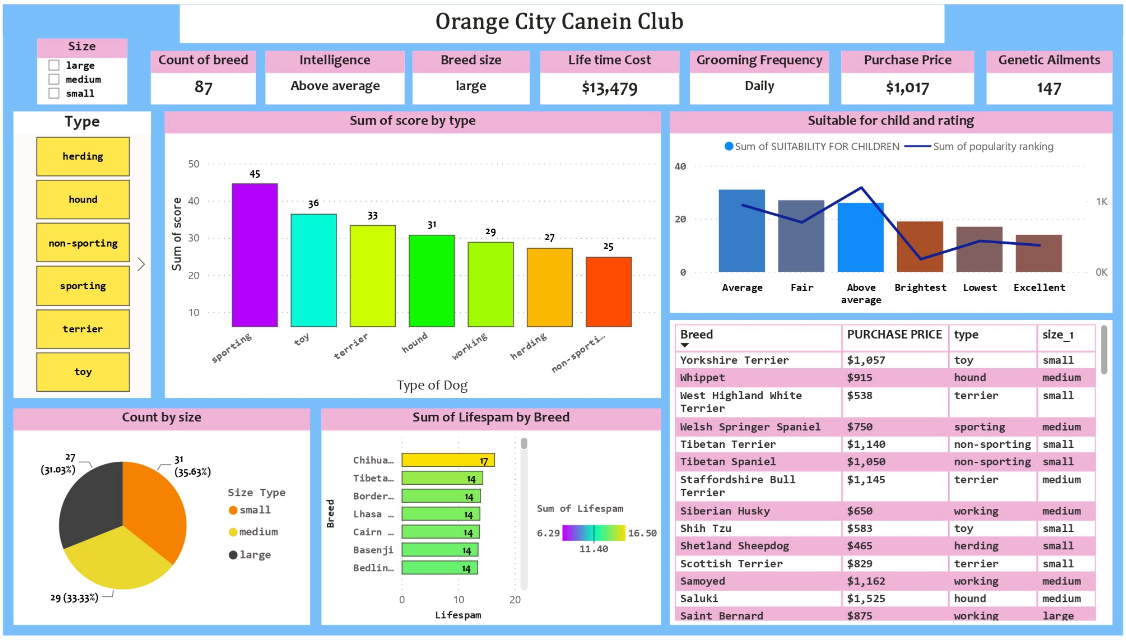
Power Bi dashboard

In [1]:
```
from IPython.display import Image

# Provide the correct path to your image file
img_path = '/Users/pritampathrabe/Downloads/Dexter_Power BI file_page-
Image(filename=img_path)
```

Out[1]:



Orange City Canine Club Dataset

```
This is an demo project where we have the set of data belonging from
dog breed with their various parameter such as
* Type of breed
* Its intelligence level
* various expenditures like Purchasing Price, Food cost per year and
life time cost
Also we have the ranking and score which defines the dog is sutable
for which kind of condition such as family dog or guard dogs.
```

In [2]:
```
#importing requiired libraries
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
plt.get_current_fig_manager().full_screen_toggle()
import seaborn as sns
```

```
<Figure size 640x480 with 0 Axes>
```

In [3]:
```
#Uploading dataset and checking its shape
data=pd.read_csv('dogs-ranking-dataset.csv')
data.shape
```

Out[3]: (87, 19)

In [4]:
```
#overview of dataset
data.head()
```

Out[4]:

	Breed	type	score	popularity ranking	size	intelligence	congential ailments	score for kids	size.1	$LIFETIM COS
0	Border Terrier	terrier	3.61	61	1	Above average	none	4.99	small	$22,6
1	Cairn Terrier	terrier	3.53	48	1	Above average	'lion jaw', heart problems	4.91	small	$21,9
2	Siberian Husky	working	3.22	16	2	Average	none	4.72	medium	$22,0
3	Welsh Springer Spaniel	sporting	3.34	81	2	Above average	hip problems	4.71	medium	$20,2
4	English Cocker Spaniel	sporting	3.33	51	2	Excellent	none	4.70	medium	$18,9

In [5]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 87 entries, 0 to 86
Data columns (total 19 columns):
 #   Column                     Non-Null Count  Dtype  
---  ------                     --------------  -----  
 0   Breed                      87 non-null     object 
 1   type                       87 non-null     object 
 2   score                      87 non-null     float64
 3   popularity ranking         87 non-null     int64  
 4   size                       87 non-null     int64  
 5   intelligence               87 non-null     object 
 6   congential ailments        87 non-null     object 
 7   score for kids             87 non-null     float64
 8   size.1                     87 non-null     object 
 9   $LIFETIME COST             87 non-null     object 
 10  INTELLIGENCE RANK          87 non-null     int64  
 11  INTELLIGENCE %             87 non-null     object 
 12  LONGEVITY(YEARS)           87 non-null     float64
 13  NUMBER OF GENETIC AILMENTS  87 non-null     int64  
 14  GENETIC AILMENTS           87 non-null     object 
 15  PURCHASE PRICE             87 non-null     object 
 16  FOOD COSTS PER YEAR        87 non-null     object 
 17  GROOMING FREQUNCY          87 non-null     object 
 18  SUITABILITY FOR CHILDREN   87 non-null     int64  
dtypes: float64(3), int64(5), object(11)
memory usage: 13.0+ KB
```

In [6]:
```
#cheaking whether the dataset containg any null value or not
null_values = data.isnull().sum()
null_percentage = (data.isnull().sum() / len(data)) * 100

null_stats = pd.DataFrame({
    'Column': data.columns,
    'Null Values': null_values.values,
    'Percentage': null_percentage.values
})

print(null_stats)
```

```
                       Column  Null Values  Percentage
0                       Breed            0         0.0
1                        type            0         0.0
2                       score            0         0.0
3          popularity ranking            0         0.0
4                        size            0         0.0
5                intelligence            0         0.0
6         congential ailments            0         0.0
7              score for kids            0         0.0
8                      size.1            0         0.0
9              $LIFETIME COST            0         0.0
10          INTELLIGENCE RANK            0         0.0
11             INTELLIGENCE %            0         0.0
12           LONGEVITY(YEARS)            0         0.0
13  NUMBER OF GENETIC AILMENTS           0         0.0
14           GENETIC AILMENTS            0         0.0
15             PURCHASE PRICE            0         0.0
16        FOOD COSTS PER YEAR            0         0.0
17          GROOMING FREQUNCY            0         0.0
18    SUITABILITY FOR CHILDREN           0         0.0
```

In [7]:
```
#describing data to see its numerical parameters
data.describe()
```

Out[7]:

	score	popularity ranking	size	score for kids	INTELLIGENCE RANK	LONGEVITY(YEARS)	NUM GEN AILMI
count	87.000000	87.000000	87.000000	87.000000	87.000000	87.000000	87.0C
mean	2.603678	44.000000	1.954023	3.681839	41.540230	11.117701	1.6ε
std	0.570288	25.258662	0.819927	0.655736	21.979803	1.938465	1.7C
min	0.990000	1.000000	1.000000	1.860000	1.000000	6.290000	0.0C
25%	2.185000	22.500000	1.000000	3.180000	27.000000	10.000000	0.5C
50%	2.710000	44.000000	2.000000	3.810000	43.000000	11.560000	1.0C
75%	3.035000	65.500000	3.000000	4.115000	59.000000	12.430000	2.0C
max	3.640000	87.000000	3.000000	4.990000	80.000000	16.500000	9.0C

In [8]:
```
# Remove '$' and ',' and convert to float
data['$LIFETIME COST'] = data['$LIFETIME COST'].astype(str).str.replac

