Lab Task 3

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Basic Insights

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



df = pd.read_csv('diamonds.csv')
df.head()
```

Out[1]:

	Unnamed: 0	carat	cut	color	clarity	depth	table	price	x	y	z
0	1	0.23	Ideal	E	SI2	61.5	55.0	326	3.95	3.98	2.43
1	2	0.21	Premium	E	SI1	59.8	61.0	326	3.89	3.84	2.31
2	3	0.23	Good	E	VS1	56.9	65.0	327	4.05	4.07	2.31
3	4	0.29	Premium	I	VS2	62.4	58.0	334	4.20	4.23	2.63
4	5	0.31	Good	J	SI2	63.3	58.0	335	4.34	4.35	2.75

Diamond Dataset Information

Column	Description	Range/Values
price	Price in US dollars	326–18,823
carat	Weight of the diamond	0.2–5.01 carats
cut	Quality of the cut	Fair, Good, Very Good, Premium, Ideal

Column	Description	Range/Values
color	Diamond color (J = worst, D = best)	J–D
clarity	Measurement of how clear the diamond is	I1 (worst), SI2, SI1, VS2, VS1, VVS2, VVS1, IF (best)
x	Length of the diamond in mm	0–10.74 mm
y	Width of the diamond in mm	0–58.9 mm
z	Depth of the diamond in mm	0–31.8 mm
depth	Total depth percentage = (\frac{2 \cdot z}{x + y})	43–79%
table	Width of the top of the diamond relative to the widest point	43–95%

In [2]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 53940 entries, 0 to 53939
Data columns (total 11 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   Unnamed: 0  53940 non-null  int64  
 1   carat       53940 non-null  float64
 2   cut         53940 non-null  object 
 3   color       53940 non-null  object 
 4   clarity     53940 non-null  object 
 5   depth       53940 non-null  float64
 6   table       53940 non-null  float64
 7   price       53940 non-null  int64  
 8   x           53940 non-null  float64
 9   y           53940 non-null  float64
 10  z           53940 non-null  float64
dtypes: float64(6), int64(2), object(3)
memory usage: 4.5+ MB
```

In [3]:
```
df.describe(include="all").T.round(2)
```

Out[3]:

	count	unique	top	freq	mean	std	min	25%	50%	75%	max
Unnamed: 0	53940.0	NaN	NaN	NaN	26970.5	15571.281097	1.0	13485.75	26970.5	40455.25	53940.0
carat	53940.0	NaN	NaN	NaN	0.79794	0.474011	0.2	0.4	0.7	1.04	5.01
cut	53940	5	Ideal	21551	NaN	NaN	NaN	NaN	NaN	NaN	NaN
color	53940	7	G	11292	NaN	NaN	NaN	NaN	NaN	NaN	NaN
clarity	53940	8	SI1	13065	NaN	NaN	NaN	NaN	NaN	NaN	NaN
depth	53940.0	NaN	NaN	NaN	61.749405	1.432621	43.0	61.0	61.8	62.5	79.0
table	53940.0	NaN	NaN	NaN	57.457184	2.234491	43.0	56.0	57.0	59.0	95.0
price	53940.0	NaN	NaN	NaN	3932.799722	3989.439738	326.0	950.0	2401.0	5324.25	18823.0
x	53940.0	NaN	NaN	NaN	5.731157	1.121761	0.0	4.71	5.7	6.54	10.74
y	53940.0	NaN	NaN	NaN	5.734526	1.142135	0.0	4.72	5.71	6.54	58.9
z	53940.0	NaN	NaN	NaN	3.538734	0.705699	0.0	2.91	3.53	4.04	31.8

In [4]:
```
numerical_vars = df.select_dtypes(include=['int64', 'float64']).columns.tolist()
categorical_vars = df.select_dtypes(include=['object']).columns.tolist()
print('Numerical variables:', numerical_vars)
print('Categorical variables:', categorical_vars)
```

```
Numerical variables: ['Unnamed: 0', 'carat', 'depth', 'table', 'price', 'x', 'y', 'z']
Categorical variables: ['cut', 'color', 'clarity']
```

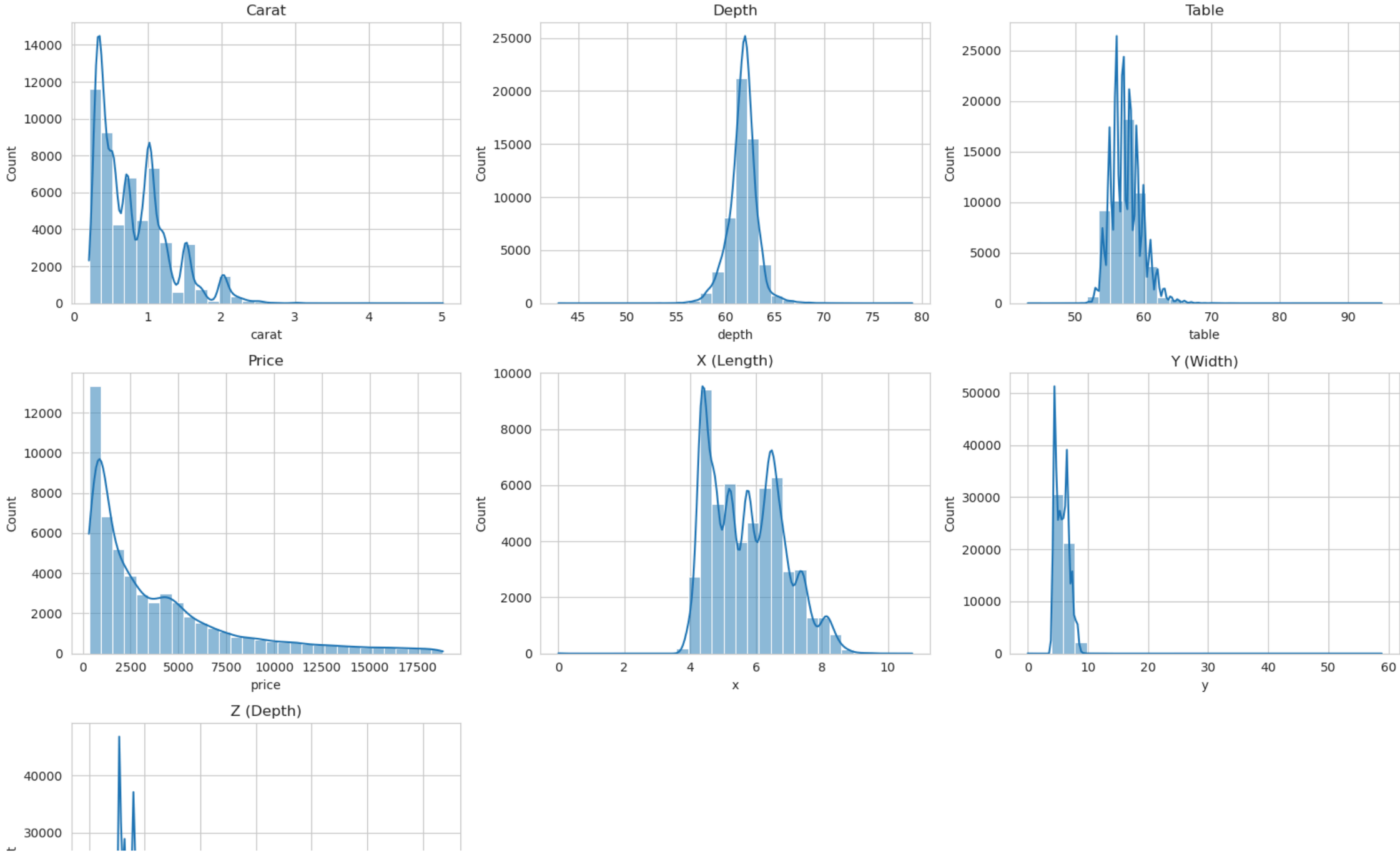
In [5]:
```
categorical_count = df.select_dtypes(include='object').shape[1]
numerical_count = df.select_dtypes(exclude='object').shape[1]

print(f"Number of categorical variables: {categorical_count}")
print(f"Number of numerical variables: {numerical_count}")
```

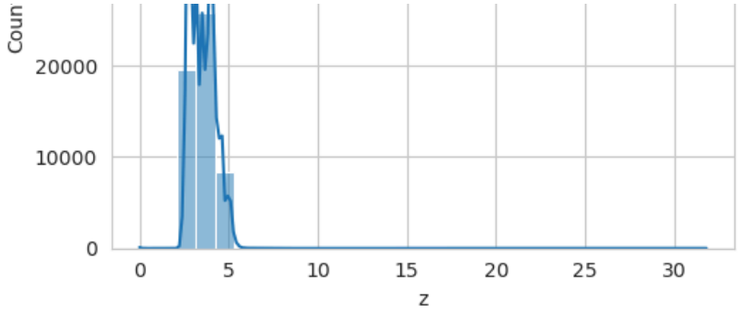
```
Number of categorical variables: 3
Number of numerical variables: 8
```

Visualization

In [6]:
```
import seaborn as sns
import matplotlib.pyplot as plt



sns.set_style("whitegrid")
```

```
plt.figure(figsize=(16, 12))

# Subplot 1 - Carat
plt.subplot(3, 3, 1)
sns.histplot(df['carat'], bins=30, kde=True)
plt.title('Carat')

# Subplot 2 - Depth
plt.subplot(3, 3, 2)
sns.histplot(df['depth'], bins=30, kde=True)
plt.title('Depth')

# Subplot 3 - Table
plt.subplot(3, 3, 3)
sns.histplot(df['table'], bins=30, kde=True)
plt.title('Table')

# Subplot 4 - Price
plt.subplot(3, 3, 4)
sns.histplot(df['price'], bins=30, kde=True)
plt.title('Price')

# Subplot 5 - X (Length)
plt.subplot(3, 3, 5)
sns.histplot(df['x'], bins=30, kde=True)
plt.title('X (Length)')

# Subplot 6 - Y (Width)
plt.subplot(3, 3, 6)
sns.histplot(df['y'], bins=30, kde=True)
plt.title('Y (Width)')

# Subplot 7 - Z (Depth)
plt.subplot(3, 3, 7)
sns.histplot(df['z'], bins=30, kde=True)
plt.title('Z (Depth)')

# Show the plot
plt.tight_layout()
plt.suptitle('Distribution of Various Numerical Parameters', fontsize=16, y=1.02)
plt.show()
```

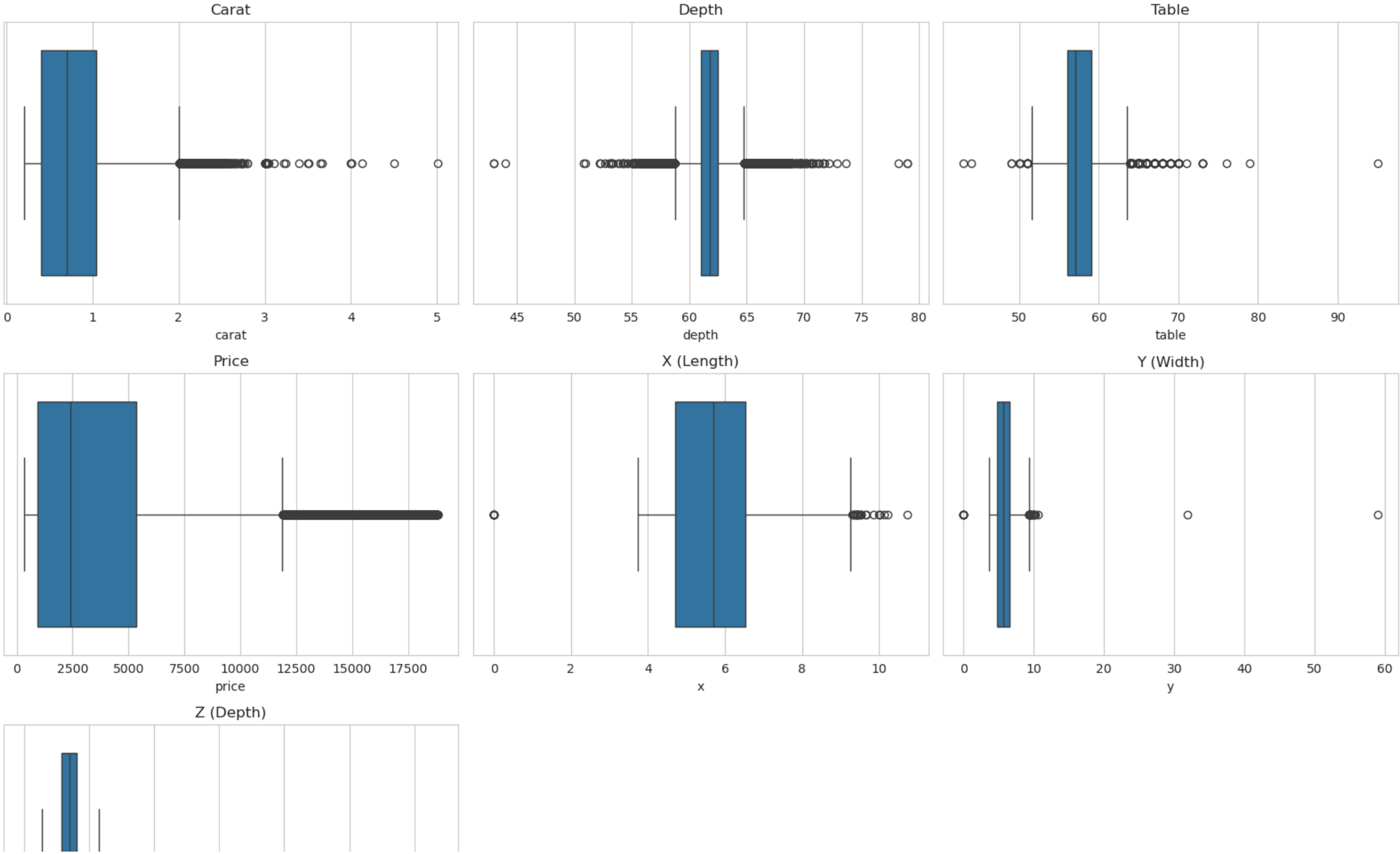

Distribution of Various Numerical Parameters
Carat
Count
carat
Depth
depth
Table
table
Price
price
X (Length)
x
Y (Width)
y
Z (Depth)

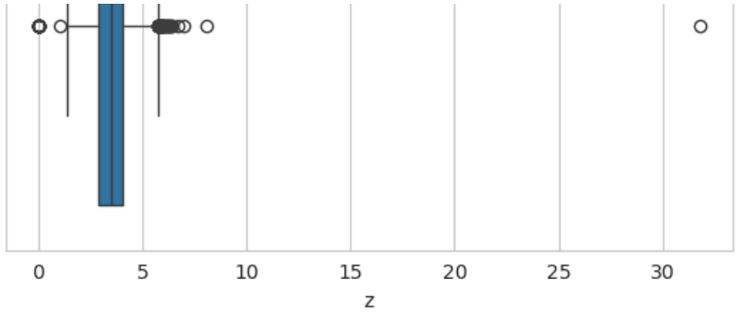


In [7]:

```
import seaborn as sns
import matplotlib.pyplot as plt


sns.set_style("whitegrid")


plt.figure(figsize=(16, 12))

# Subplot 1 - Carat
plt.subplot(3, 3, 1)
sns.boxplot(x=df['carat'])
plt.title('Carat')

# Subplot 2 - Depth
plt.subplot(3, 3, 2)
sns.boxplot(x=df['depth'])
plt.title('Depth')

# Subplot 3 - Table
plt.subplot(3, 3, 3)
sns.boxplot(x=df['table'])
plt.title('Table')

# Subplot 4 - Price
plt.subplot(3, 3, 4)
sns.boxplot(x=df['price'])
plt.title('Price')

# Subplot 5 - X (Length)
plt.subplot(3, 3, 5)
sns.boxplot(x=df['x'])
plt.title('X (Length)')
```

```
# Subplot 6 - Y (Width)
plt.subplot(3, 3, 6)
sns.boxplot(x=df['y'])
plt.title('Y (Width)')

# Subplot 7 - Z (Depth)
plt.subplot(3, 3, 7)
sns.boxplot(x=df['z'])
plt.title('Z (Depth)')

# Adjust layout
plt.tight_layout()
plt.suptitle('Boxplots of Numerical Variables', fontsize=16, y=1.02)
plt.show()
```


Boxplots of Numerical Variables
Carat
carat
Depth
depth
Table
table
Price
price
X (Length)
x
Y (Width)
y
Z (Depth)



Cleaning

In [8]:
```
missing_values = df.isnull().sum()
print(missing_values)
```

```
Unnamed: 0    0
carat         0
cut           0
color         0
clarity       0
depth         0
table         0
price         0
x             0
y             0
z             0
dtype: int64
```

In [9]:
```
duplicate_rows = df.duplicated().sum()
print(f"Number of duplicate rows: {duplicate_rows}")
```

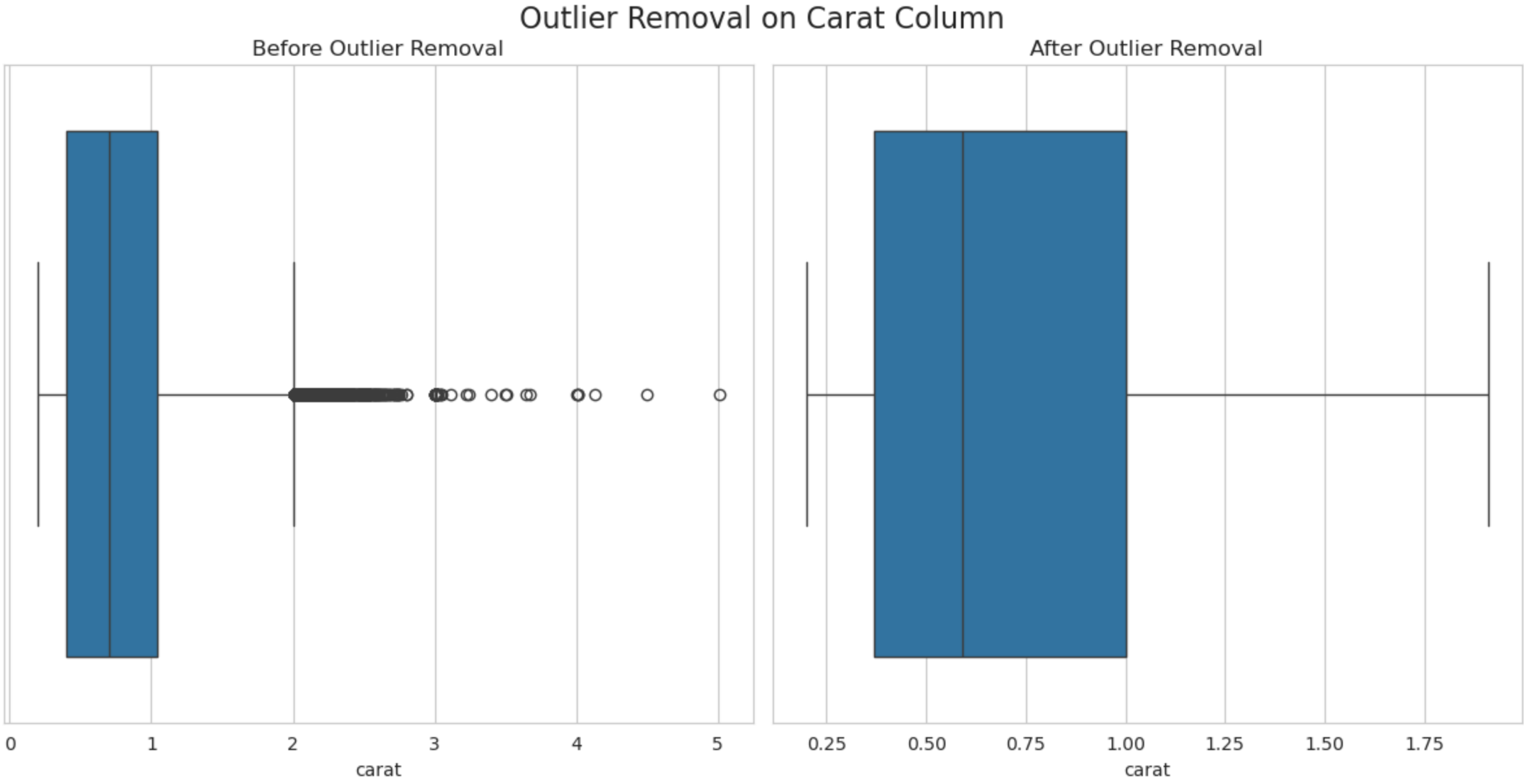
```
Number of duplicate rows: 0
```

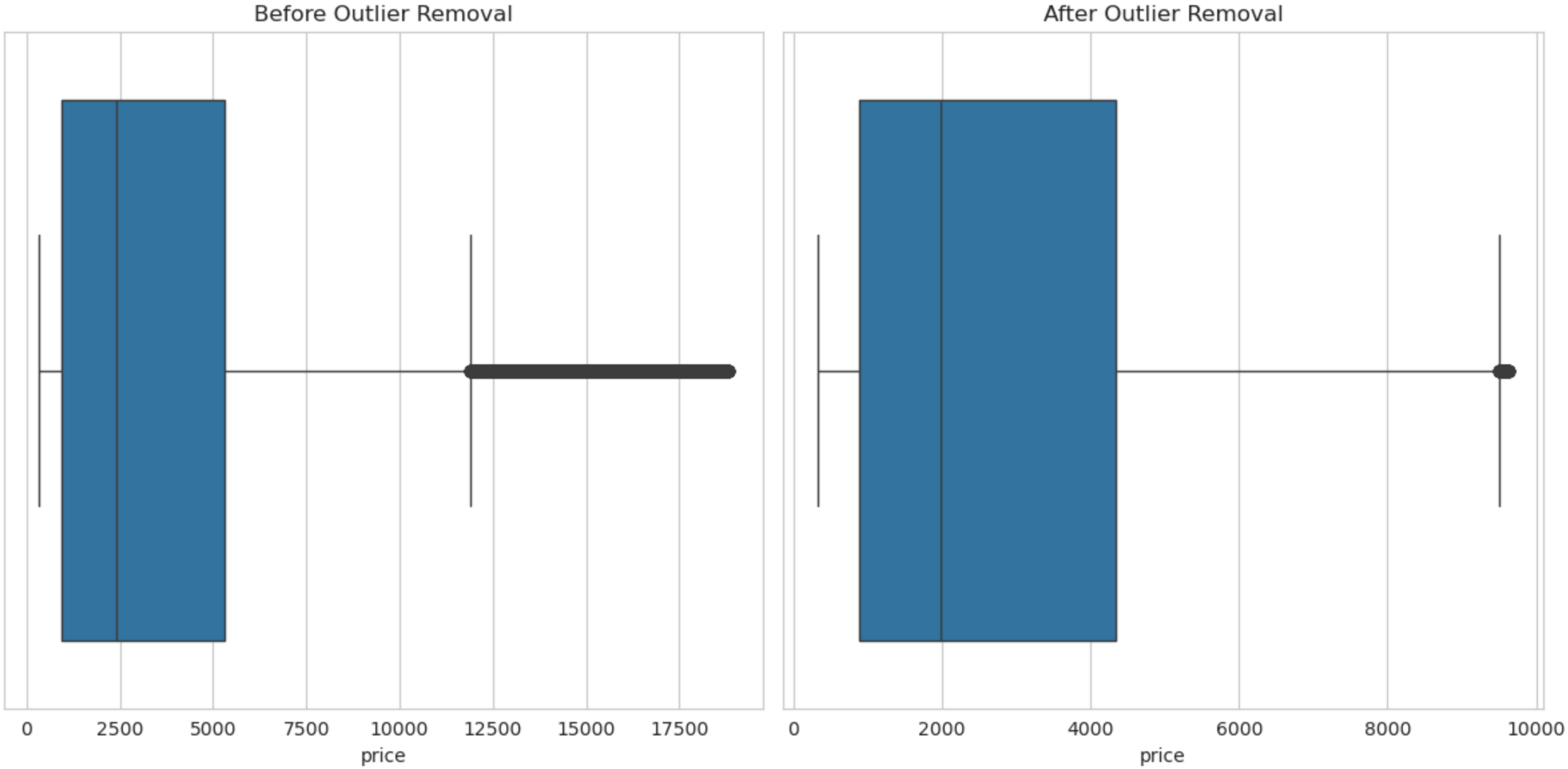
In [10]:
```
import seaborn as sns
import matplotlib.pyplot as plt


sns.set_style("whitegrid")


def remove_outliers_iqr(df, column):
    Q1 = df[column].quantile(0.25)
    Q3 = df[column].quantile(0.75)
    IQR = Q3 - Q1
```

```
    lower_bound = Q1 - 1.5 * IQR
    upper_bound = Q3 + 1.5 * IQR
    return df[(df[column] >= lower_bound) & (df[column] <= upper_bound)]


df_filtered_carat = remove_outliers_iqr(df, 'carat')
df_filtered_price = remove_outliers_iqr(df_filtered_carat, 'price')
df_filtered_table = remove_outliers_iqr(df_filtered_price, 'table')
df_filtered_y = remove_outliers_iqr(df_filtered_table, 'y')
df_filtered_z = remove_outliers_iqr(df_filtered_y, 'z')


print(f"Original data shape: {df.shape}")
print(f"Data shape after removing outliers: {df_filtered_price.shape}")

df_cleaned = df_filtered_price.copy()

plt.figure(figsize=(12, 6))

# Subplot 1 - Before Outlier Removal
plt.subplot(1, 2, 1)
sns.boxplot(x=df['carat'])
plt.title('Before Outlier Removal')

# Subplot 2 - After Outlier Removal
plt.subplot(1, 2, 2)
sns.boxplot(x=df_cleaned['carat'])
plt.title('After Outlier Removal')


plt.tight_layout()
plt.suptitle('Outlier Removal on Carat Column', fontsize=16, y=1.02)


plt.show()


plt.figure(figsize=(12, 6))

# Subplot 1 - Before Outlier Removal
plt.subplot(1, 2, 1)
sns.boxplot(x=df['price'])
plt.title('Before Outlier Removal')

# Subplot 2 - After Outlier Removal
```

```
plt.subplot(1, 2, 2)
sns.boxplot(x=df_cleaned['price'])
plt.title('After Outlier Removal')


plt.tight_layout()
```

```
Original data shape: (53940, 11)
Data shape after removing outliers: (47699, 11)
```





In [11]:
```
from sklearn.preprocessing import  MinMaxScaler


numerical_vars = ['carat', 'depth', 'table', 'price', 'x', 'y', 'z']


# MinMaxScaler
min_max_scaler = MinMaxScaler()
df_cleaned = df_filtered_price.copy()
```

```
df_cleaned[numerical_vars] = min_max_scaler.fit_transform(df_cleaned[numerical_vars])


df_cleaned.head()
```

Out[11]:

	Unnamed: 0	carat	cut	color	clarity	depth	table	price	x	y	z
0	1	0.017544	Ideal	E	SI2	0.525568	0.260870	0.000000	0.049661	0.066225	0.250696
1	2	0.005848	Premium	E	SI1	0.477273	0.782609	0.000000	0.036117	0.035320	0.217270
3	4	0.052632	Premium	I	VS2	0.551136	0.521739	0.000860	0.106095	0.121413	0.306407
4	5	0.064327	Good	J	SI2	0.576705	0.521739	0.000968	0.137698	0.147903	0.339833
5	6	0.023392	Very Good	J	VVS2	0.562500	0.434783	0.001075	0.047404	0.061810	0.264624

Encoding

In [12]:

```
from sklearn.preprocessing import OneHotEncoder, OrdinalEncoder
import pandas as pd


ordinal_cols = ['cut', 'color', 'clarity']
non_ordinal_cols = []

df_cleaned[ordinal_cols] = df_cleaned[ordinal_cols].astype(str)
df[ordinal_cols] = df[ordinal_cols].astype(str)


ordinal_encoder = OrdinalEncoder(categories=[['Fair', 'Good', 'Very Good', 'Premium', 'Ideal'],
                                             ['J', 'I', 'H', 'G', 'F', 'E', 'D'],
                                             ['I1', 'SI2', 'SI1', 'VS2', 'VS1', 'VVS2', 'VVS1', 'IF']])
df_cleaned[ordinal_cols] = ordinal_encoder.fit_transform(df_cleaned[ordinal_cols])


if non_ordinal_cols:
    onehot_encoder = OneHotEncoder(sparse_output=False)
    onehot_encoded = onehot_encoder.fit_transform(df_cleaned[non_ordinal_cols])
    onehot_encoded_df = pd.DataFrame(onehot_encoded, columns=onehot_encoder.get_feature_names_out(non_ordinal_cols))
    df_cleaned = pd.concat([df_cleaned, onehot_encoded_df], axis=1).drop(columns=non_ordinal_cols)


df_cleaned.head()
```

Out[12]:

	Unnamed: 0	carat	cut	color	clarity	depth	table	price	x	y	z
0	1	0.017544	4.0	5.0	1.0	0.525568	0.260870	0.000000	0.049661	0.066225	0.250696
1	2	0.005848	3.0	5.0	2.0	0.477273	0.782609	0.000000	0.036117	0.035320	0.217270
3	4	0.052632	3.0	1.0	3.0	0.551136	0.521739	0.000860	0.106095	0.121413	0.306407
4	5	0.064327	1.0	0.0	1.0	0.576705	0.521739	0.000968	0.137698	0.147903	0.339833
5	6	0.023392	2.0	0.0	5.0	0.562500	0.434783	0.001075	0.047404	0.061810	0.264624

In [ ]: