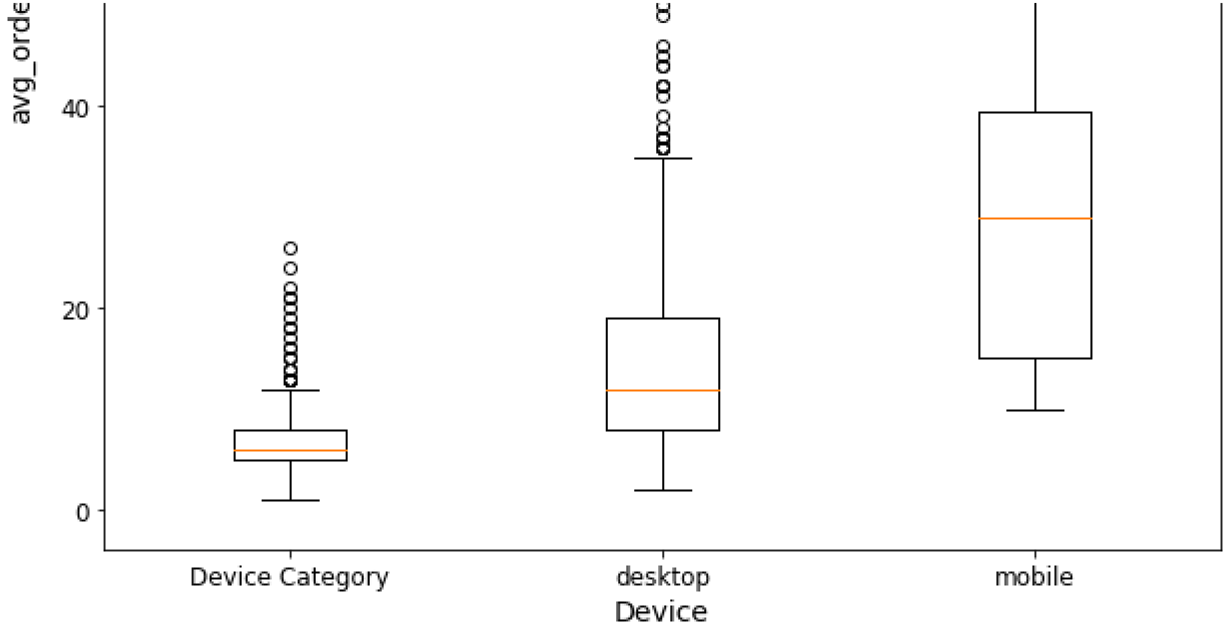
```
Out[29]: (8386, 12)
```

```
In [30]: dfp= df[df['avg_order_value']>0]
         device_categories = dfp['device_category'].unique()
         dct = {}
         for i in  device_categories:
             dct[i] = dfp[dfp['device_category']==i]['new_users'].values
```

```
In [31]: plt.figure(figsize=(10,10))
         plt.boxplot(dct.values())
         plt.xticks([1,2,3],labels = dct.keys())
         plt.ylabel('avg_order_value', fontsize = 14)
         plt.xlabel('Device', fontsize = 14)
         plt.title('Avg Order Value vs Device', fontsize = 16)
         plt.xticks(fontsize = 12)
         plt.yticks(fontsize= 12)
```

```
Out[31]: (array([-20.,   0.,  20.,  40.,  60.,  80., 100., 120.]),
          <a list of 8 Text yticklabel objects>)
```





```
In [32]: df.columns.tolist()
```

