In [58]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
from sklearn.linear_model import LinearRegression
from sklearn.neighbors import KNeighborsRegressor
warnings.filterwarnings('ignore')
```

Part 1: Data Exploration and Visualization (20 marks)

Q1 loading

In [9]:
```
df = pd.read_csv('lifesat.csv');
df.head()
```

Out[9]:

	Country	GDP per capita (USD)	Life satisfaction
0	Russia	26456.387938	5.8
1	Greece	27287.083401	5.4
2	Turkey	28384.987785	5.5
3	Latvia	29932.493910	5.9
4	Hungary	31007.768407	5.6

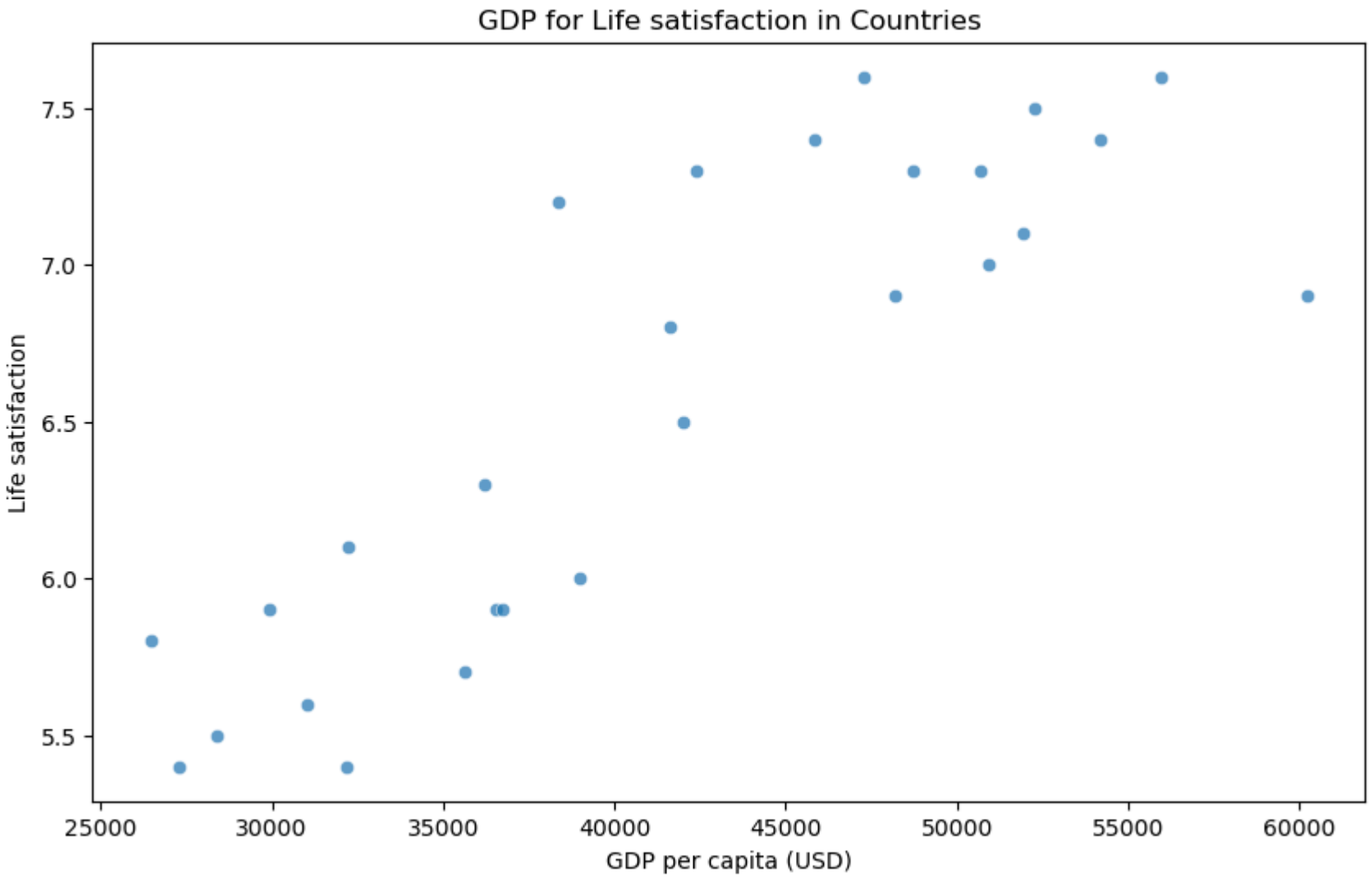
Q2

In [14]:
```
print(df.info())
print(df.describe())
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 27 entries, 0 to 26
Data columns (total 3 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   Country               27 non-null     object 
 1   GDP per capita (USD)  27 non-null     float64
 2   Life satisfaction     27 non-null     float64
