In [1]:

```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import OneHotEncoder
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_absolute_percentage_error
from sklearn import svm
from sklearn.ensemble import RandomForestRegressor
from sklearn.linear_model import LinearRegression
```

In [2]:

```
dataset = pd.read_csv("housing.csv")
```

In [3]:

```
print(dataset.head(5))
print("Dataset shape:", dataset.shape)
```

```
   longitude  latitude  housing_median_age  total_rooms  total_bedrooms  \
0    -122.23     37.88                41.0        880.0           129.0
1    -122.22     37.86                21.0       7099.0          1106.0
2    -122.24     37.85                52.0       1467.0           190.0
3    -122.25     37.85                52.0       1274.0           235.0
4    -122.25     37.85                52.0       1627.0           280.0

   population  households  median_income  median_house_value ocean_proximity
0       322.0       126.0         8.3252            452600.0        NEAR BAY
1      2401.0      1138.0         8.3014            358500.0        NEAR BAY
2       496.0       177.0         7.2574            352100.0        NEAR BAY
3       558.0       219.0         5.6431            341300.0        NEAR BAY
4       565.0       259.0         3.8462            342200.0        NEAR BAY
Dataset shape: (20640, 10)
```

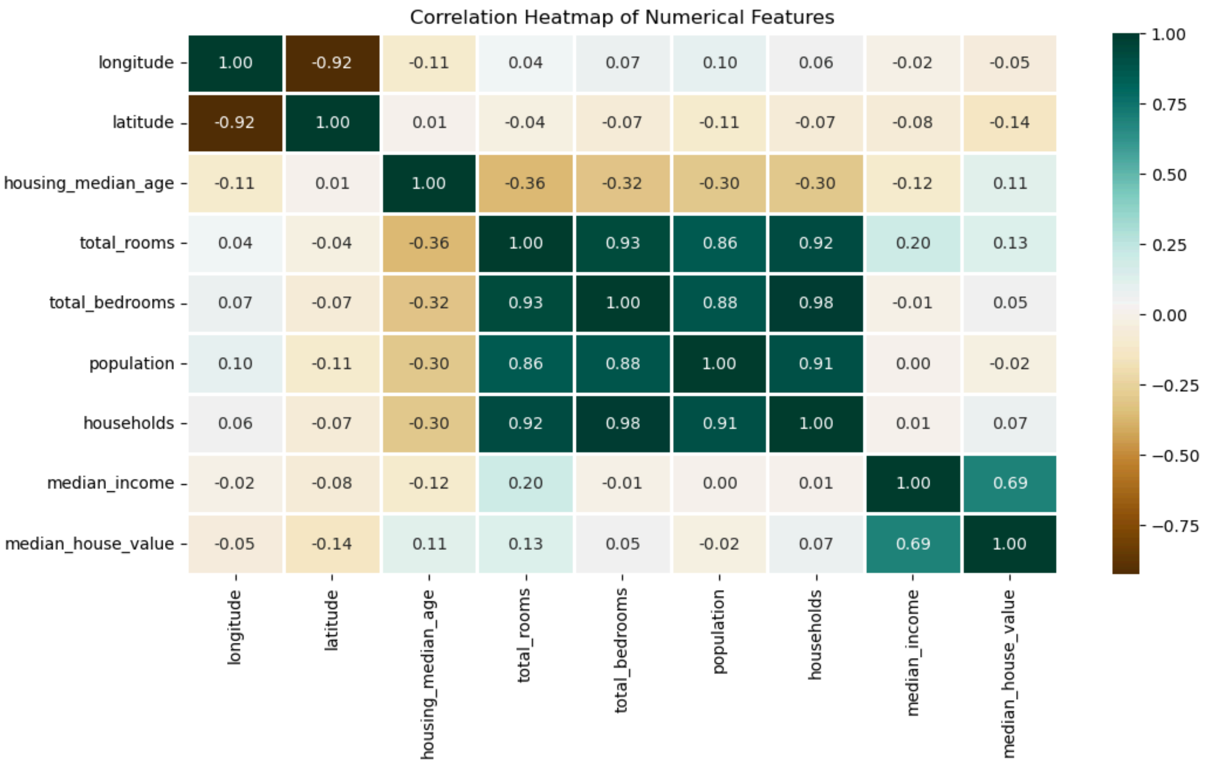
In [4]:

```
obj = (dataset.dtypes == 'object')
object_cols = list(obj[obj].index)
print("Categorical variables:", len(object_cols))

int_ = (dataset.dtypes == 'int64')
num_cols = list(int_[int_].index)
print("Integer variables:", len(num_cols))

fl = (dataset.dtypes == 'float64')
fl_cols = list(fl[fl].index)
print("Float variables:", len(fl_cols))
```

```
Categorical variables: 1
Integer variables: 0
Float variables: 9
```