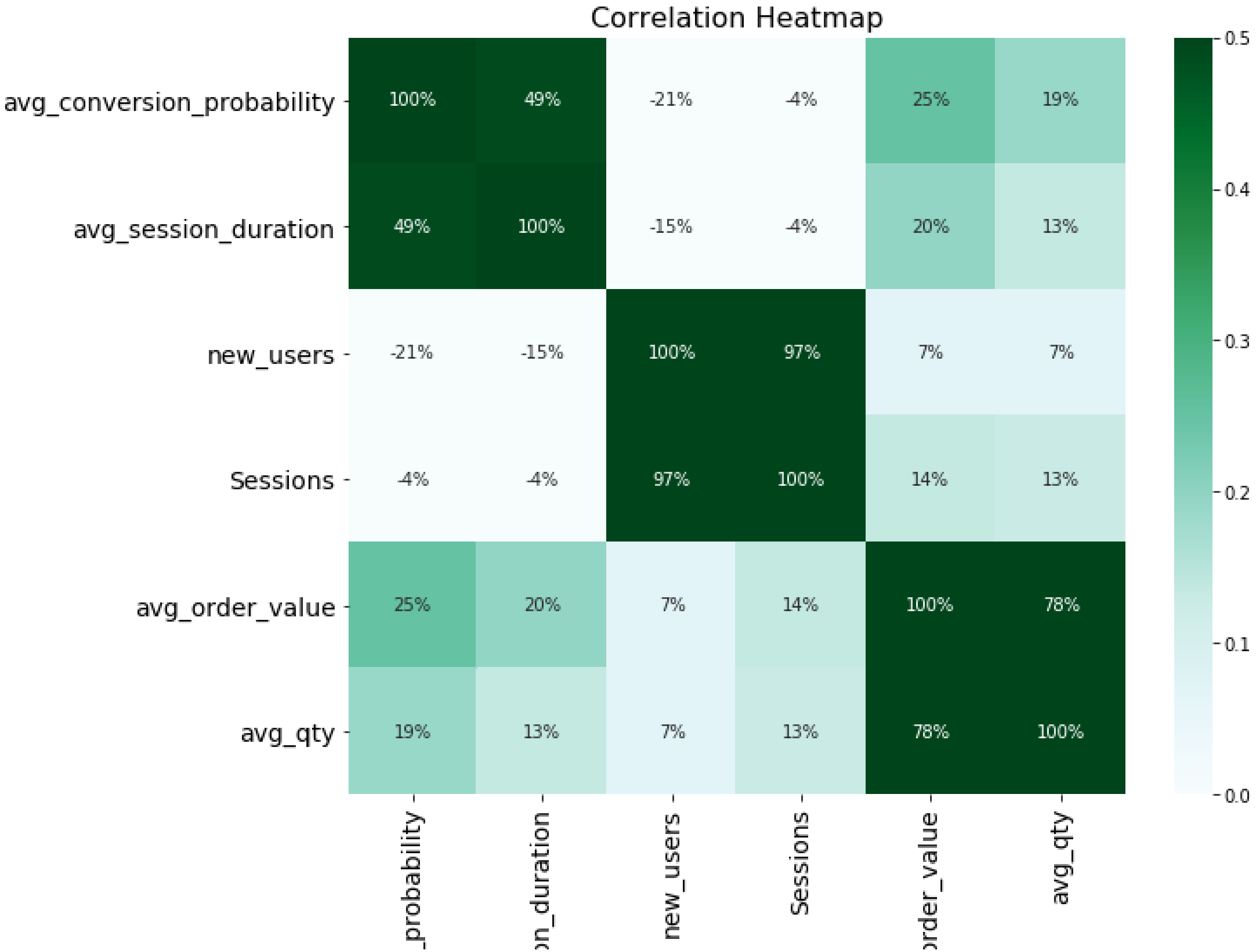
```
Out[32]: ['device_category',
          'in_market_segment',
          'affinity_category_reach',
          'day_of_week',
          'source_medium',
          'avg_conversion_probability',
          'avg_session_duration',
          'new_users',
          'Sessions',
          'avg_order_value',
          'avg_qty',
          'ones']
```

```
In [33]: corr = df[['avg_conversion_probability','avg_session_duration',
             'new_users','Sessions','avg_order_value','avg_qty']].corr()
```

```
In [34]: import seaborn as sns
         import matplotlib.pyplot as plt
         plt.figure(figsize = (10,8))
         plt.title('Correlation Heatmap', fontsize = 16)
```

```
sns.heatmap(data = corr,
annot = True,
fmt = '.0%',
vmin = 0.0,
vmax = 0.5,
cmap = 'BuGn')
plt.xticks(fontsize = 14)
plt.yticks(fontsize= 14)
```

```
Out[34]: (array([0.5, 1.5, 2.5, 3.5, 4.5, 5.5]), <a list of 6 Text yticklabel objects>)
```