# Remove '%' and convert to float
data['INTELLIGENCE %'] = data['INTELLIGENCE %'].str.rstrip('%').astype

# Remove '$' and ',' and convert to float
data['PURCHASE PRICE'] = data['PURCHASE PRICE'].astype(str).str.replac

data['FOOD COSTS PER YEAR'] = data['FOOD COSTS PER YEAR'].str.replace(
```

In [9]:
```
#creating a new dataset containing object datatype
data_category = data.select_dtypes(include=['object'])
```

In [10]:
```
#creating a new dataset containing int, float datatype
data_numeric = data.select_dtypes(include=['int64','float64'])
```

In [11]:
```
data_category.head()
```

Out[11]:

	Breed	type	intelligence	congential ailments	size.1	GENETIC AILMENTS	GROOMING FREQUNCY
0	Border Terrier	terrier	Above average	none	small	none	Once a week
1	Cairn Terrier	terrier	Above average	'lion jaw', heart problems	small	'lion jaw', heart problems	Once a week
2	Siberian Husky	working	Average	none	medium	none	Once in a few weeks
3	Welsh Springer Spaniel	sporting	Above average	hip problems	medium	hip problems	Once a week
4	English Cocker Spaniel	sporting	Excellent	none	medium	none	Once a week

In [12]:
```
data_numeric.head()
```

Out[12]:

	score	popularity ranking	size	score for kids	$LIFETIME COST	INTELLIGENCE RANK	INTELLIGENCE %	LONGEVITY(YEA
0	3.61	61	1	4.99	22638.0	30	70.0	14
1	3.53	48	1	4.91	21992.0	35	61.0	13
2	3.22	16	2	4.72	22049.0	45	45.0	12
3	3.34	81	2	4.71	20224.0	31	69.0	12
4	3.33	51	2	4.70	18993.0	18	82.0	11

```
#NO missing vale found
#NO dupplicate value found
#A seperate dataframe has been created for categorical Variable
called as data_category
```

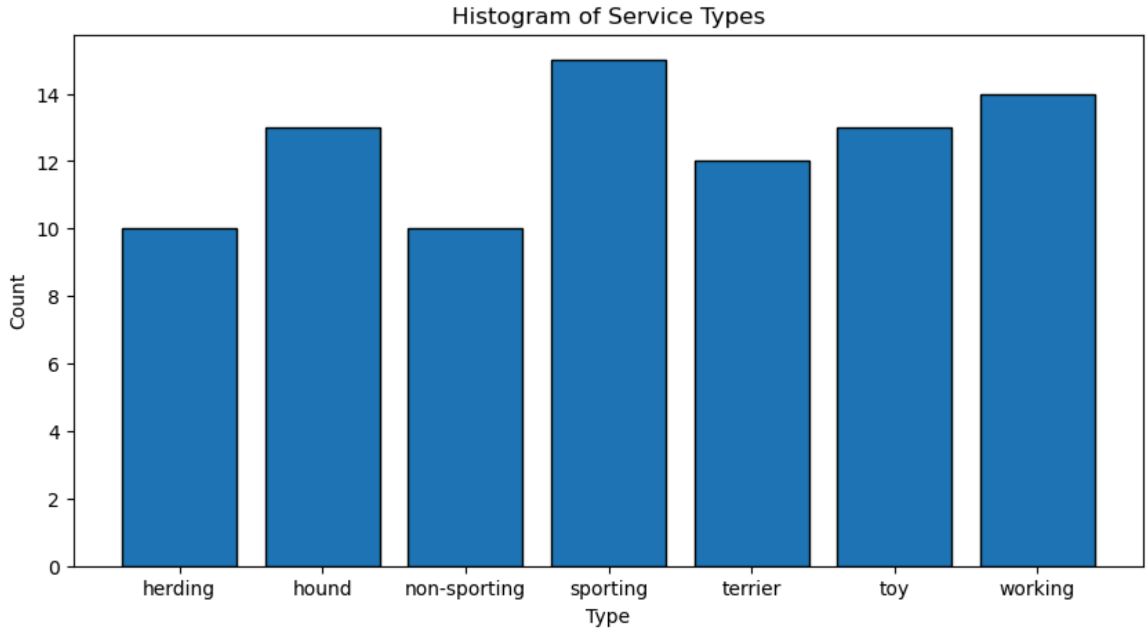
```
#A seperate dataframe has been created for numerical Variable called
as data_numeric
```

Univariate analysis

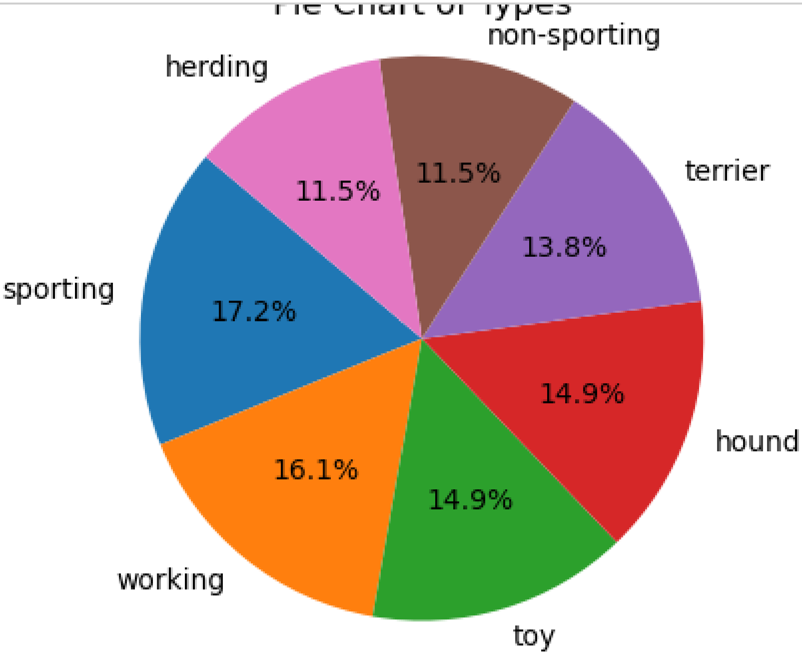
In [13]:
```
#lokking for frequency of particular variable and its value count
data['type'].value_counts()
```

Out[13]:
```
type
sporting        15
working         14
toy             13
hound           13
terrier         12
non-sporting    10
herding         10
Name: count, dtype: int64
```

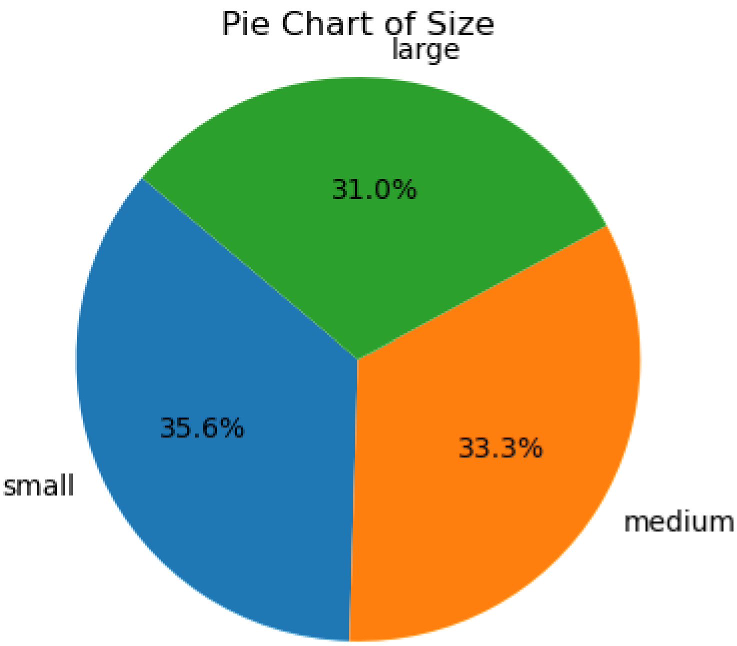
In [14]:
```
#Count of type of Dog
Type_count= data['type'].value_counts().sort_index()
plt.figure(figsize=(10, 5))
plt.bar(Type_count.index, Type_count.values, edgecolor='black')
plt.xlabel('Type')
plt.ylabel('Count')
plt.title('Histogram of Service Types')
plt.show()
```



In [15]:
```
type_counts = data['type'].value_counts()