dtypes: float64(2), object(1)
memory usage: 780.0+ bytes
None
       GDP per capita (USD)  Life satisfaction
count             27.000000          27.000000
mean           41564.521771           6.566667
std             9631.452319           0.765607
min            26456.387938           5.400000
25%            33938.289305           5.900000
50%            41627.129269           6.800000
75%            49690.580269           7.300000
max            60235.728492           7.600000
```

Q3

In [41]:
```
plt.figure(figsize=(10, 6))
sns.scatterplot(df, x="GDP per capita (USD)", y="Life satisfaction", alpha=0.7).set_title('GDP for Life satisfactio
plt.show()
```



There is a positive correlation

Part 2: Linear Regression Model (30 marks)

Q4

In [29]:
```
X = df[['GDP per capita (USD)']]
y = df[['Life satisfaction']]
print(X.shape, y.shape, sep='\n')
```

```
(27, 1)
(27, 1)
```

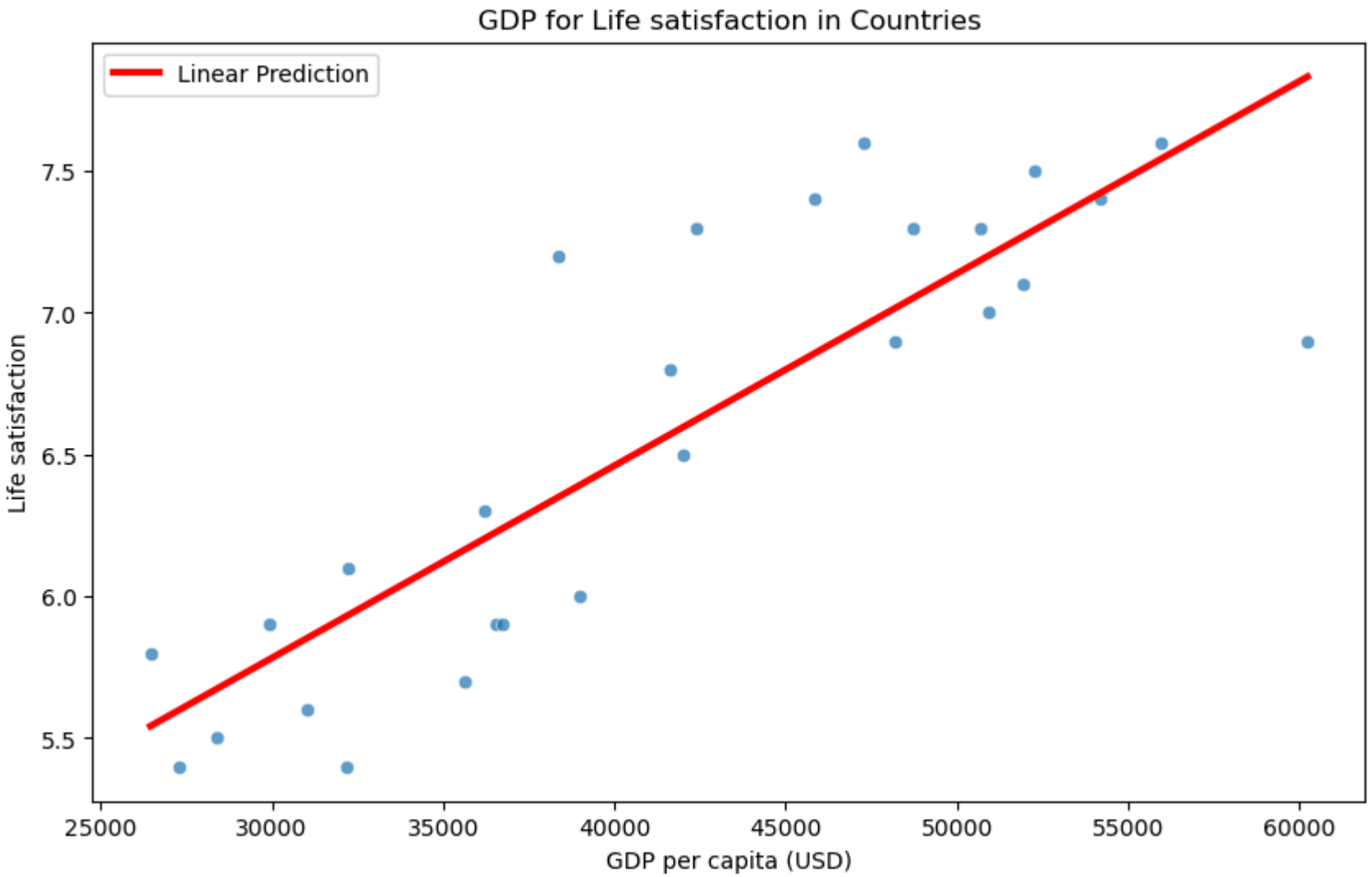
Q5

In [46]:
```
lr = LinearRegression().fit(X, y)
print("Coefficient: ", lr.coef_[0])
print("Intercept: ", lr.intercept_)
```

```
Coefficient:  [6.77889969e-05]
Intercept:  [3.74904943]
```

Q6

In [52]:
```
plt.figure(figsize=(10, 6))
# plt.scatter(X, y, color='blue', label='Data')
sns.scatterplot(df, x="GDP per capita (USD)", y="Life satisfaction", alpha=0.7).set_title('GDP for Life satisfactio
plt.plot(X, lr.predict(X), color='red', linewidth=3, label='Linear Prediction')
plt.legend()
plt.show()
```



Q7

In [75]:
```
prediction_lr = lr.predict([[37655.2]])
print(prediction_lr[0])
```

```
[6.30165767]
```

Part 3: K-Nearest Neighbors Regression (25 marks)

In [59]:
```
knn = KNeighborsRegressor(n_neighbors=3)
knn.fit(X, y)
```

Out[59]:

KNeighborsRegressor

▼ Parameters

n_neighbors	3
weights	'uniform'
algorithm	'auto'
leaf_size	30
p	2
metric	'minkowski'
metric_params	None
n_jobs	None

Q9

In [67]:
```
prediction_knn = knn.predict([[37655.2]])
prediction_lr = lr.predict([[37655.2]])
print(prediction_knn[0], prediction_lr[0], sep='\n')
```

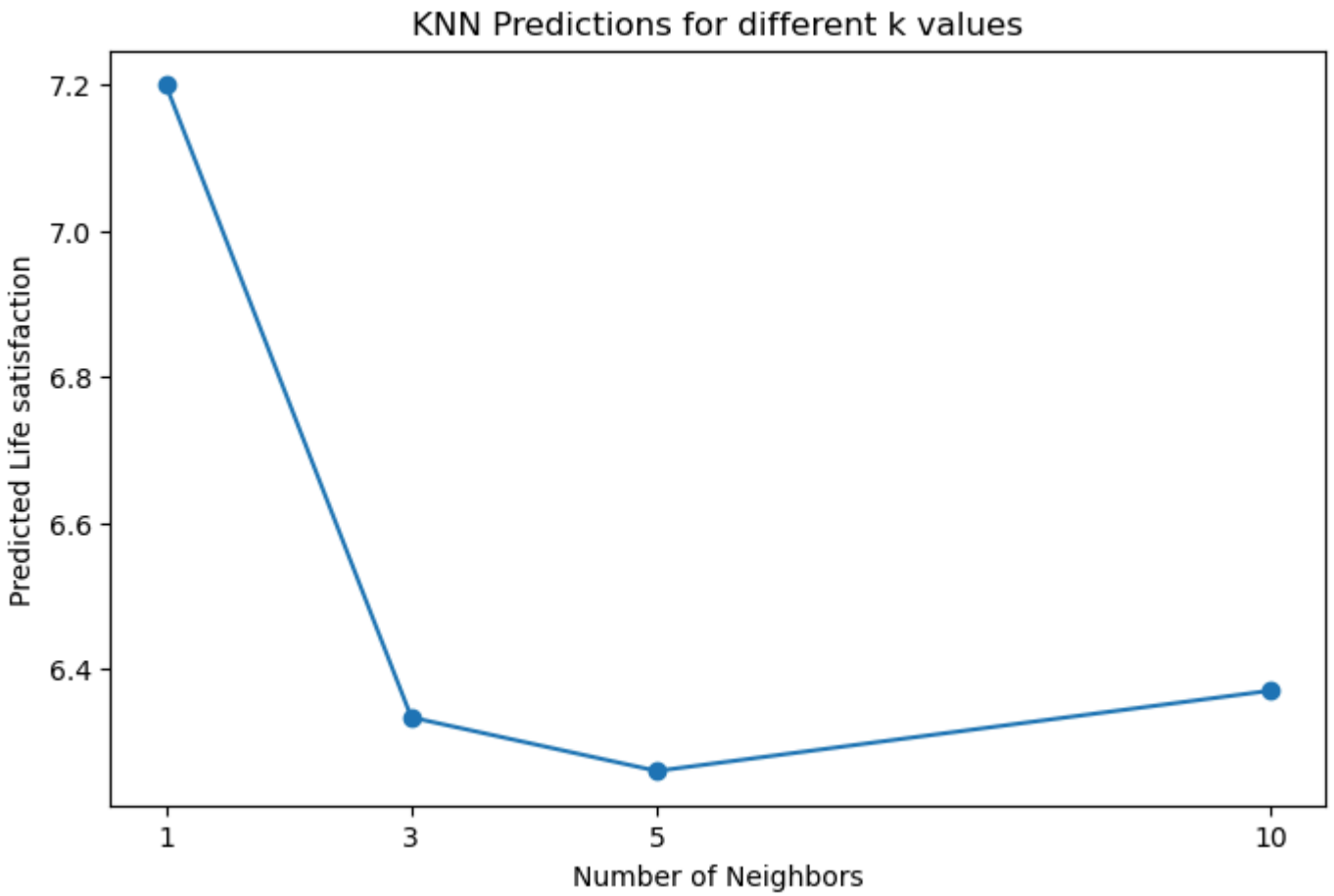
```
[6.33333333]
[6.30165767]
```

Q10

In [77]:
```
ks = [1, 3, 5, 10]
ans = []
for k in ks:
    model = KNeighborsRegressor(n_neighbors=k)
    model.fit(X, y)
    pred = model.predict([[37655.2]])[0]
    ans.append(pred)

print(ans)
plt.figure(figsize=(8, 5))
plt.plot(ks, ans, marker='o', linestyle='-')
plt.title("KNN Predictions for different k values")
plt.xlabel("Number of Neighbors")
plt.ylabel("Predicted Life satisfaction")
plt.xticks(ks)
plt.show()
```

```
[array([7.2]), array([6.33333333]), array([6.26]), array([6.37])]
```


KNN Predictions for different k values
Predicted Life satisfaction
7.2
7.0
6.8
6.6
6.4
1
3
5
10
Number of Neighbors