Correlation Heatmap

Correlation with Normalized Values

In [35]:
```
df2 = df[['avg_conversion_probability','avg_session_duration',
    'new_users','Sessions','avg_order_value','avg_qty']]
```

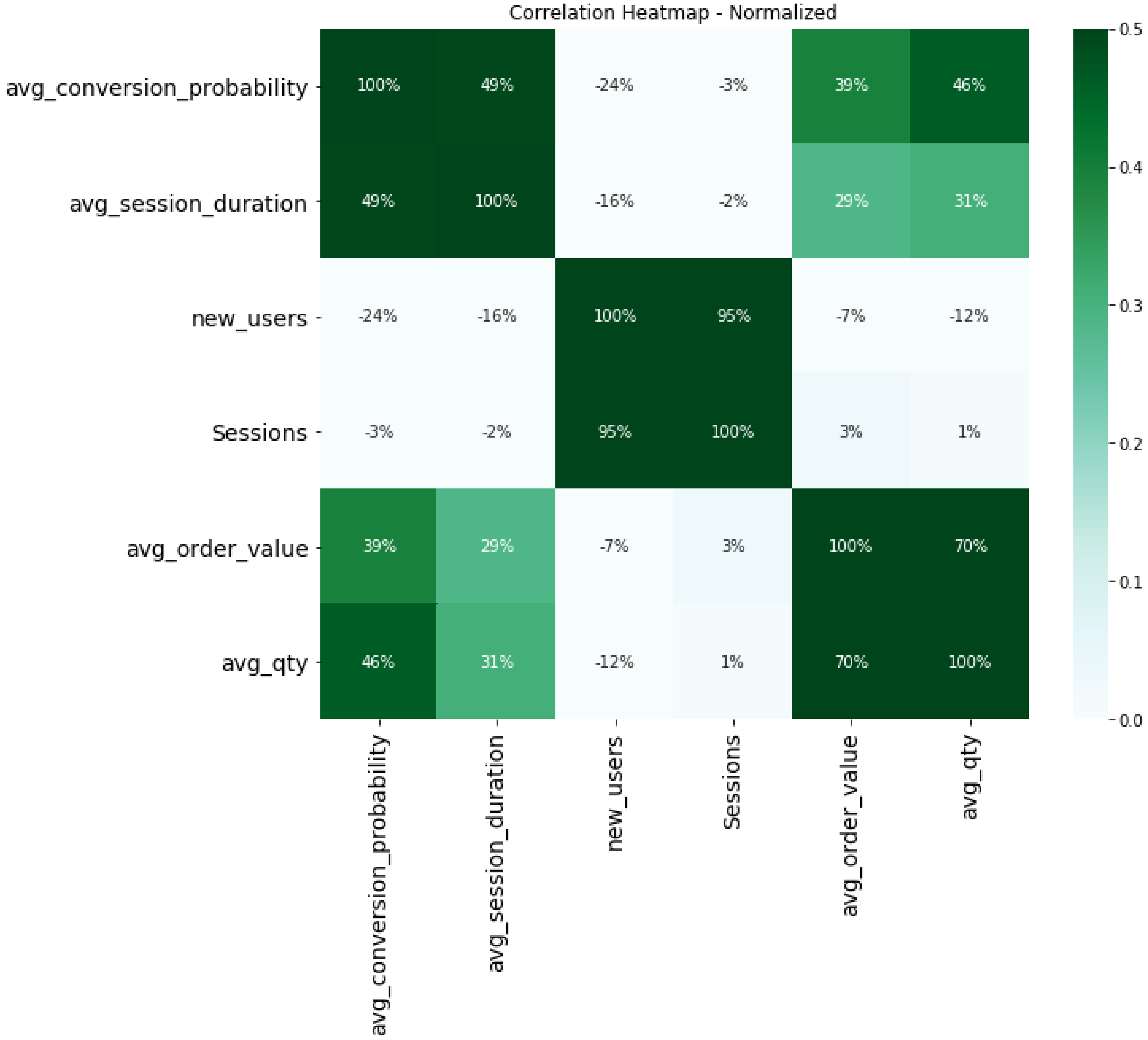
In [36]:
```
from scipy import stats
z_scores = stats.zscore(df2,ddof=1)
#calculate z-scores of `df`

abs_z_scores = np.abs(z_scores)
filtered_entries = (abs_z_scores <5 ).all(axis=1)
new_df = df[filtered_entries]
corr2 = new_df.corr()
```

In [37]:
```
new_df = new_df[['avg_conversion_probability','avg_session_duration',
    'new_users','Sessions','avg_order_value','avg_qty']]
corr2 = new_df.corr()
```

In [38]:
```
import seaborn as sns
import matplotlib.pyplot as plt
plt.figure(figsize = (10,8))
plt.title('Correlation Heatmap - Normalized')
sns.heatmap(data = corr2,
annot = True,
fmt = '.0%',
vmin = 0.0,
vmax = 0.5,
cmap = 'BuGn')
plt.xticks(fontsize = 14)
plt.yticks(fontsize= 14)
```

```
Out[38]: (array([0.5, 1.5, 2.5, 3.5, 4.5, 5.5]), <a list of 6 Text xticklabel objects>)
```

```
Out[38]: (array([0.5, 1.5, 2.5, 3.5, 4.5, 5.5]), <a list of 6 Text yticklabel objects>)
```



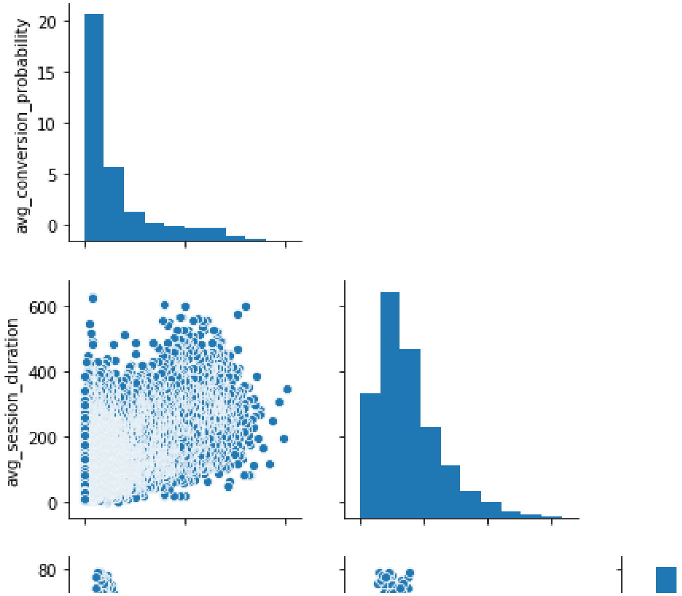
```
In [39]: """"
```

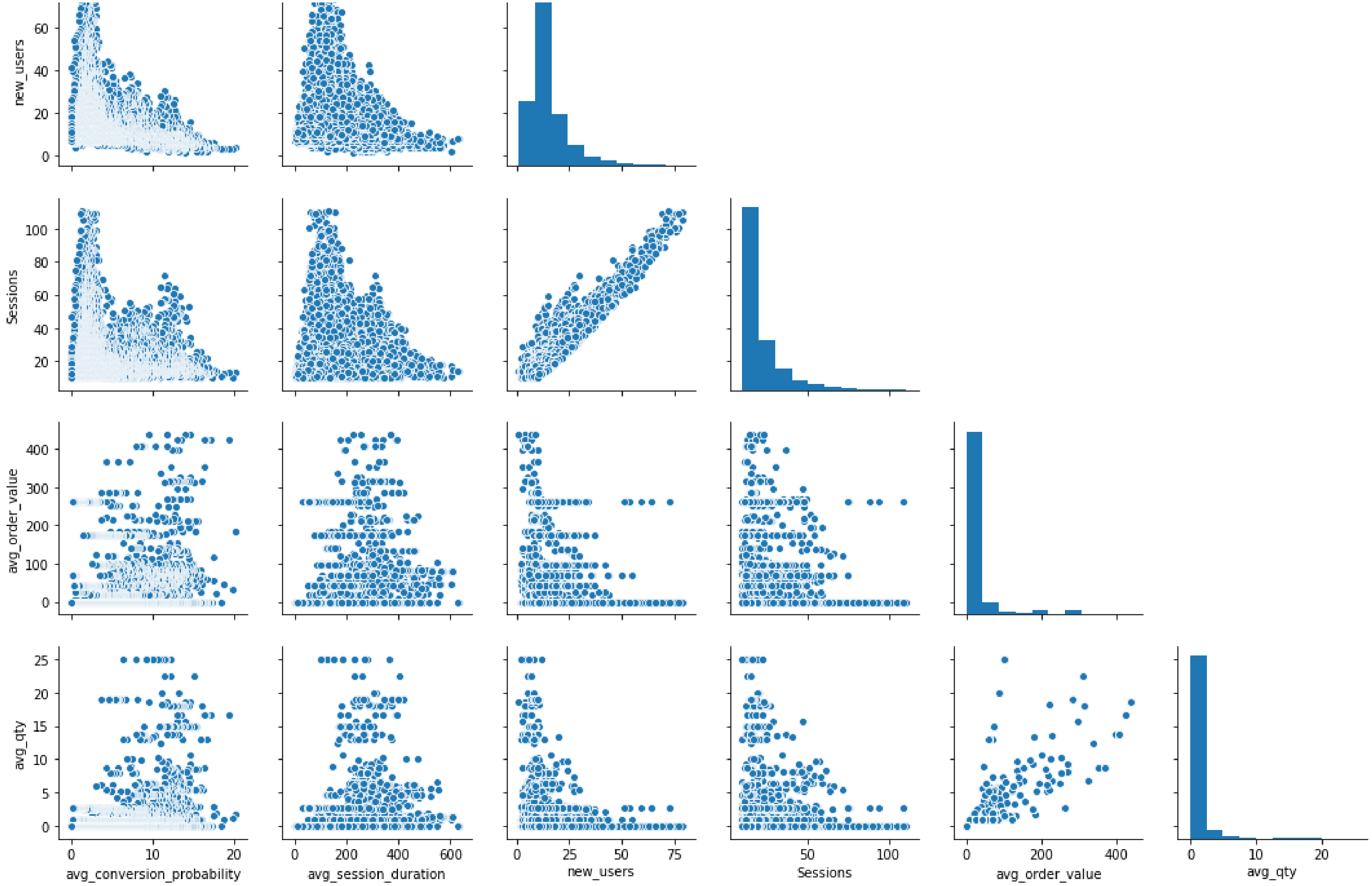
```
grid = sns.pairplot(new_df)
grid = grid.map_upper(plt.scatter, color = 'darkred')

grid = grid.map_diag(plt.hist, bins = 10, color = 'darkred',
                     edgecolor = 'k')
# Map a density plot to the lower triangle
grid = grid.map_lower(sns.kdeplot, cmap = 'Reds')
"""
```

```
Out[39]: '"\ngrid = sns.pairplot(new_df)\ngrid = grid.map_upper(plt.scatter, color = \'darkred\')\n\ngrid = gr
         id.map_diag(plt.hist, bins = 10, color = \'darkred\', \n                           edgecolor = \'k\')\n# Ma
         p a density plot to the lower triangle\ngrid = grid.map_lower(sns.kdeplot, cmap = \'Reds\')\n'
```

```
In [40]: plt.figure(figsize = (20,10))
         g = sns.pairplot(new_df)
         #g = g.map_lower(sns.kdeplot, cmap = 'greens')
         for i, j in zip(*np.triu_indices_from(g.axes, 1)):
             g.axes[i, j].set_visible(False)
         #sns.set(font_scale = 1.1)
         #for ax in g.axes.flat:
         #    ax.set_yticklabels(ax.get_yticklabels(), rotation=45)

         plt.show()
```

```
<Figure size 1440x720 with 0 Axes>
```

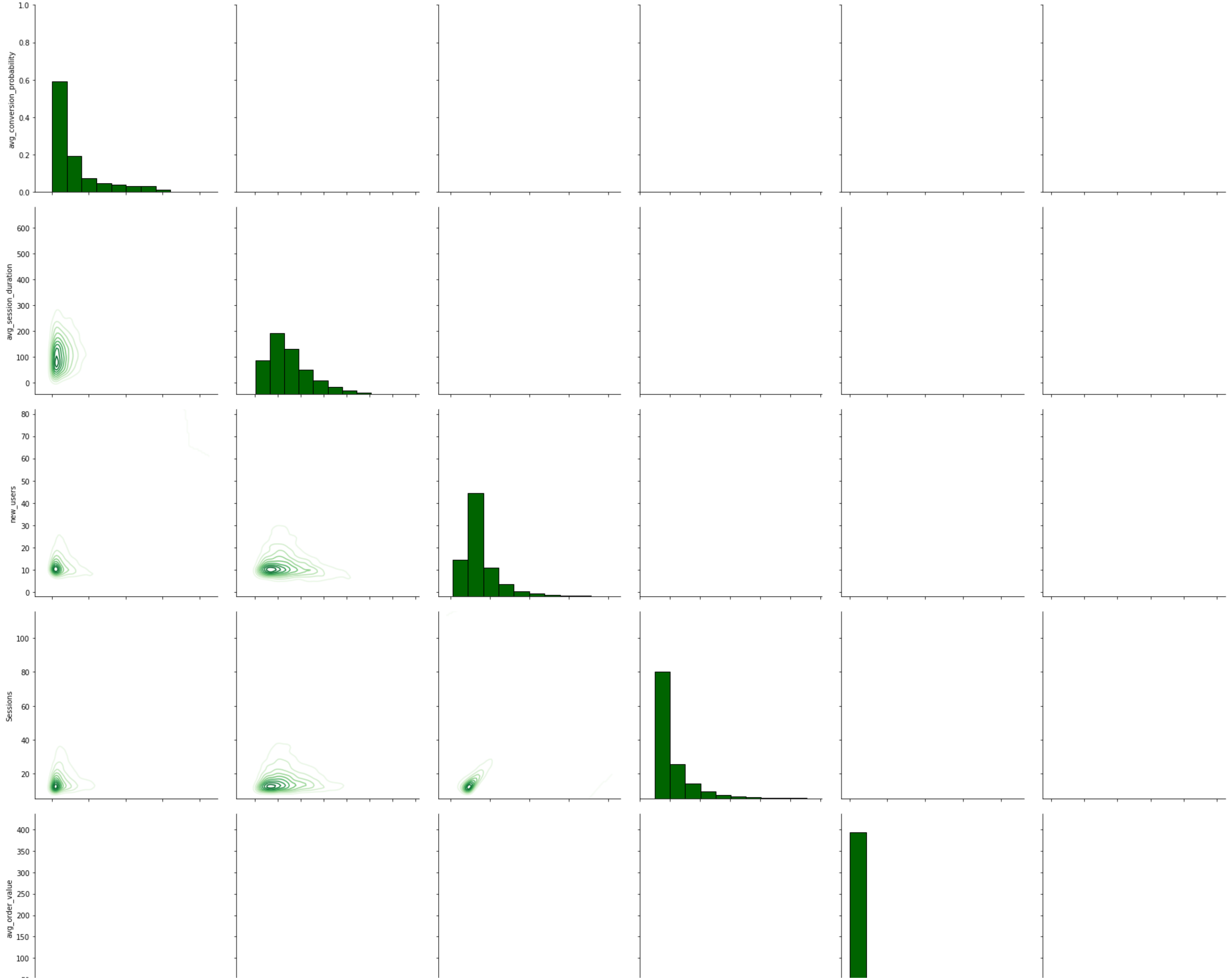


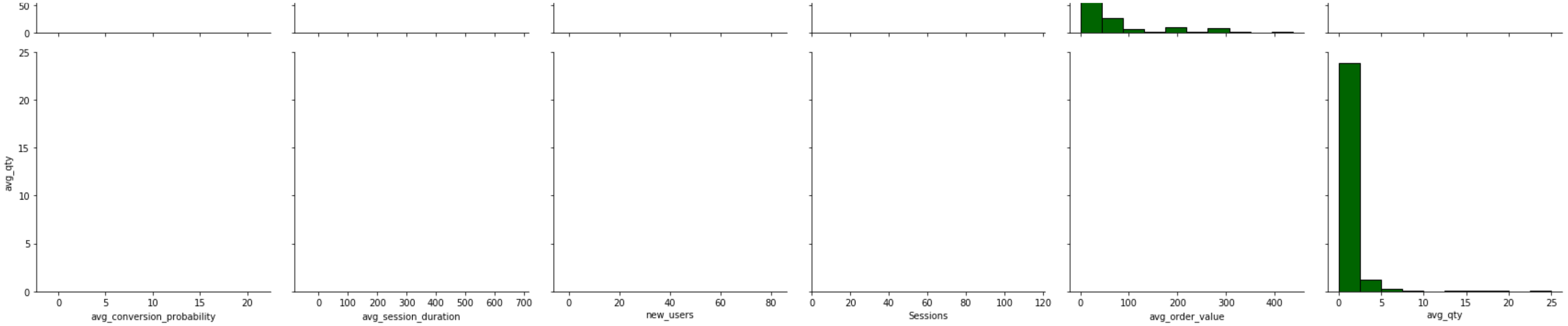


In [41]:
```
def corr(x, y, **kwargs):

    # Calculate the value
    coef = np.corrcoef(x, y)[0][1]
    # Make the label
    label = r'$\rho$ = ' + str(round(coef, 2))

    # Add the label to the plot
    ax = plt.gca()
    ax.annotate(label, xy = (0.2, 0.95), size = 20, xycoords = ax.transAxes)


grid = sns.PairGrid(data= new_df, size = 4)

# Map the plots to the locations
grid = grid.map_lower(sns.kdeplot, cmap = 'Greens')
grid = grid.map_diag(plt.hist, bins = 10, edgecolor =  'k', color = 'darkgreen')
```

```
C:\Users\ritvik\Anaconda3\lib\site-packages\seaborn\axisgrid.py:1241: UserWarning: The `size` paramte
r has been renamed to `height`; please update your code.
  warnings.warn(UserWarning(msg))
C:\Users\ritvik\Anaconda3\lib\site-packages\statsmodels\nonparametric\kernels.py:128: RuntimeWarning:
divide by zero encountered in true_divide
  return (1. / np.sqrt(2 * np.pi)) * np.exp(-(Xi - x)**2 / (h**2 * 2.))
C:\Users\ritvik\Anaconda3\lib\site-packages\statsmodels\nonparametric\kernels.py:128: RuntimeWarning:
invalid value encountered in true_divide
  return (1. / np.sqrt(2 * np.pi)) * np.exp(-(Xi - x)**2 / (h**2 * 2.))
C:\Users\ritvik\Anaconda3\lib\site-packages\statsmodels\nonparametric\_kernel_base.py:516: RuntimeWar
ning: invalid value encountered in true_divide
  dens = Kval.prod(axis=1) / np.prod(bw[iscontinuous])
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\contour.py:1520: UserWarning: Warning: convert
ing a masked element to nan.
  self.zmax = float(z.max())
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\contour.py:1521: UserWarning: Warning: convert
ing a masked element to nan.
  self.zmin = float(z.min())
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\contour.py:1169: RuntimeWarning: invalid value
encountered in less
  under = np.nonzero(lev < self.zmin)[0]
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\contour.py:1171: RuntimeWarning: invalid value
encountered in greater
  over = np.nonzero(lev > self.zmax)[0]
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\contour.py:1200: RuntimeWarning: invalid value
encountered in greater
  inside = (self.levels > self.zmin) & (self.levels < self.zmax)
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\contour.py:1200: RuntimeWarning: invalid value
encountered in less
  inside = (self.levels > self.zmin) & (self.levels < self.zmax)
C:\Users\ritvik\Anaconda3\lib\site-packages\seaborn\distributions.py:423: UserWarning: No contour lev
els were found within the data range.
  cset = contour_func(xx, yy, z, n_levels, **kwargs)
C:\Users\ritvik\Anaconda3\lib\site-packages\matplotlib\colors.py:479: RuntimeWarning: invalid value e
```

```
ncountered in less
  xa[xa < 0] = -1
```




50
0
25
20
15
10
5
0
avg_qty
0
5
10
15
20
avg_conversion_probability
0
100
200
300
400
500
600
700
avg_session_duration
0
20
40
60
80
new_users
0
20
40
60
80
100
120
Sessions
0
100
200
300
400
avg_order_value
0
5
10
15
20
25
avg_qty

In [ ]: