Question 5

Import required libraries

In [290]:

```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn import metrics
from sklearn.cluster import DBSCAN
sns.set_style("darkgrid")
RANDOM_STATE = 123
```

Load the dataset (Question 1) into a DataFrame object

In [226]:

```
crawled_df = pd.read_csv('Q1_Mudah_PropAds.csv')
crawled_df.head()
```

Out[226]:

	list_title	url	price	area	category	prop_type	prop_title1	p
0	New Luxury Freehold Residence 4min Walk to Mid...	https://www.mudah.my/New+Luxury+Freehold+Resid...	597000	Mid Valley City	Apartments	Condo / Services residence / Penthouse / Townh...	Freehold	
1	Sri Putramas 1 1100sqft Jalan Kuching Below Ma...	https://www.mudah.my/Sri+Putramas+1+1100sqft+J...	405000	Jalan Kuching	Apartments	Condo / Services residence / Penthouse / Townh...	Freehold	
2	0% DOWNPAYMENT Arena Green 750SF Bukit Jalil [...	https://www.mudah.my/0+DOWNPAYMENT+Arena+Green...	320000	Bukit Jalil	Apartments	Condo / Services residence / Penthouse / Townh...	Freehold	
3	[Duplex Penthouse] Silk Residence Duplex Doubl...	https://www.mudah.my/+Duplex+Penthouse+Silk+Re...	900000	Cheras	Apartments	Condo / Services residence / Penthouse / Townh...	Freehold	
4	BELOW MARKET!! Menara D'Sara Condo Sri Damansa...	https://www.mudah.my/BELOW+MARKET+Menara+D+Sar...	380000	Sri Damansara	Apartments	Condo / Services residence / Penthouse / Townh...	Freehold	

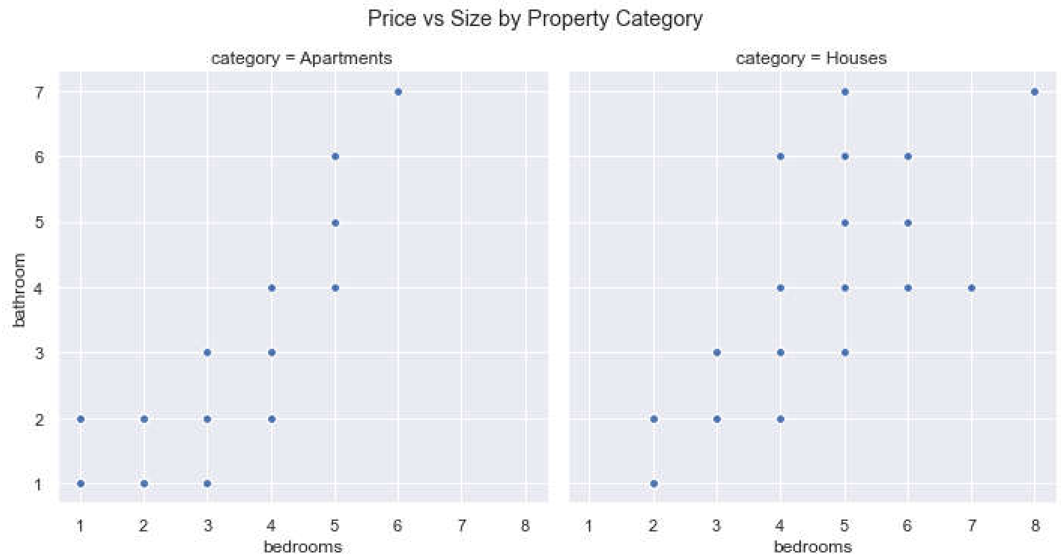
Visualize the data, use only two of these attributes at the time

In [227]:

```
g = sns.FacetGrid(crawled_df[crawled_df['bedrooms']>0], col="category", height=5)
g = g.map(plt.scatter, "bedrooms", "bathroom", edgecolor="w")
g.fig.suptitle('Price vs Size by Property Category', y =1.04)
```

Out[227]:

```
Text(0.5, 1.04, 'Price vs Size by Property Category')
```

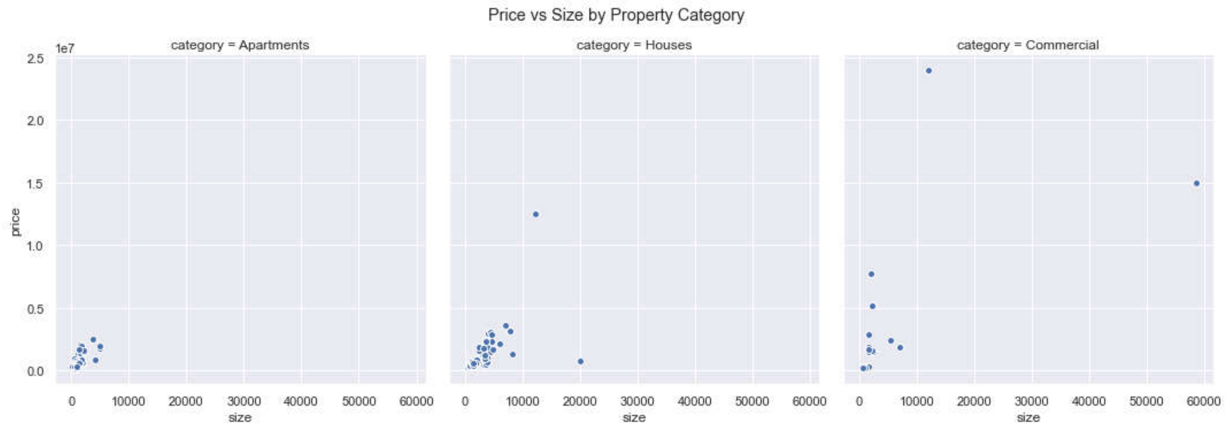


In [228]:

```
g = sns.FacetGrid(crawled_df[crawled_df['size_unit']=='sq.ft.'], col="category", height=5)
g = g.map(plt.scatter, "size", "price", edgecolor="w")
g.fig.suptitle('Price vs Size by Property Category', y =1.04)
```

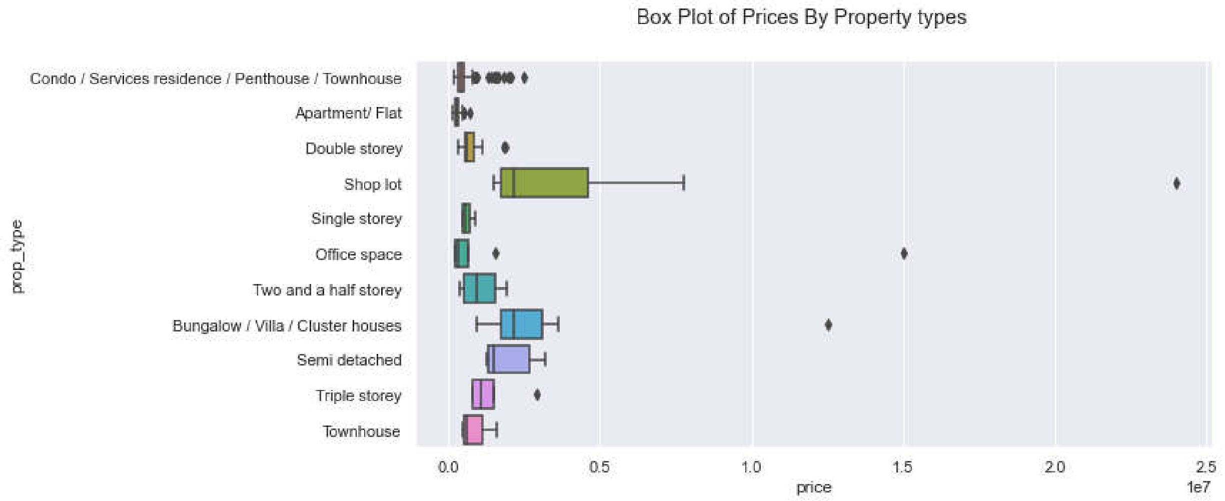
Out[228]:

```
Text(0.5, 1.04, 'Price vs Size by Property Category')
```



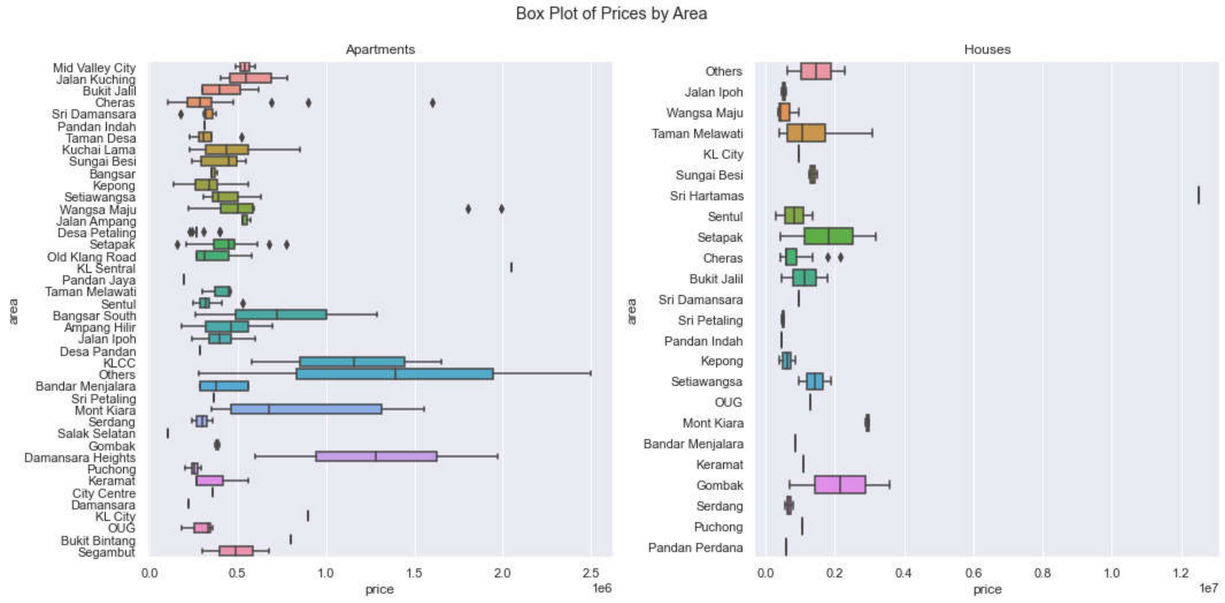
In [229]:

```
plt.figure(figsize=(10,5))
ax = sns.boxplot(x="price", y="prop_type", data=crawled_df[crawled_df['size_unit']=='sq.ft.'])
plt.suptitle('Box Plot of Prices By Property types')
plt.show()
```



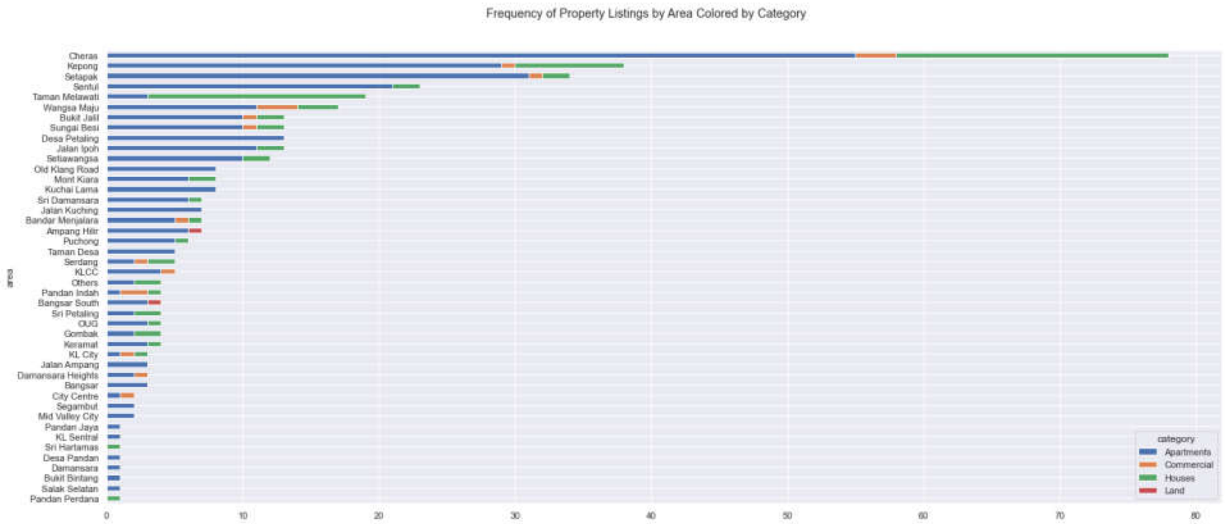
In [230]:

```
fig, ax = plt.subplots(1,2, figsize=(15,7))
sns.boxplot(x="price", y="area", data=crawled_df[crawled_df['category']=='Apartments'], ax=ax[0])
sns.boxplot(x="price", y="area", data=crawled_df[crawled_df['category']=='Houses'], ax=ax[1])
plt.suptitle('Box Plot of Prices by Area ', y=1.04)
ax[0].set_title('Apartments')
ax[1].set_title('Houses')
fig.tight_layout()
plt.show()
```



In [231]:

```
plot_data = crawled_df.pivot_table(index='area', columns='category', values='prop_type', aggfunc='count').fillna(0)
index = plot_data.sum(1).sort_values(ascending=True).index
plot_data.loc[index].plot(kind='barh', stacked=True)
plt.suptitle('Frequency of Property Listings by Area Colored by Category', y =0.95)
plt.show()
```



Normalize numerical attributes

There are only 4 numerical columns in our dataset. Normalize them using Standard Scaler normalization

In [232]:

```
from scipy.stats import mstats
from sklearn.preprocessing import StandardScaler
```

In [233]:

```
# First winsorize the outliers in price and size data
crawled_df[['price', 'size']] = mstats.winsorize(crawled_df[['price', 'size']], limits=[0.05, 0.05])

# Normalize using skleran StandardScaler library
scaler = StandardScaler()
crawled_df[['price', 'size', 'bedrooms', 'bathroom']] = scaler.fit_transform(crawled_df[['price', 'size', 'bedrooms',
'bathroom']].fillna(0))
```

In [234]:

```
crawled_df[['price', 'size', 'bedrooms', 'bathroom']]
```

Out[234]:

	price	size	bedrooms	bathroom
0	0.133628	-0.274015	-1.812094	-0.184995
1	-0.363670	-0.153477	-0.050642	-0.184995
2	-0.583828	-0.221223	-0.050642	-0.184995
3	0.918428	0.785497	2.591537	4.327069
4	-0.428422	-0.144323	-0.050642	-0.184995
...	...	...	...	...
395	-0.630450	-0.206575	-0.050642	-0.184995
396	-0.285967	-0.061930	-0.050642	-0.184995
397	0.154349	-0.061930	0.830084	1.619831
398	0.219102	-0.068643	-0.050642	-0.184995
399	-0.480224	-0.199251	-0.050642	-0.184995

400 rows × 4 columns

Plot Correlation

Plot Correlation for numerical attributes

In [235]:

```
corr = crawled_df[['price', 'size', 'bedrooms', 'bathroom']].corr()
display(corr.style.applymap(lambda x: 'background-color: yellow' if x > 0.75 else ''))
```

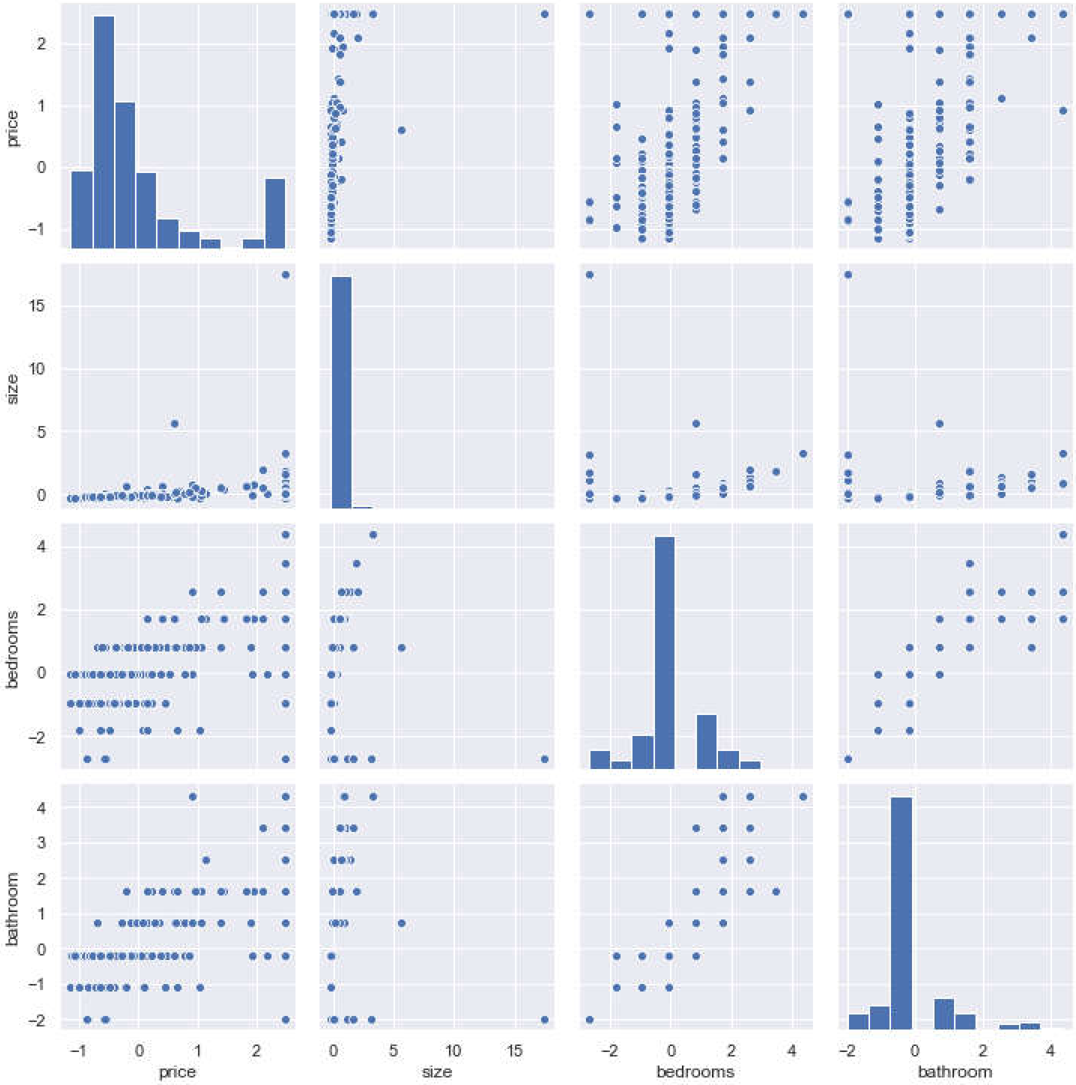
	price	size	bedrooms	bathroom
price	1.000000	0.394403	0.216944	0.429050
size	0.394403	1.000000	0.058092	0.133787
bedrooms	0.216944	0.058092	1.000000	0.843032
bathroom	0.429050	0.133787	0.843032	1.000000

In [236]:

```
sns.pairplot(crawled_df[['price', 'size', 'bedrooms', 'bathroom']])
```

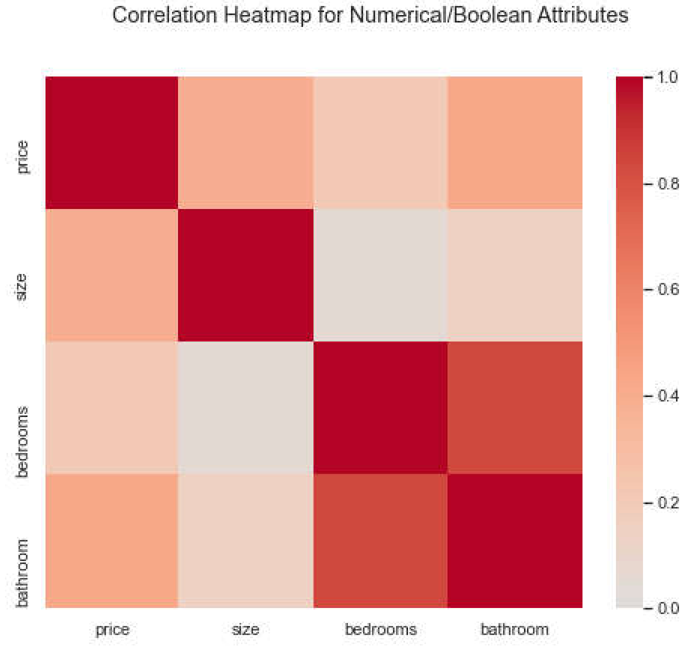
Out[236]:

```
<seaborn.axisgrid.PairGrid at 0x2cb9cc07288>
```



In [237]:

```
# plot the heatmap
fig, ax = plt.subplots(figsize=(8,6.5))
sns.heatmap(corr,
            vmin = 0,
            vmax =1,
            cmap = 'coolwarm',
            center=0,
            xticklabels=corr.columns,
            yticklabels=corr.columns,
            ax=ax)
plt.suptitle('Correlation Heatmap for Numerical/Boolean Attributes')
plt.show()
```



Construct a density-based clustering model and extract cluster labels and outliers to plot your results.

In [309]:

```
dummies = pd.get_dummies(crawled_df[['area', 'category', 'prop_type', 'prop_title1', 'prop_title2', 'size_unit']])
X= pd.concat([crawled_df[['price', 'size', 'bedrooms', 'bathroom']], dummies], axis=1)
```

In [310]:

```
# Perform a PCA to reduce dimension to 2D
from sklearn.decomposition import PCA
pca = PCA(n_components=2)
X = pca.fit_transform(X)
```

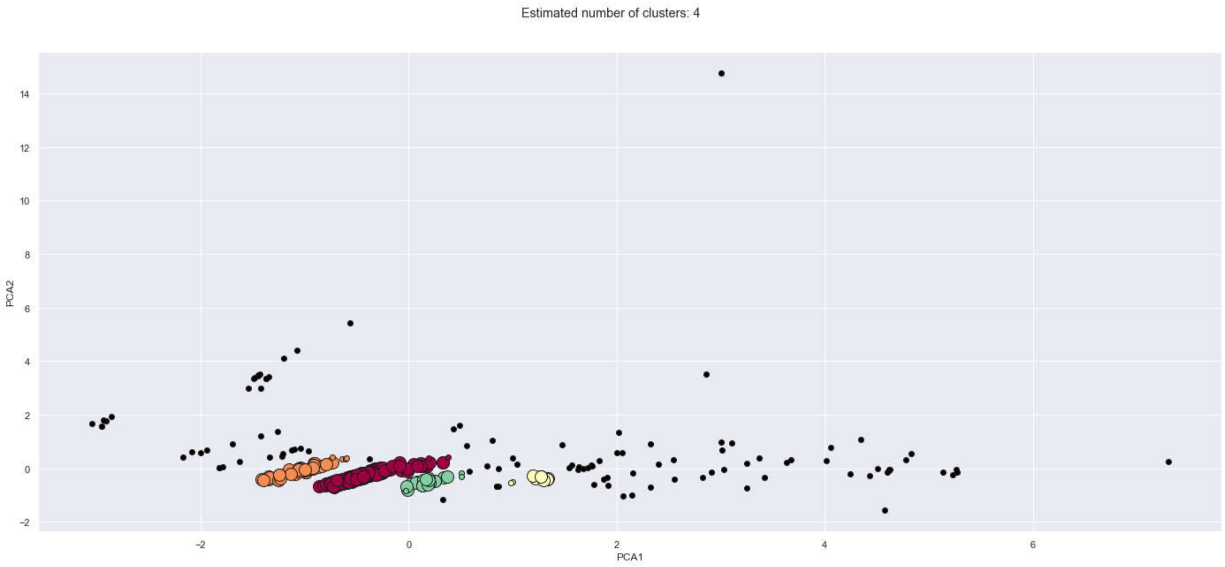
In [311]:

```
db = DBSCAN(eps=0.3, min_samples=10).fit(X)
```

In [313]:

```
core_samples_mask = np.zeros_like(db.labels_, dtype=bool)
core_samples_mask[db.core_sample_indices_] = True
labels = db.labels_

# Number of clusters in labels, ignoring noise if present.
n_clusters_ = len(set(labels)) - (1 if -1 in labels else 0)
n_noise_ = list(labels).count(-1)

print('Estimated number of clusters: %d' % n_clusters_)
print('Estimated number of noise points: %d' % n_noise_)
print("Silhouette Coefficient: %0.3f"
      % metrics.silhouette_score(X, labels))

# #############################################################################
# Plot result
import matplotlib.pyplot as plt

# Black removed and is used for noise instead.
unique_labels = set(labels)
colors = [plt.cm.Spectral(each)
          for each in np.linspace(0, 1, len(unique_labels))]
for k, col in zip(unique_labels, colors):
    if k == -1:
        # Black used for noise.
        col = [0, 0, 0, 1]

    class_member_mask = (labels == k)

    xy = X[class_member_mask & core_samples_mask]
    plt.plot(xy[:, 0], xy[:, 1], 'o', markerfacecolor=tuple(col),
             markeredgecolor='k', markersize=14)

    xy = X[class_member_mask & ~core_samples_mask]
    plt.plot(xy[:, 0], xy[:, 1], 'o', markerfacecolor=tuple(col),
             markeredgecolor='k', markersize=6)


plt.xlabel('PCA1')
plt.ylabel('PCA2')
plt.suptitle('Estimated number of clusters: %d' % n_clusters_, y=0.95)
plt.show()
```

```
Estimated number of clusters: 4
Estimated number of noise points: 108
Silhouette Coefficient: 0.248
```



In [ ]:

```
```