task-5-diamond-price-prediction

October 15, 2024

1 Diamond Price Prediction

[22]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

2 LOAD THE DATA

[2]:
```
# Load the new CSV file uploaded by the user
file_path_new = "D:\INNOMATICS FILE\DATA SET\diamonds.csv"
df_new = pd.read_csv(file_path_new)

# Display the first few rows of the new file to understand the dataset
df_new.head()
```

[2]:

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

[35]:
```
df_new.tail()
```

[35]:

	carat	cut	color	clarity	depth	table	price	x	y	z	\
53935	0.72	2	0	2	60.8	57.0	2757	5.75	5.76	3.50	
53936	0.72	1	0	2	63.1	55.0	2757	5.69	5.75	3.61	
53937	0.70	4	0	2	62.8	60.0	2757	5.66	5.68	3.56	
53938	0.86	3	4	3	61.0	58.0	2757	6.15	6.12	3.74	
53939	0.75	2	0	3	62.2	55.0	2757	5.83	5.87	3.64	

	carat_range	cut_encoded	clarity_encoded
53935	(0.5, 1.0]	2	2
53936	(0.5, 1.0]	1	2
53937	(0.5, 1.0]	4	2
53938	(0.5, 1.0]	3	3
53939	(0.5, 1.0]	2	3

3 Actual Vs Predicted Diamond Prices (Linear Regression)

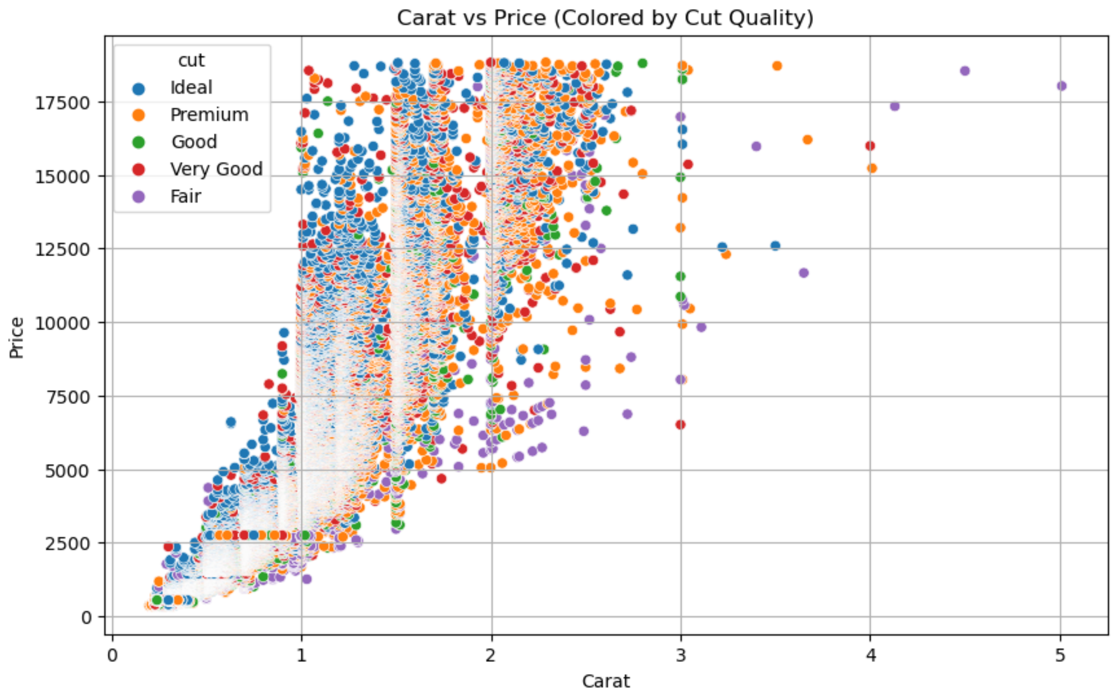
[36]:
```
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder, StandardScaler
from sklearn.metrics import mean_absolute_error

# Preprocessing: Encode categorical variables
label_encoders = {}
for column in ['cut', 'color', 'clarity']:
    le = LabelEncoder()
    df_new[column] = le.fit_transform(df_new[column])
    label_encoders[column] = le

# Select features and target variable
X = df_new[['carat', 'cut', 'color', 'clarity', 'depth', 'table', 'x', 'y',␣
↪'z']]
y = df_new['price']

# Split the data into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)

# Train a Random Forest Regressor model
rf_model = RandomForestRegressor(n_estimators=100, random_state=42)
rf_model.fit(X_train, y_train)

# Predict on the test set
y_pred = rf_model.predict(X_test)

# Evaluate the model
mae = mean_absolute_error(y_test, y_pred)

# Output the Mean Absolute Error
mae
```

[36]: 267.9755022379363

4 Carat Vs Price (Colored By Cut Quality)

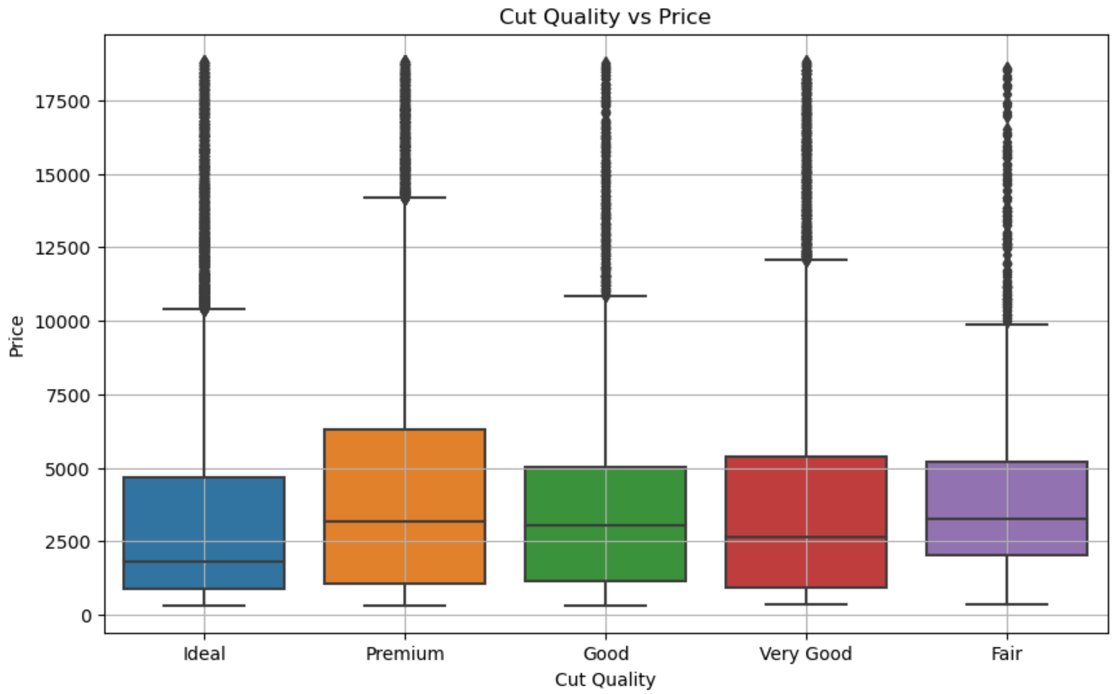
[5]:
```
import seaborn as sns

#  Carat vs Price
plt.figure(figsize=(10, 6))
sns.scatterplot(x='carat', y='price', data=df_new, hue='cut')
plt.title('Carat vs Price (Colored by Cut Quality)')
```

```
plt.xlabel('Carat')
plt.ylabel('Price')
plt.grid(True)
plt.show()
```



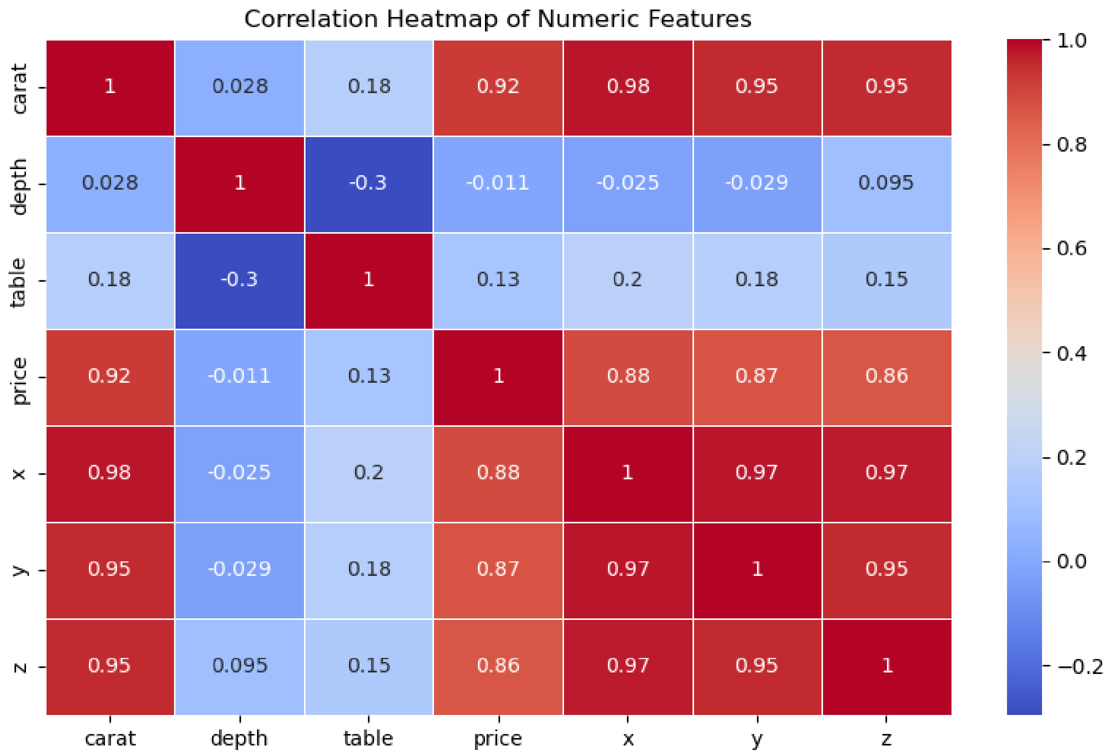
5 Cut vs Price

[6]:
```
#  Cut vs Price (Boxplot)
plt.figure(figsize=(10, 6))
sns.boxplot(x='cut', y='price', data=df_new)
plt.title('Cut Quality vs Price')
plt.xlabel('Cut Quality')
plt.ylabel('Price')
plt.grid(True)
plt.show()
```



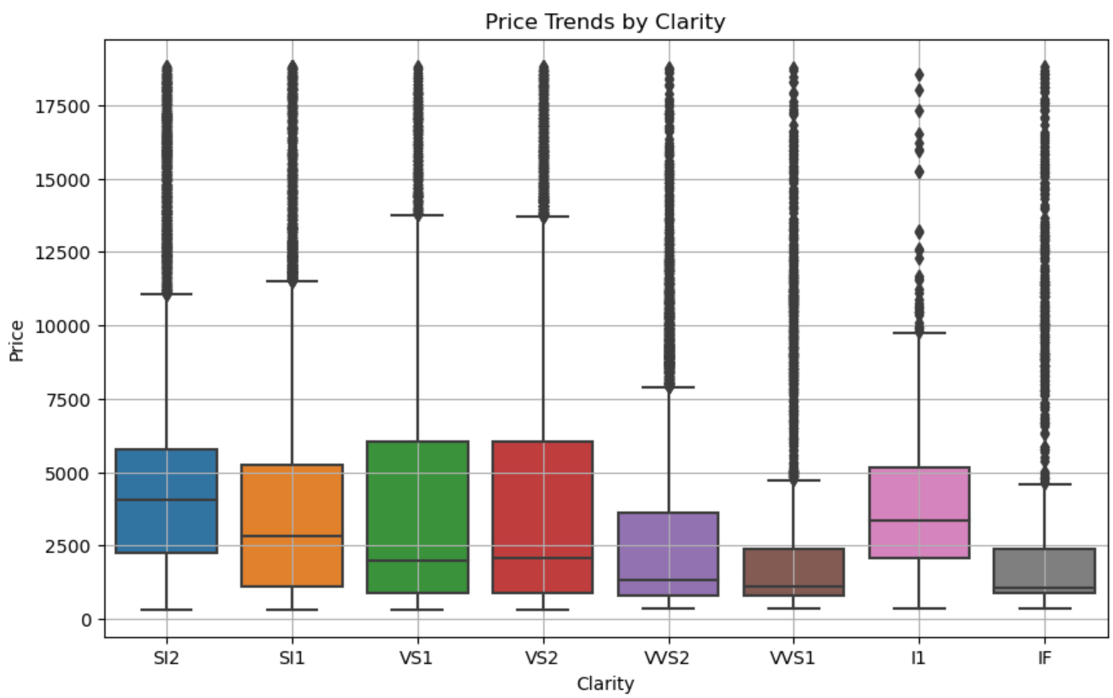
6 Correlation Heatmap of Numeric Features

[7]:
```
# Correlation Heatmap of Numeric Features
plt.figure(figsize=(10, 6))
corr_matrix = df_new[['carat', 'depth', 'table', 'price', 'x', 'y', 'z']].corr()
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', linewidths=0.5)
plt.title('Correlation Heatmap of Numeric Features')
plt.show()
```



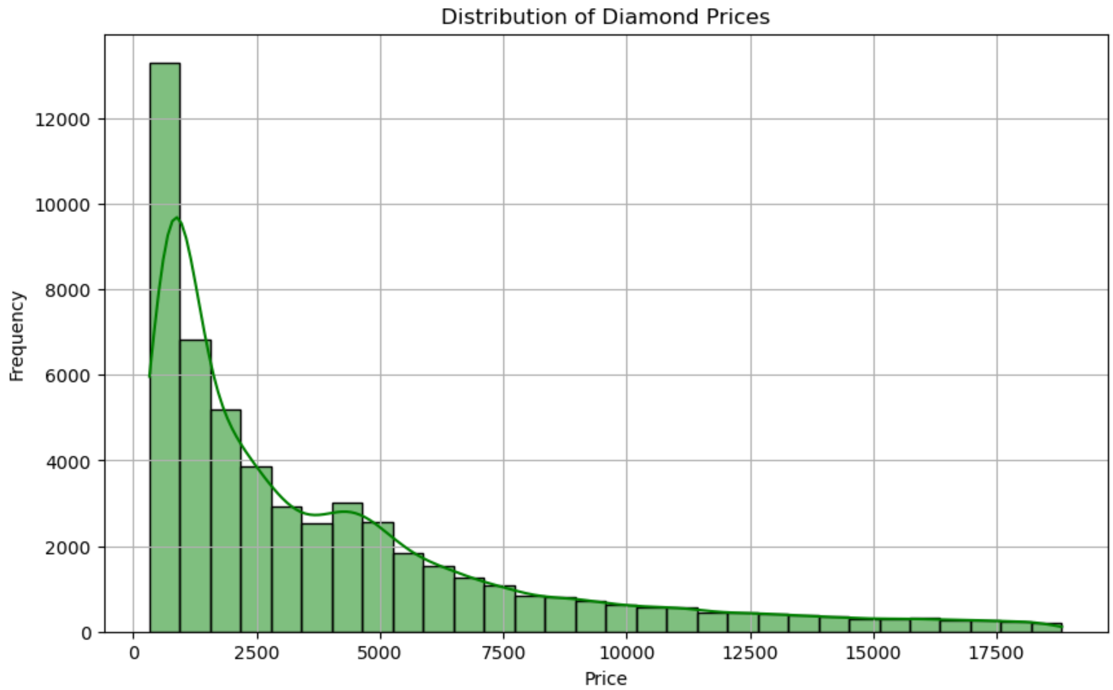
7 Price Trends by Clarity

[8]:
```
# Visualization: (Boxplot)
plt.figure(figsize=(10, 6))
sns.boxplot(x='clarity', y='price', data=df_new)
plt.title('Price Trends by Clarity')
plt.xlabel('Clarity')
plt.ylabel('Price')
plt.grid(True)
plt.show()
```



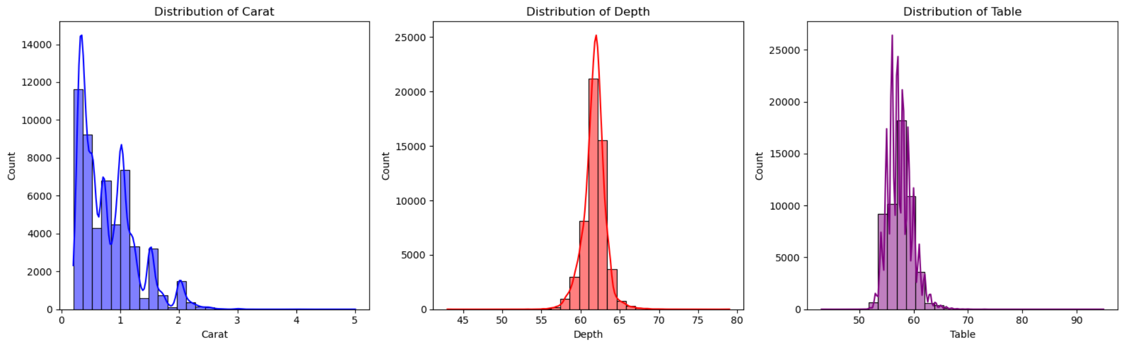
8 Distribution of the Target Variable (Price)

[9]:
```
# Visualization 2: Distribution of the Target Variable (Price)
plt.figure(figsize=(10, 6))
sns.histplot(df_new['price'], bins=30, kde=True, color='green')
plt.title('Distribution of Diamond Prices')
plt.xlabel('Price')
plt.ylabel('Frequency')
plt.grid(True)
plt.show()
```



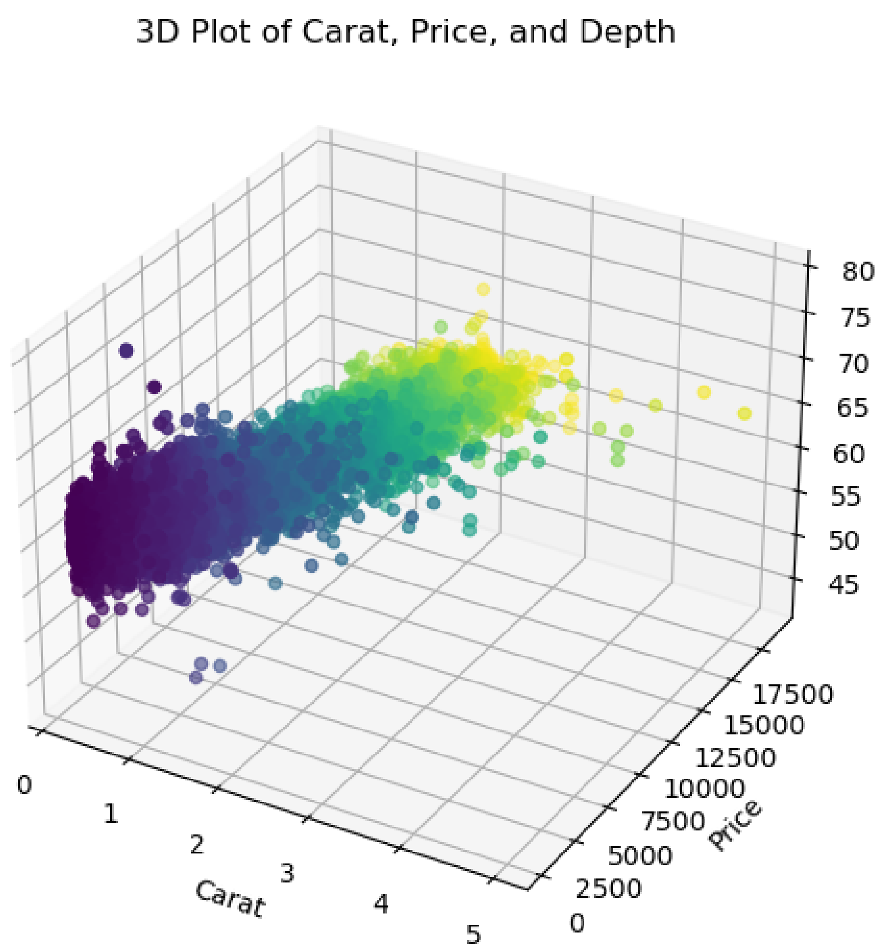
9 Distribution of Carat, Depth, and Table

[10]:
```
# Visualization 3: Distribution of Carat, Depth, and Table
plt.figure(figsize=(16, 5))

plt.subplot(1, 3, 1)
sns.histplot(df_new['carat'], bins=30, kde=True, color='blue')
plt.title('Distribution of Carat')
plt.xlabel('Carat')

plt.subplot(1, 3, 2)
sns.histplot(df_new['depth'], bins=30, kde=True, color='red')
plt.title('Distribution of Depth')
plt.xlabel('Depth')

plt.subplot(1, 3, 3)
sns.histplot(df_new['table'], bins=30, kde=True, color='purple')
plt.title('Distribution of Table')
plt.xlabel('Table')

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



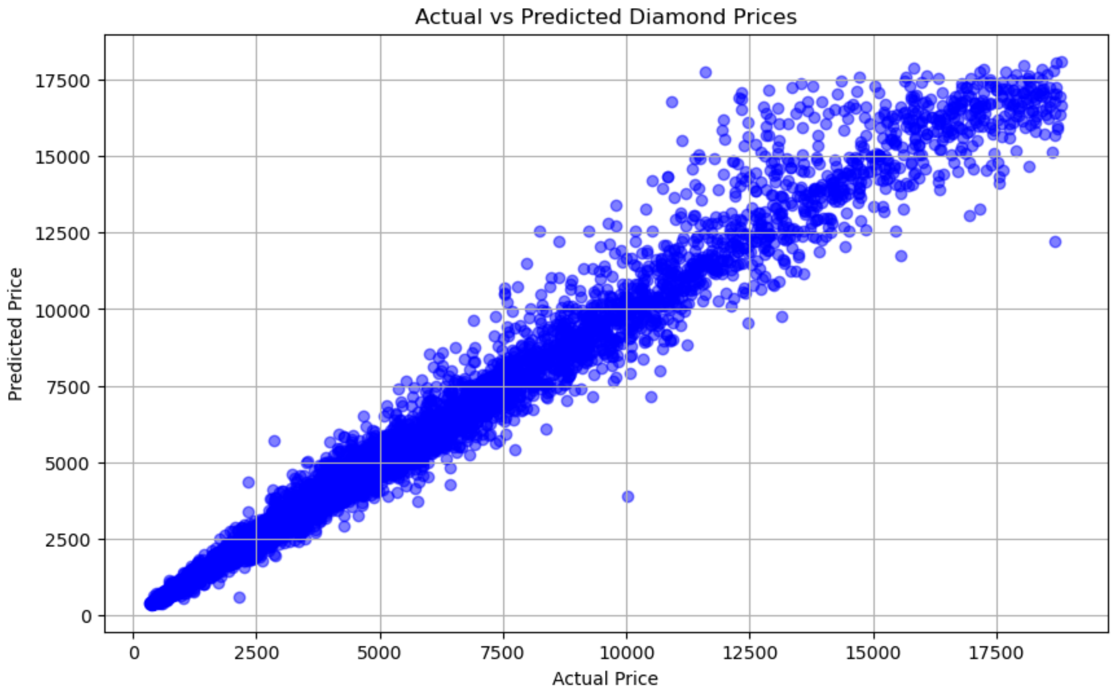
10 Create a 3D plot of Carat, Price, and Depth

[11]:
```
from mpl_toolkits.mplot3d import Axes3D

# Create a 3D plot of Carat, Price, and Depth
fig = plt.figure(figsize=(10, 6))
ax = fig.add_subplot(111, projection='3d')

# Scatter plot with carat, price, and depth
ax.scatter(df_new['carat'], df_new['price'], df_new['depth'],␣
↪c=df_new['price'], cmap='viridis', marker='o')

# Setting labels
ax.set_title('3D Plot of Carat, Price, and Depth')
ax.set_xlabel('Carat')
ax.set_ylabel('Price')
ax.set_zlabel('Depth')

plt.show()
```



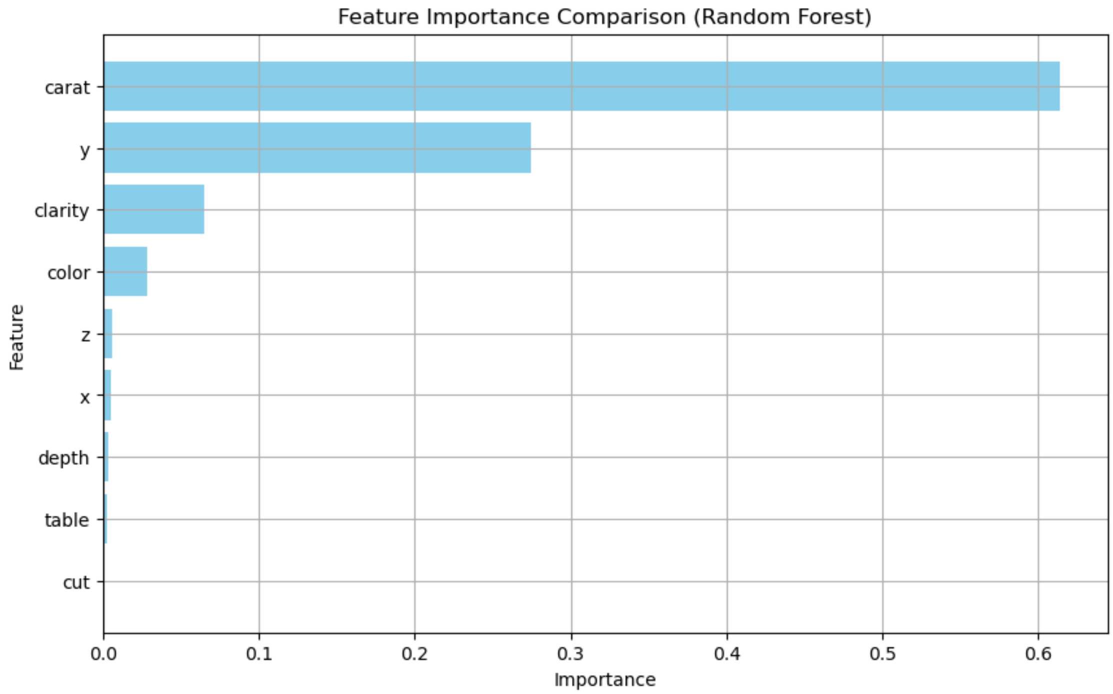
11 Actual Vs Predicted Diamond Prices

[17]:
```
import matplotlib.pyplot as plt

# Plotting the Actual vs Predicted prices
plt.figure(figsize=(10, 6))
plt.scatter(y_test, y_pred, alpha=0.5, color='blue')
plt.title('Actual vs Predicted Diamond Prices')
plt.xlabel('Actual Price')
plt.ylabel('Predicted Price')
plt.grid(True)
plt.show()
```



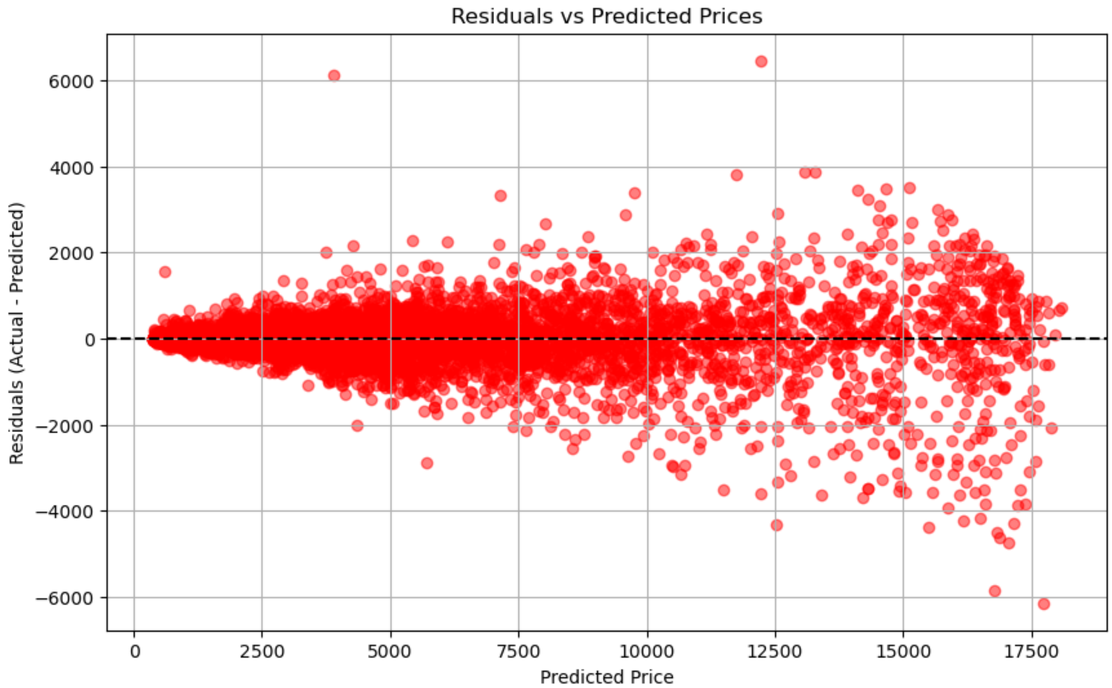
12 Feature Importance Comparison (Random Forest)

[18]:
```
# Retrieve feature importances from the Random Forest model
feature_importances = rf_model.feature_importances_

# Create a DataFrame for feature importance comparison
features_df = pd.DataFrame({
    'Feature': X_train.columns,
    'Importance': feature_importances
})

# Sort the features by importance
features_df = features_df.sort_values(by='Importance', ascending=False)

# Plot the feature importance
plt.figure(figsize=(10, 6))
plt.barh(features_df['Feature'], features_df['Importance'], color='skyblue')
plt.title('Feature Importance Comparison (Random Forest)')
plt.xlabel('Importance')
plt.ylabel('Feature')
plt.gca().invert_yaxis()  # Highest importance on top
plt.grid(True)
plt.show()
```



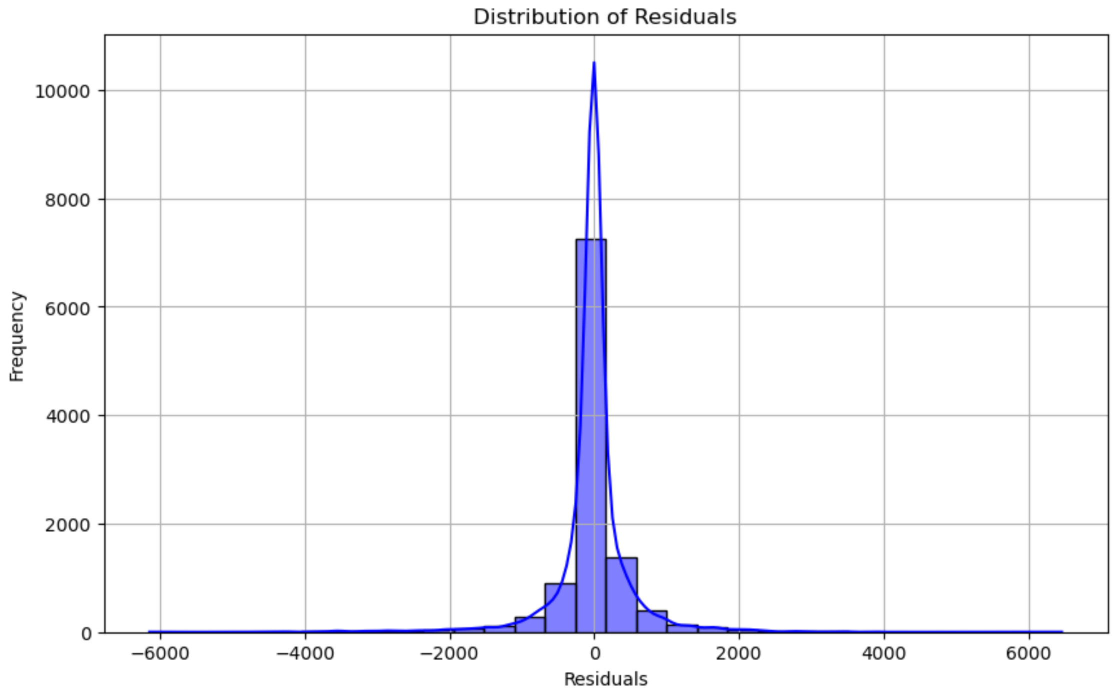
13 Residuals Vs Predicted Prices

[19]:
```
# Calculate residuals (difference between actual and predicted prices)
residuals = y_test - y_pred

# Plot the residuals to check model performance
plt.figure(figsize=(10, 6))
plt.scatter(y_pred, residuals, alpha=0.5, color='red')
plt.axhline(y=0, color='black', linestyle='--')
plt.title('Residuals vs Predicted Prices')
plt.xlabel('Predicted Price')
plt.ylabel('Residuals (Actual - Predicted)')
plt.grid(True)
plt.show()
```

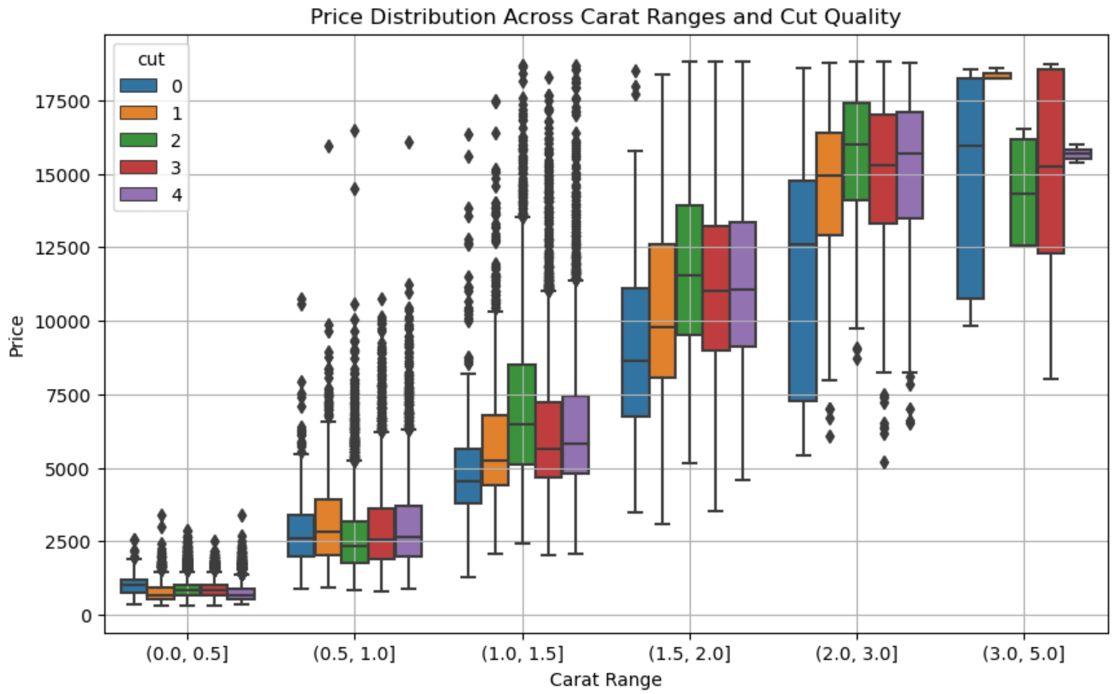


14 Distribution Of Residuals

[20]:
```
# Plot distribution of residuals to check for normality
plt.figure(figsize=(10, 6))
sns.histplot(residuals, bins=30, kde=True, color='blue')
plt.title('Distribution of Residuals')
plt.xlabel('Residuals')
plt.ylabel('Frequency')
plt.grid(True)
plt.show()
```

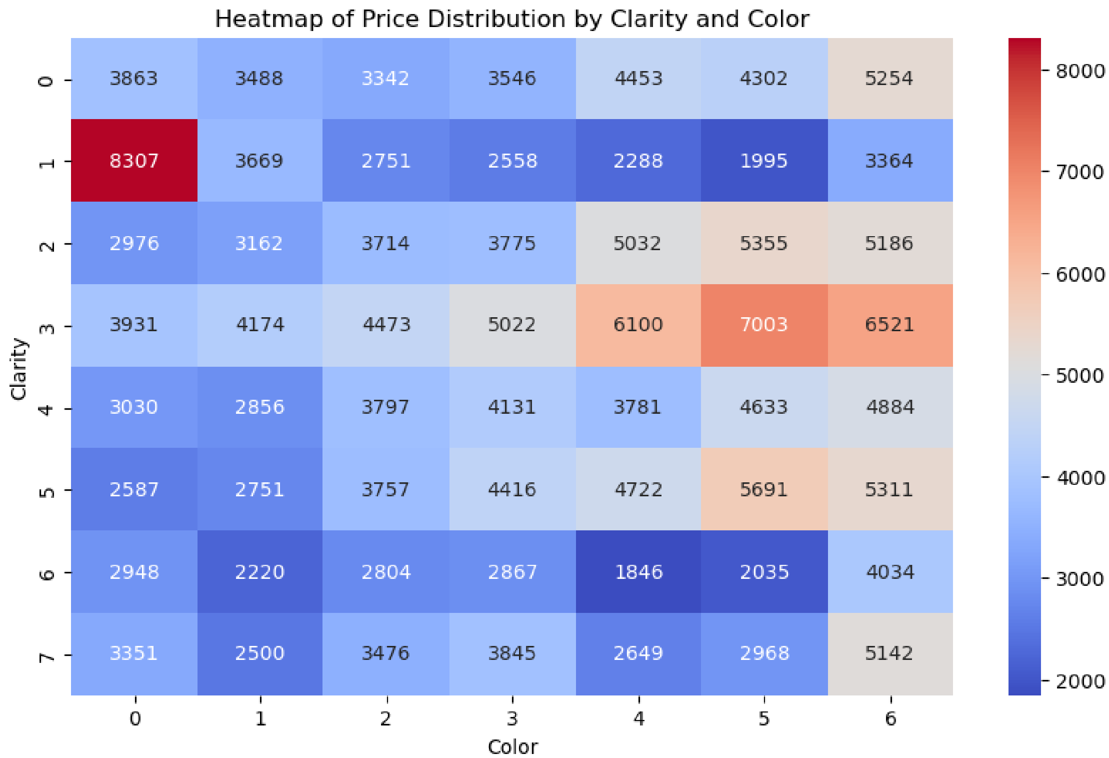


[23]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from mpl_toolkits.mplot3d import Axes3D

# Visualization 1: Price distribution across carat ranges and cut quality
df_new['carat_range'] = pd.cut(df_new['carat'], bins=[0, 0.5, 1.0, 1.5, 2.0, 3.
↪0, 5.0])
plt.figure(figsize=(10, 6))
sns.boxplot(x='carat_range', y='price', hue='cut', data=df_new)
plt.title('Price Distribution Across Carat Ranges and Cut Quality')
plt.xlabel('Carat Range')
plt.ylabel('Price')
plt.grid(True)
plt.show()
```



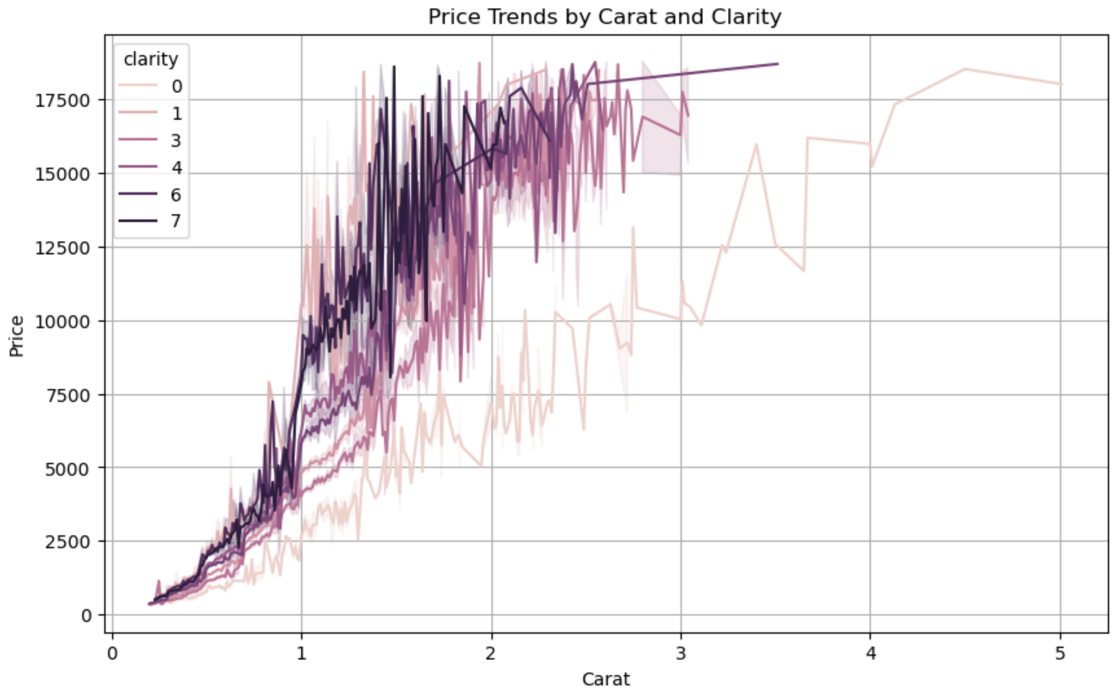
15 Heatmap of price distribution based on clarity and color

[24]:
```
#  Heatmap of price distribution based on clarity and color
price_pivot = df_new.pivot_table(values='price', index='clarity',␣
 ↪columns='color', aggfunc='mean')
plt.figure(figsize=(10, 6))
sns.heatmap(price_pivot, annot=True, fmt=".0f", cmap='coolwarm')
plt.title('Heatmap of Price Distribution by Clarity and Color')
plt.xlabel('Color')
plt.ylabel('Clarity')
plt.show()
```



16 Price trends by carat and clarity

[26]:
```
#  Price trends by carat and clarity
plt.figure(figsize=(10, 6))
sns.lineplot(x='carat', y='price', hue='clarity', data=df_new)
plt.title('Price Trends by Carat and Clarity')
plt.xlabel('Carat')
plt.ylabel('Price')
plt.grid(True)
plt.show()
```


Price Trends by Carat and Clarity
clarity
0
1
3
4
6
7
17500
15000
12500
10000
7500
5000
2500
0
Price
0
1
2
3
4
5
Carat

```
[ ]:
```