In [5]:

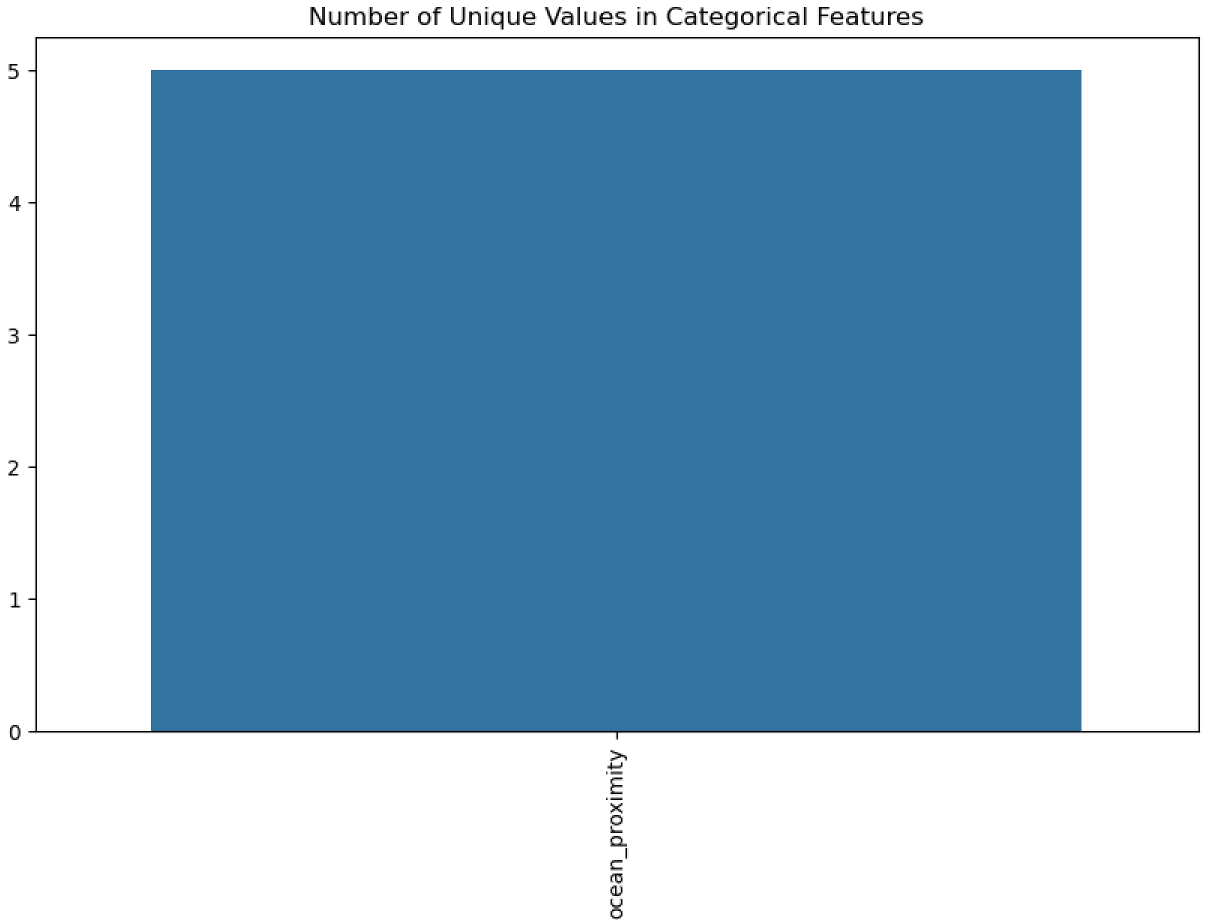
```
numerical_dataset = dataset.select_dtypes(include=['number'])
plt.figure(figsize=(12, 6))
sns.heatmap(numerical_dataset.corr(), cmap='BrBG', fmt='.2f', linewidths=2, annot=T
plt.title('Correlation Heatmap of Numerical Features')
plt.show()
```



	longitude	latitude	housing_median_age	total_rooms	total_bedrooms	population	households	median_income	median_house_value
longitude	1.00	-0.92	-0.11	0.04	0.07	0.10	0.06	-0.02	-0.05
latitude	-0.92	1.00	0.01	-0.04	-0.07	-0.11	-0.07	-0.08	-0.14
housing_median_age	-0.11	0.01	1.00	-0.36	-0.32	-0.30	-0.30	-0.12	0.11
total_rooms	0.04	-0.04	-0.36	1.00	0.93	0.86	0.92	0.20	0.13
total_bedrooms	0.07	-0.07	-0.32	0.93	1.00	0.88	0.98	-0.01	0.05
population	0.10	-0.11	-0.30	0.86	0.88	1.00	0.91	0.00	-0.02
households	0.06	-0.07	-0.30	0.92	0.98	0.91	1.00	0.01	0.07
median_income	-0.02	-0.08	-0.12	0.20	-0.01	0.00	0.01	1.00	0.69
median_house_value	-0.05	-0.14	0.11	0.13	0.05	-0.02	0.07	0.69	1.00

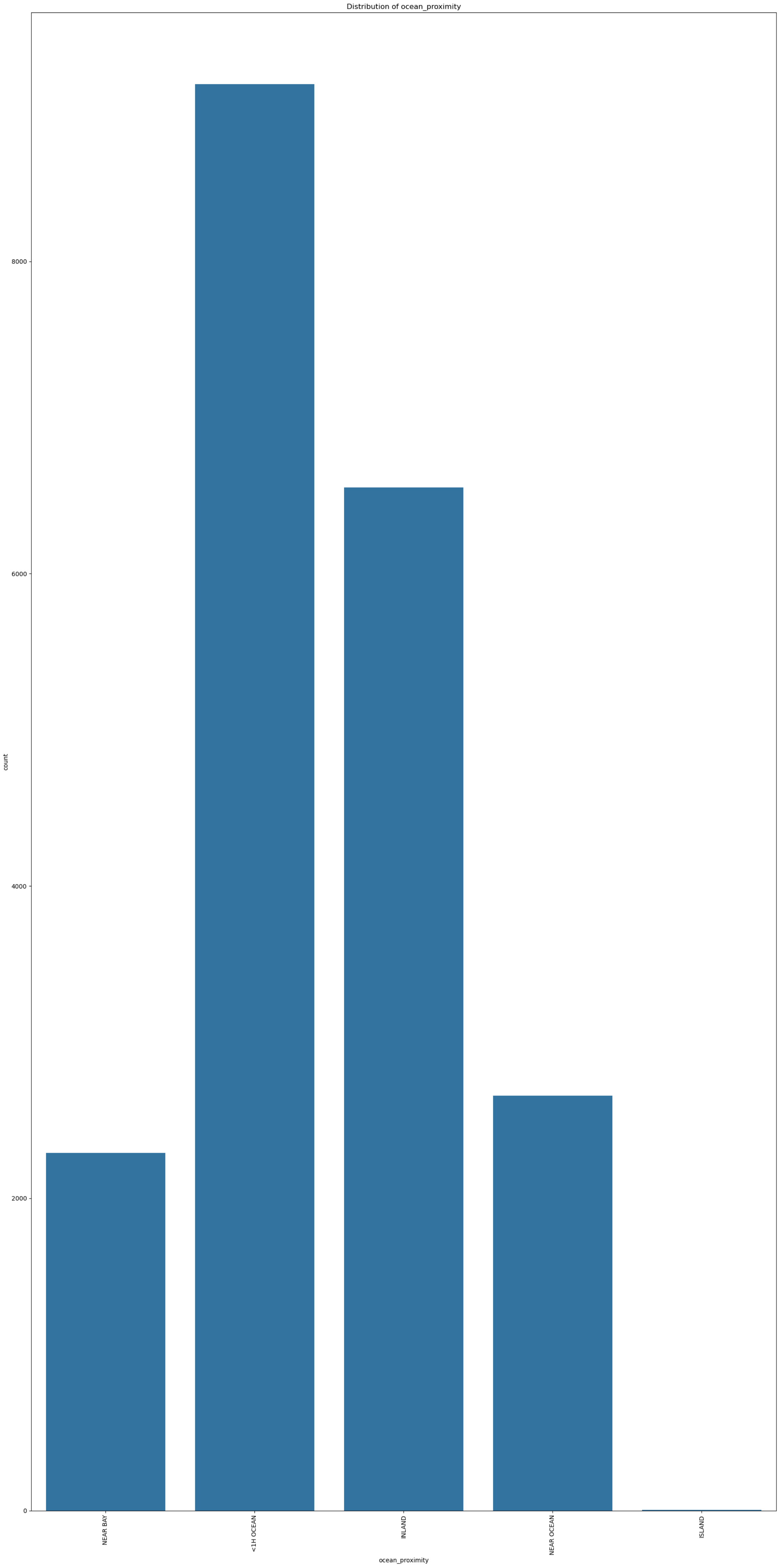
In [6]:

```python
unique_values = [dataset[col].nunique() for col in object_cols]
plt.figure(figsize=(10, 6))
plt.title('Number of Unique Values in Categorical Features')
plt.xticks(rotation=90)
sns.barplot(x=object_cols, y=unique_values)
plt.show()
```



In [7]:

```python
plt.figure(figsize=(18, 36))
index = 1
for col in object_cols:
    plt.subplot(len(object_cols), 1, index)
    plt.xticks(rotation=90)
    sns.countplot(data=dataset, x=col)
    plt.title(f'Distribution of {col}')
    index += 1
plt.tight_layout()
plt.show()
```


Distribution of ocean_proximity
count
8000
6000
4000
2000
0
NEAR BAY
<1H OCEAN
INLAND
NEAR OCEAN
ISLAND
ocean_proximity

In [8]:

```
if 'Id' in dataset.columns:
    dataset.drop(['Id'], axis=1, inplace=True)

if 'SalePrice' in dataset.columns:
    dataset['SalePrice'].fillna(dataset['SalePrice'].mean(), inplace=True)

dataset_clean = dataset.dropna()

print("Missing values after cleaning:\n", dataset_clean.isnull().sum())
```

```
Missing values after cleaning:
 longitude             0
latitude              0
housing_median_age    0
total_rooms           0
total_bedrooms        0
population            0
households            0
median_income         0
median_house_value    0
ocean_proximity       0
dtype: int64
```

In [9]:

```
s = (dataset_clean.dtypes == 'object')
object_cols = list(s[s].index)
print("Categorical variables for encoding:")
print(object_cols)

OH_encoder = OneHotEncoder(sparse_output=False, handle_unknown='ignore')
OH_cols = pd.DataFrame(OH_encoder.fit_transform(dataset_clean[object_cols]))
OH_cols.index = dataset_clean.index
OH_cols.columns = OH_encoder.get_feature_names_out()
df_final = dataset_clean.drop(object_cols, axis=1)
df_final = pd.concat([df_final, OH_cols], axis=1)
```

```
Categorical variables for encoding:
['ocean_proximity']
```

In [10]:

```
print(df_final.columns)
```

```
Index(['longitude', 'latitude', 'housing_median_age', 'total_rooms',
       'total_bedrooms', 'population', 'households', 'median_income',
       'median_house_value', 'ocean_proximity_<1H OCEAN',
       'ocean_proximity_INLAND', 'ocean_proximity_ISLAND',
       'ocean_proximity_NEAR BAY', 'ocean_proximity_NEAR OCEAN'],
      dtype='object')
```

In [11]:

```
Y = dataset_clean['median_house_value']
X_categorical = dataset_clean[object_cols]
X_numerical = dataset_clean.drop(object_cols + ['median_house_value'], axis=1)


OH_encoder = OneHotEncoder(sparse_output=False, handle_unknown='ignore')
OH_cols = pd.DataFrame(OH_encoder.fit_transform(X_categorical))
OH_cols.index = X_categorical.index
OH_cols.columns = OH_encoder.get_feature_names_out()


X_final = pd.concat([X_numerical, OH_cols], axis=1)
```

In [12]:

```
from sklearn.model_selection import train_test_split
from sklearn.metrics import mean_absolute_percentage_error
from sklearn import svm
from sklearn.ensemble import RandomForestRegressor
from sklearn.linear_model import LinearRegression


Y = dataset_clean['median_house_value']


X_train, X_valid, Y_train, Y_valid = train_test_split(X_final, Y, train_size=0.8, t
model_SVR = svm.SVR()
model_SVR.fit(X_train, Y_train)
Y_pred_SVR = model_SVR.predict(X_valid)
print("SVR Mean Absolute Percentage Error:", mean_absolute_percentage_error(Y_valid


model_RFR = RandomForestRegressor(n_estimators=10)
model_RFR.fit(X_train, Y_train)
Y_pred_RFR = model_RFR.predict(X_valid)
print("Random Forest Mean Absolute Percentage Error:", mean_absolute_percentage_err


model_LR = LinearRegression()
model_LR.fit(X_train, Y_train)
Y_pred_LR = model_LR.predict(X_valid)
print("Linear Regression Mean Absolute Percentage Error:", mean_absolute_percentage
```

```
SVR Mean Absolute Percentage Error: 0.5246195604384525
Random Forest Mean Absolute Percentage Error: 0.18589009551826097
Linear Regression Mean Absolute Percentage Error: 0.2864193519216636
```

```
In [ ]:
```