# Create a pie chart
plt.figure(figsize=(4, 4))
plt.pie(type_counts, labels=type_counts.index, autopct='%1.1f%%', star
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a
plt.title("Pie Chart of Types")
plt.show()
```

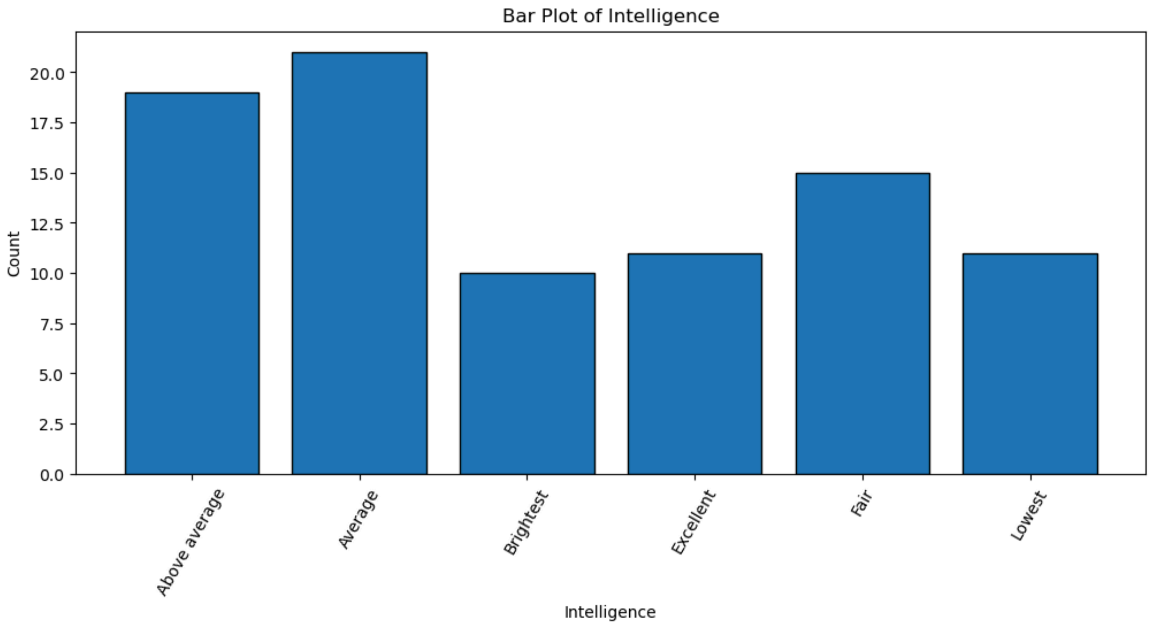


In [16]:
```
size_counts = data['size.1'].value_counts()

# Create a pie chart
plt.figure(figsize=(4, 4))
plt.pie(size_counts, labels=size_counts.index, autopct='%1.1f%%', star
plt.axis('equal')  # Equal aspect ratio ensures that pie is drawn as a
plt.title("Pie Chart of Size")
plt.show()
```

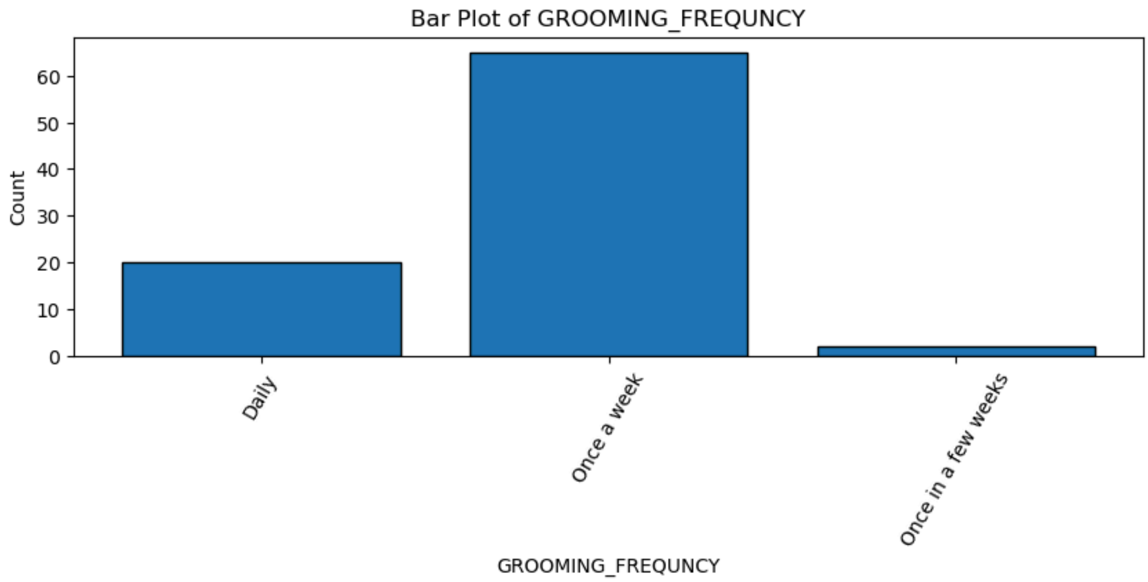


In [17]:
```
#Droping dupplicate column as it has been presentt in the form of mune
data = data.drop(columns=['size.1','congential ailments'])
```

In [18]:
```
#count of intelligence
intelligence_counts = data['intelligence'].value_counts().sort_index()
plt.figure(figsize=(12, 5))
plt.bar(intelligence_counts.index, intelligence_counts.values, edgecol
plt.xlabel('Intelligence')
plt.xticks(rotation=60)
plt.ylabel('Count')
plt.title('Bar Plot of Intelligence')
plt.show()
```

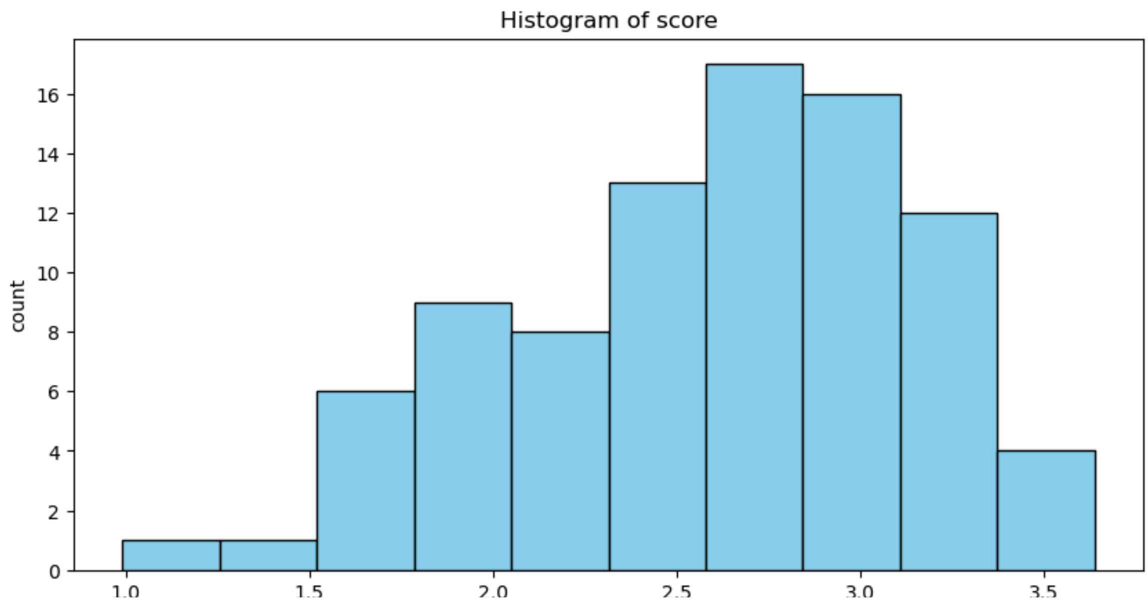


In [19]:
```
# Count of Grooming Frequency
GROOMING_FREQUNCY=data['GROOMING FREQUNCY'].value_counts().sort_index(
plt.figure(figsize=(10,3))
plt.bar(GROOMING_FREQUNCY.index, GROOMING_FREQUNCY.values, edgecolor='
plt.xlabel('GROOMING_FREQUNCY')
plt.xticks(rotation=60)
plt.ylabel('Count')
plt.title('Bar Plot of GROOMING_FREQUNCY')
plt.show()
```



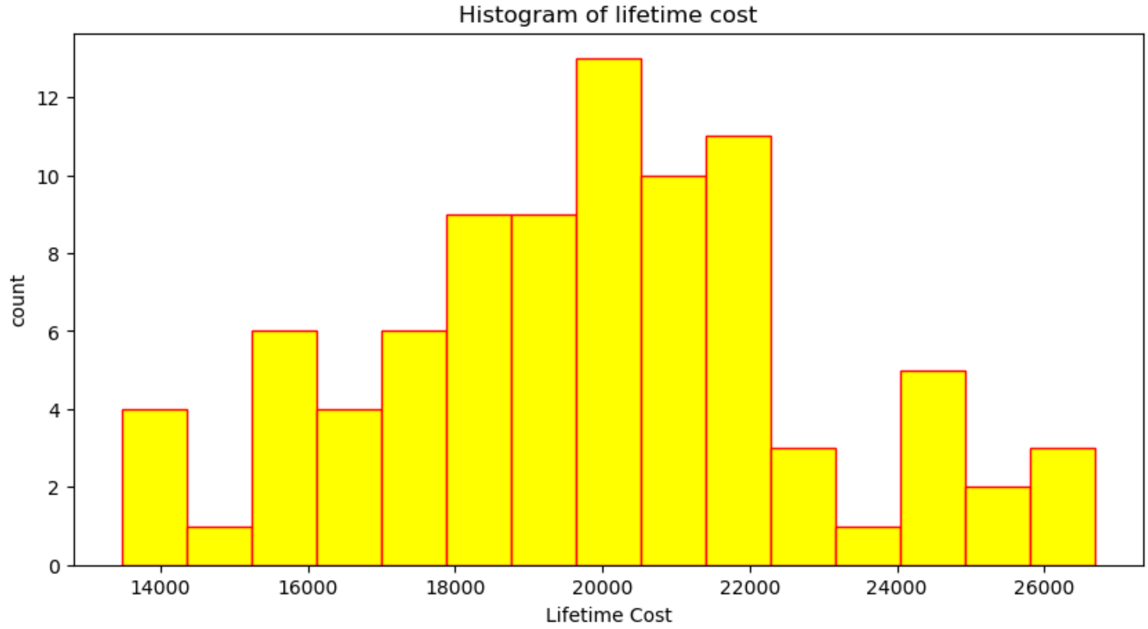
In [20]:
```
plt.figure(figsize=(10,5))
plt.hist(data['score'],bins=10,color='skyblue', edgecolor='black')
plt.xlabel('Score')
plt.ylabel('count')
plt.title('Histogram of score')
plt.show
```

Out[20]: <function matplotlib.pyplot.show(close=None, block=None)>



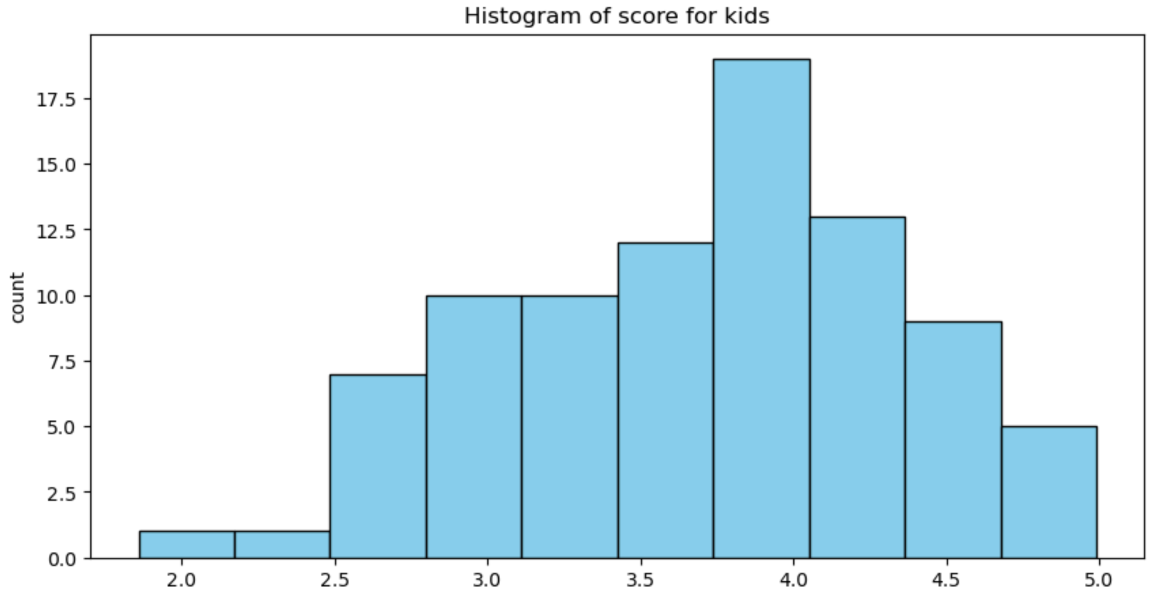
In [21]:
```
plt.figure(figsize=(10,5))
plt.hist(data['PURCHASE PRICE'], bins=15, color='red',edgecolor='green
plt.xlabel('PURCHASE PRICE')
plt.ylabel('count')
plt.title('Histogram of purchase price')
plt.show()
```

In [22]:
```

plt.figure(figsize=(10,5))
plt.hist(data['$LIFETIME COST'], bins=15, color='yellow',edgecolor='re
plt.xlabel('Lifetime Cost')
plt.ylabel('count')
plt.title('Histogram of lifetime cost')
plt.show()
```



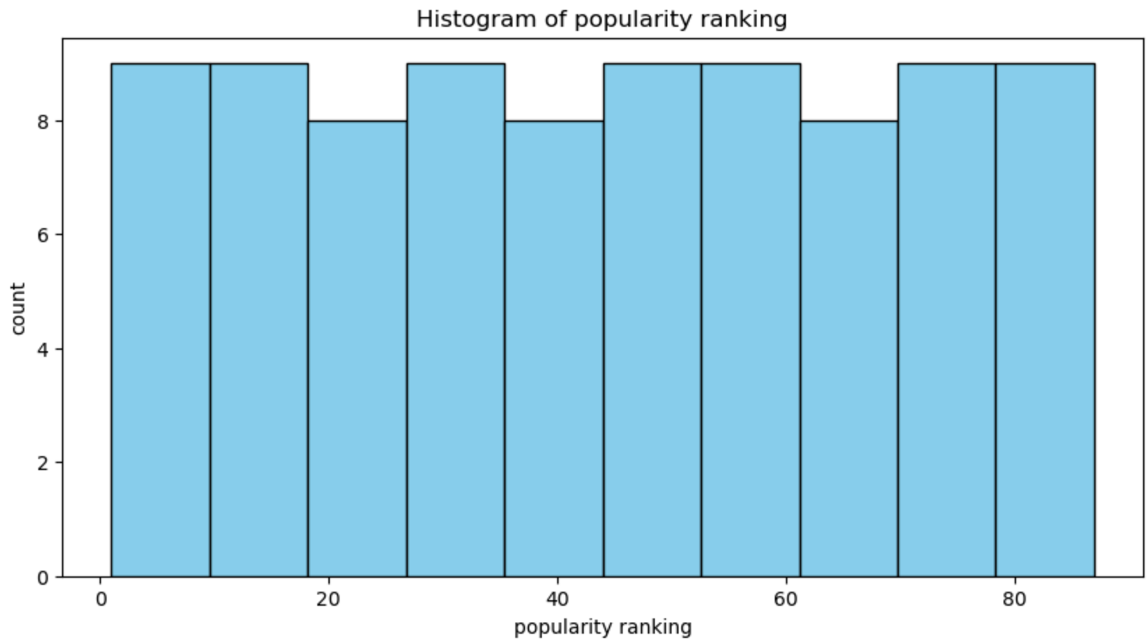
In [23]:
```
plt.figure(figsize=(10,5))
plt.hist(data['score for kids'],bins=10,color='skyblue', edgecolor='bl
plt.xlabel('Score for kids')
plt.ylabel('count')
plt.title('Histogram of score for kids')
plt.show
```

Out[23]: <function matplotlib.pyplot.show(close=None, block=None)>



In [24]:
```
plt.figure(figsize=(10,5))
plt.hist(data['popularity ranking'],bins=10,color='skyblue', edgecolor
plt.xlabel('popularity ranking')
plt.ylabel('count')
plt.title('Histogram of popularity ranking')
plt.show
```

Out[24]: <function matplotlib.pyplot.show(close=None, block=None)>



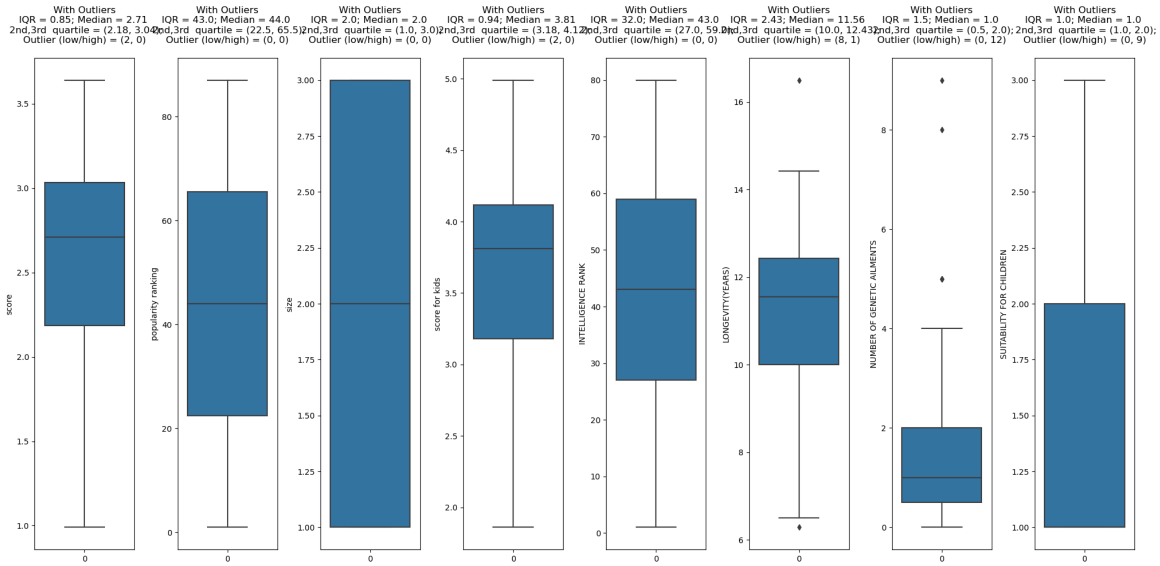
Bivariate and Multivariate Analysis

In [25]:
```
#function to examing whether the variables contain any outlier or not
def UVA_outlier(data, var_group, include_outlier=True):
    size = len(var_group)
    plt.figure(figsize=(20,10), dpi=100)

    for j, i in enumerate(var_group):
        # calculating descriptives of variable
        quant25 = data[i].quantile(0.25)
        quant75 = data[i].quantile(0.75)
        IQR = quant75 - quant25
        med = data[i].median()
        whis_low = med - (1.5 * IQR)
        whis_high = med + (1.5 * IQR)

        # Calculating Number of Outliers
        outlier_high = len(data[i][data[i] > whis_high])
        outlier_low = len(data[i][data[i] < whis_low])

        if include_outlier:
            # Plotting the variable with every information
            plt.subplot(1, size, j + 1)
            sns.boxplot(data[i], orient="v")
            plt.ylabel('{}'.format(i))
            plt.title('With Outliers\nIQR = {}; Median = {} \n 2nd,3rd
                round(IQR, 2),
                round(med, 2),
                (round(quant25, 2), round(quant75, 2)),
                (outlier_low, outlier_high)
            ))
        else:
            # replacing outliers with max/min whisker
            data2 = data[var_group].copy()
            data2[i][data2[i] > whis_high] = whis_high + 1
            data2[i][data2[i] < whis_low] = whis_low - 1

            # plotting without outliers
            plt.subplot(1, size, j + 1)
            sns.boxplot(data2[i], orient="v")
            plt.ylabel('{}'.format(i))
            plt.title('Without Outliers\nIQR = {}; Median = {} \n 2nd,3
                round(IQR, 2),
                round(med, 2),
                (round(quant25, 2), round(quant75, 2)),
                (outlier_low, outlier_high)
            ))

    plt.tight_layout()
    plt.show()
```

In [26]:
```
column_names_numeric = data_numeric.columns.tolist()
column_names_numeric
```

Out[26]:
```
['score',
 'popularity ranking',
 'size',
 'score for kids',
 '$LIFETIME COST',
 'INTELLIGENCE RANK',
 'INTELLIGENCE %',
 'LONGEVITY(YEARS)',
 'NUMBER OF GENETIC AILMENTS',
 'PURCHASE PRICE',
 'FOOD COSTS PER YEAR',
 'SUITABILITY FOR CHILDREN']
```

In [27]:
```
UVA_outlier(data_numeric,['score', 'popularity ranking', 'size', 'scor
```



In [28]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 87 entries, 0 to 86
Data columns (total 17 columns):
 #   Column                      Non-Null Count  Dtype  
---  ------                      --------------  -----  
 0   Breed                       87 non-null     object 
 1   type                        87 non-null     object 
 2   score                       87 non-null     float64
 3   popularity ranking          87 non-null     int64  
 4   size                        87 non-null     int64  
 5   intelligence                87 non-null     object 
 6   score for kids              87 non-null     float64
 7   $LIFETIME COST              87 non-null     float64
 8   INTELLIGENCE RANK           87 non-null     int64  
 9   INTELLIGENCE %              87 non-null     float64
 10  LONGEVITY(YEARS)            87 non-null     float64
 11  NUMBER OF GENETIC AILMENTS  87 non-null     int64  
 12  GENETIC AILMENTS            87 non-null     object 
 13  PURCHASE PRICE              87 non-null     float64
 14  FOOD COSTS PER YEAR         87 non-null     float64
 15  GROOMING FREQUNCY           87 non-null     object 
 16  SUITABILITY FOR CHILDREN    87 non-null     int64  
dtypes: float64(7), int64(5), object(5)
memory usage: 11.7+ KB
```

Changing categorical variable into numerical

In [29]:
```
#impoting preprocessing libraries for converting the variable
from sklearn.preprocessing import LabelEncoder
label_encoder = LabelEncoder()
```

In [30]:
```
data['GROOMING FREQUNCY'].value_counts()
```

Out[30]:
```
GROOMING FREQUNCY
Once a week          65
Daily                20
Once in a few weeks   2
Name: count, dtype: int64
```

In [31]:
```
data['GROOMING FREQUNCY']=data['GROOMING FREQUNCY'].map({'Once a week'
data['GROOMING FREQUNCY']
```

Out[31]:
```
0     0
1     0
2     2
3     0
4     0
     ..
82    1
83    0
84    1
85    0
86    0
Name: GROOMING FREQUNCY, Length: 87, dtype: int64
```

In [32]:
```
data['type'].value_counts()
```

Out[32]:
```
type
sporting        15
working         14
toy             13
hound           13
terrier         12
non-sporting    10
herding         10
Name: count, dtype: int64
```

In [33]:
```
data['type']=data['type'].map({'sporting':0,'working':1,'toy':2,'hounc
data['type']
```

Out[33]:
```
0     4
1     4
2     1
3     0
4     0
     ..
82    1
83    3
84    5
85    1
86    5
Name: type, Length: 87, dtype: int64
```

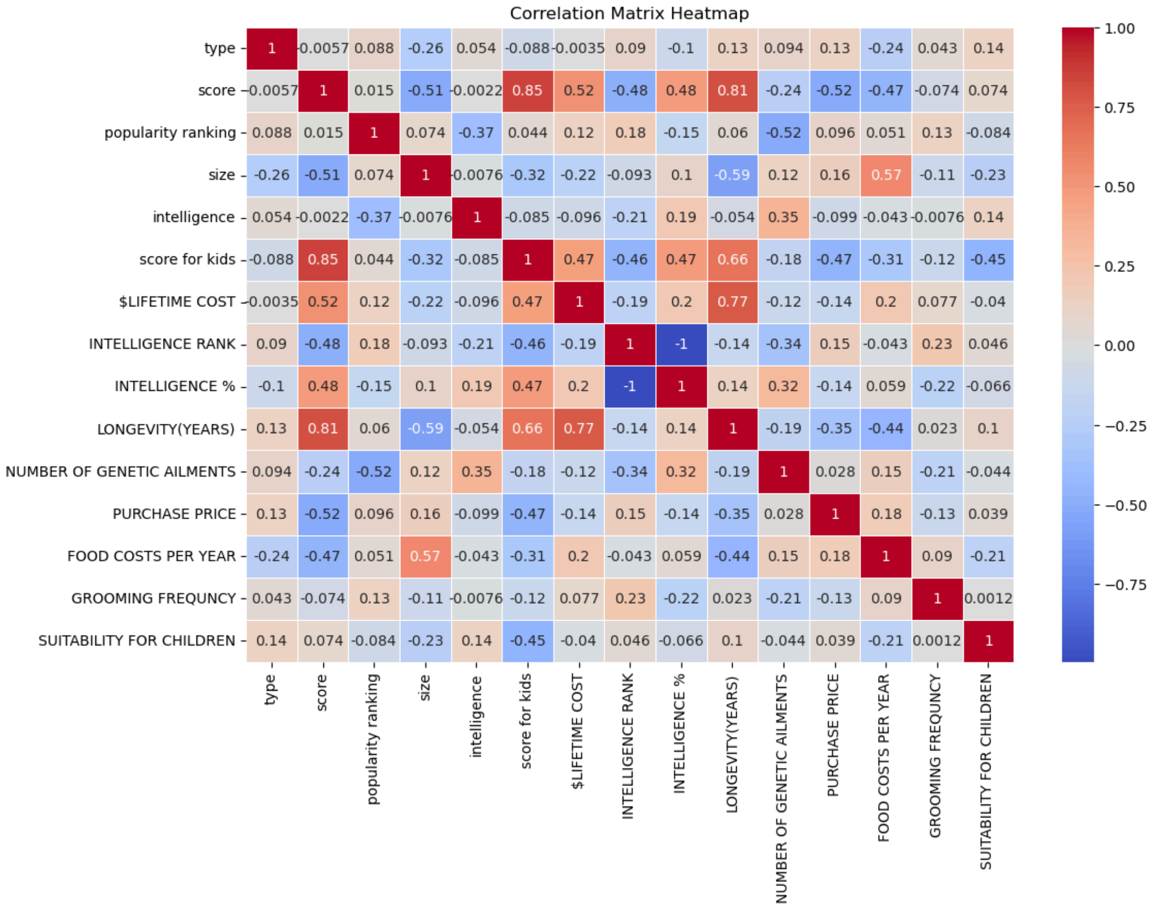
In [34]:
```
data['intelligence'].value_counts()
```

Out[34]:
```
intelligence
Average          21
Above average    19
Fair             15
Excellent        11
Lowest           11
Brightest        10
Name: count, dtype: int64
```

In [35]:
```
data['intelligence']=data['intelligence'].map({'Average':0,'Above aver
data['intelligence']
```

Out[35]:
```
0     1
1     1
2     0
3     1
4     3
     ..
82    0
83    4
84    4
85    0
86    4
Name: intelligence, Length: 87, dtype: int64
```

In [36]:
```
# Checking the correlation between the variables
data_corr = data.select_dtypes(include=['int', 'float'])
correlation_matrix = data_corr.corr()

# Plot the heatmap
plt.figure(figsize=(12, 8))
heatmap = sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm',
plt.title('Correlation Matrix Heatmap')
plt.show()
```



In [37]:
```
data['GENETIC AILMENTS'].value_counts()
```

Out[37]:
```
GENETIC AILMENTS
none
22
hip problems
12
heart problems
3
deafness, hip problems
2
knee problems
2
eye, hip problems
2
heart, spine, blood clotting disorders
1
hip problems, heart defects
1
kidney, eye problems, anaemia
1
```

In [38]:
```
data = pd.get_dummies(data, columns=['Breed', 'GENETIC AILMENTS'])
data = data.astype(int)
```

In [39]:
```
data
```

Out[39]:

	type	score	popularity ranking	size	intelligence	score for kids	$LIFETIME COST	INTELLIGENCE RANK	INTELLIGENC
0	4	3	61	1	1	4	22638	30	
1	4	3	48	1	1	4	21992	35	
2	1	3	16	2	0	4	22049	45	
3	0	3	81	2	1	4	20224	31	
4	0	3	51	2	3	4	18993	18	
...	...	...	...	...	...	...	...	...	
82	1	1	47	3	0	2	21986	50	
83	3	1	42	3	4	2	13824	75	
84	5	1	54	2	4	2	15898	77	

Spliting the Dataset

In [40]:
```
#creating two dataset where x contain all variable except target varia
x=data.drop(['PURCHASE PRICE'],axis=1)
y=data['PURCHASE PRICE']
```

In [41]:
```
#importing required libraries
from sklearn.model_selection import train_test_split
```

In [42]:
```
#split dataset in two parts train and test with test size 20%
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.2,rand
print('x_train =',x_train.shape)
print('y_train =',y_train.shape)
print('x_test =',x_test.shape)
print('y_test =',y_test.shape)
```

```
x_train = (69, 151)
y_train = (69,)
x_test = (18, 151)
y_test = (18,)
```

Linear Regression

In [43]:
```
from sklearn.linear_model import LinearRegression
# Instance the linear regression object
reg = LinearRegression().fit(x_train, y_train)
reg.score(x_train, y_train)
```

Out[43]: 1.0

In [44]:
```
y_pred_train = reg.predict(x_train)
y_pred_test = reg.predict(x_test)
```

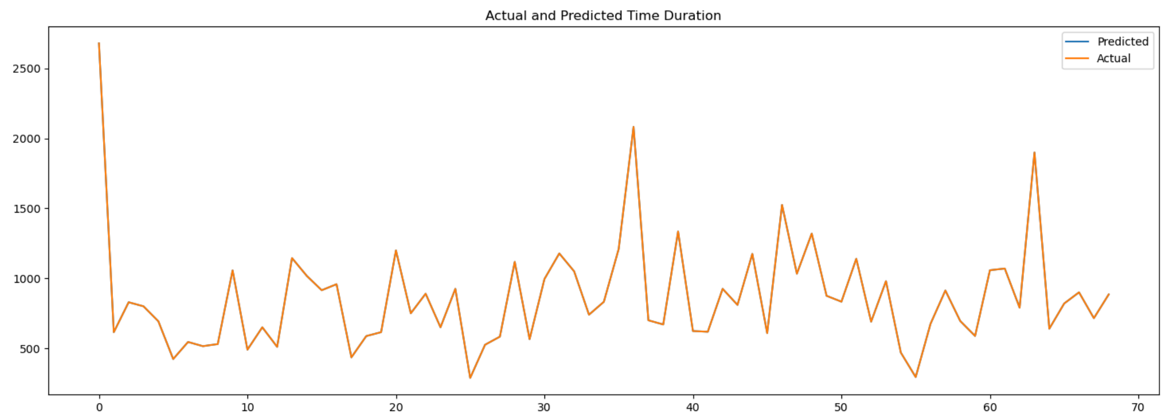
In [45]:
```
from sklearn.metrics import r2_score
from sklearn.metrics import mean_squared_error
```

In [46]:
```
from matplotlib import legend
# Function for evaluation metric for regression
def EvaluationMetric(Xt,yt,yp,disp="on"):
  ''' Take the different set of parameter and prints evaluation metric
  MSE=round(mean_squared_error(y_true=yt,y_pred=yp),4)
  RMSE=(np.sqrt(MSE))
  R2=(r2_score(y_true=yt,y_pred=yp))
  Adjusted_R2=(1-(1-r2_score(yt, yp))*((Xt.shape[0]-1)/(Xt.shape[0]-Xt
  if disp=="on":
    print("MSE :",MSE,"RMSE :", RMSE)
    print("R2 :",R2,"Adjusted R2 :",Adjusted_R2)

  #Plotting Actual and Predicted Values
  plt.figure(figsize=(18,6))
  plt.plot((yp)[:100])
  plt.plot((np.array(yt)[:100]))
  plt.legend(["Predicted","Actual"])
  plt.title('Actual and Predicted Time Duration')



  return (MSE,RMSE,R2,Adjusted_R2)
```

In [47]:
```
#Evaluation metrics for Train set
EvaluationMetric(x_train,y_train,y_pred_train)
```

```
MSE : 0.0 RMSE : 0.0
R2 : 1.0 Adjusted R2 : 1.0
```

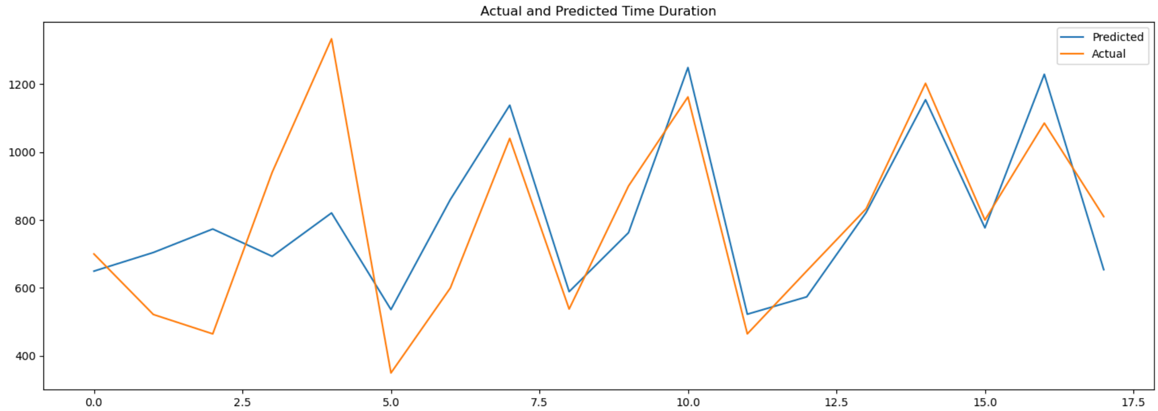
Out[47]: (0.0, 0.0, 1.0, 1.0)



In [48]:
```
#Evaluation metrics for Test set
EvaluationMetric(x_test,y_test,y_pred_test)
```

```
MSE : 36242.6197 RMSE : 190.374945042671
R2 : 0.531253709560429 Adjusted R2 : 1.0594678129662143
```

Out[48]:
```
(36242.6197, 190.374945042671, 0.531253709560429, 1.059467812966214
3)
```



Decision Tree

In [49]:
```
from sklearn import tree
from sklearn.tree import DecisionTreeRegressor
```

In [50]:
```
x.shape ,y.shape
```

Out[50]:
```
((87, 151), (87,))
```

In [51]:
```
dt_model = tree.DecisionTreeRegressor()
dt_model = dt_model.fit(x, y)
```

In [52]:
```
#checking the training score
dt_model.score(x_train, y_train)
```

Out[52]:
```
1.0
```

In [53]:
```
#test score
dt_model.score(x_test, y_test)
```

Out[53]:
```
1.0
```

In [54]:
```
# Maximum depth of trees
max_depth = [5,10]

# Minimum number of samples required to split a node
min_samples_split = [10,20]

# Minimum number of samples required at each leaf node
min_samples_leaf = [10,20]

# HYperparameter Grid
param_dt = {
              'max_depth' : max_depth,
              'min_samples_split' : min_samples_split,
              'min_samples_leaf' : min_samples_leaf}
```

In [55]:
```
from sklearn.model_selection import GridSearchCV
```

In [56]:
```
dt_model = DecisionTreeRegressor()

# Grid search
dt_grid = GridSearchCV(estimator=dt_model,
                       param_grid = param_dt,
                       cv = 5, verbose=2, scoring='r2')

dt_grid.fit(x_train,y_train)
```

```
Fitting 5 folds for each of 8 candidates, totalling 40 fits
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=20; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=20; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=20; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=20; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=10, min_samples_split=20; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=10; tot
al time=   0.0s
[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=10; tot
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[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=20; tot
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[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=20; tot
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[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=20; tot
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[CV] END max_depth=5, min_samples_leaf=20, min_samples_split=20; tot
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=10; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=10; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=10; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=10; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=10; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=20; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=20; to
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[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=20; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=20; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=10, min_samples_split=20; to
tal time=   0.0s
```

```
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=10; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=10; to
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[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=10; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=20; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=20; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=20; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=20; to
tal time=   0.0s
[CV] END max_depth=10, min_samples_leaf=20, min_samples_split=20; to
tal time=   0.0s
```

Out[56]:

```
▸ GridSearchCV
▸ estimator: DecisionTreeRegressor
  ▸ DecisionTreeRegressor
```

In [57]:

```
dt_grid.best_score_
```

Out[57]:

```
-0.0317273131918893
```

In [58]:

```
dt_grid.best_estimator_
```

Out[58]:

```
▾ DecisionTreeRegressor
DecisionTreeRegressor(max_depth=5, min_samples_leaf=20, min_samples_
split=10)
```

In [59]:

```
dt_optimal_model =dt_grid.best_estimator_
```

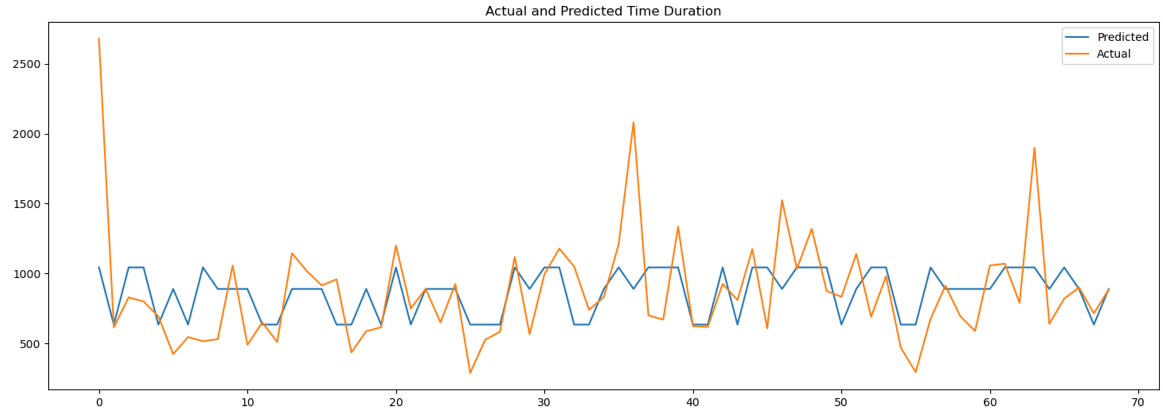
In [60]:

```
y_pred_dt_test=dt_optimal_model.predict(x_test)
y_pred_dt_train=dt_optimal_model.predict(x_train)
```

In [61]:
```
#Evaluation metrics for Train set
EvaluationMetric(x_train,y_train,y_pred_dt_train)
```

```
MSE : 125128.0001 RMSE : 353.7343637533679
R2 : 0.18263361267317557 Adjusted R2 : 1.669649570340049
```

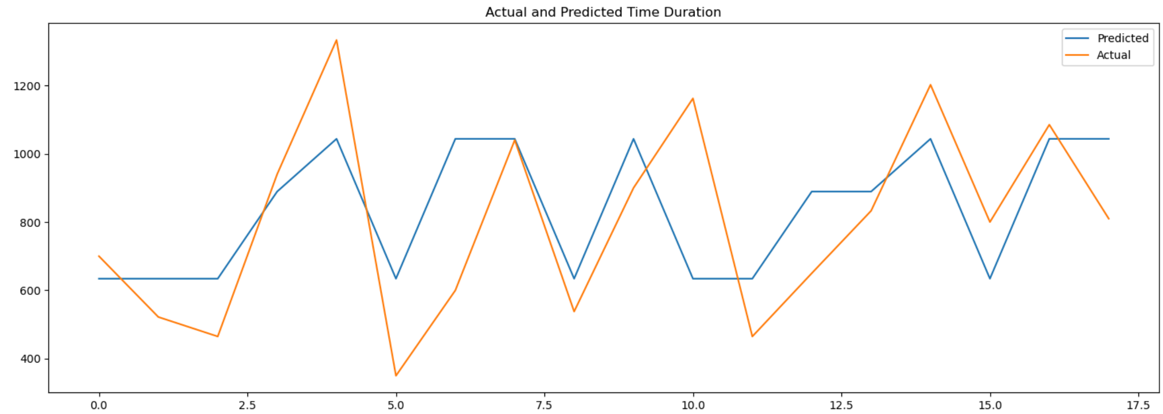
Out[61]:
```
(125128.0001, 353.7343637533679, 0.18263361267317557, 1.669649570340049)
```



In [62]:
```
#Evaluation metrics for Test set
EvaluationMetric(x_test,y_test,y_pred_dt_test)
```

```
MSE : 50878.9357 RMSE : 225.56359568866606
R2 : 0.3419539604998376 Adjusted R2 : 1.0834834527724087
```

Out[62]:
```
(50878.9357, 225.56359568866606, 0.3419539604998376, 1.0834834527724087)
```



In [ ]: