In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error, r2_score
```

In [3]:
```
data = pd.read_csv("Boston.csv")
data.head()
```

Out[3]:

	ID	crim	zn	indus	chas	nox	rm	age	dis	rad	tax	ptratio	black
0	1	0.00632	18.0	2.31	0	0.538	6.575	65.2	4.0900	1	296	15.3	396.90
1	2	0.02731	0.0	7.07	0	0.469	6.421	78.9	4.9671	2	242	17.8	396.90
2	4	0.03237	0.0	2.18	0	0.458	6.998	45.8	6.0622	3	222	18.7	394.63
3	5	0.06905	0.0	2.18	0	0.458	7.147	54.2	6.0622	3	222	18.7	396.90
4	7	0.08829	12.5	7.87	0	0.524	6.012	66.6	5.5605	5	311	15.2	395.60

In [4]:
```
data.shape
```

Out[4]: (333, 15)

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

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 333 entries, 0 to 332
Data columns (total 15 columns):
 #   Column   Non-Null Count  Dtype  
---  ------   --------------  -----  
 0   ID       333 non-null    int64  
 1   crim     333 non-null    float64
 2   zn       333 non-null    float64
 3   indus    333 non-null    float64
 4   chas     333 non-null    int64  
 5   nox      333 non-null    float64
 6   rm       333 non-null    float64
 7   age      333 non-null    float64
 8   dis      333 non-null    float64
 9   rad      333 non-null    int64  
 10  tax      333 non-null    int64  
 11  ptratio  333 non-null    float64
 12  black    333 non-null    float64
 13  lstat    333 non-null    float64
 14  medv     333 non-null    float64
dtypes: float64(11), int64(4)
memory usage: 39.2 KB
```

In [6]:
```
data.isnull().sum()
```

Out[6]:
```
ID         0
crim       0
zn         0
indus      0
chas       0
nox        0
rm         0
age        0
dis        0
rad        0
tax        0
ptratio    0
black      0
lstat      0
medv       0
dtype: int64
```

In [7]:
```
data.fillna(data.mean(), inplace=True)
```

In [8]:
```
X = data[['rm']]
y = data['medv']
```

In [9]:
```
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)
```

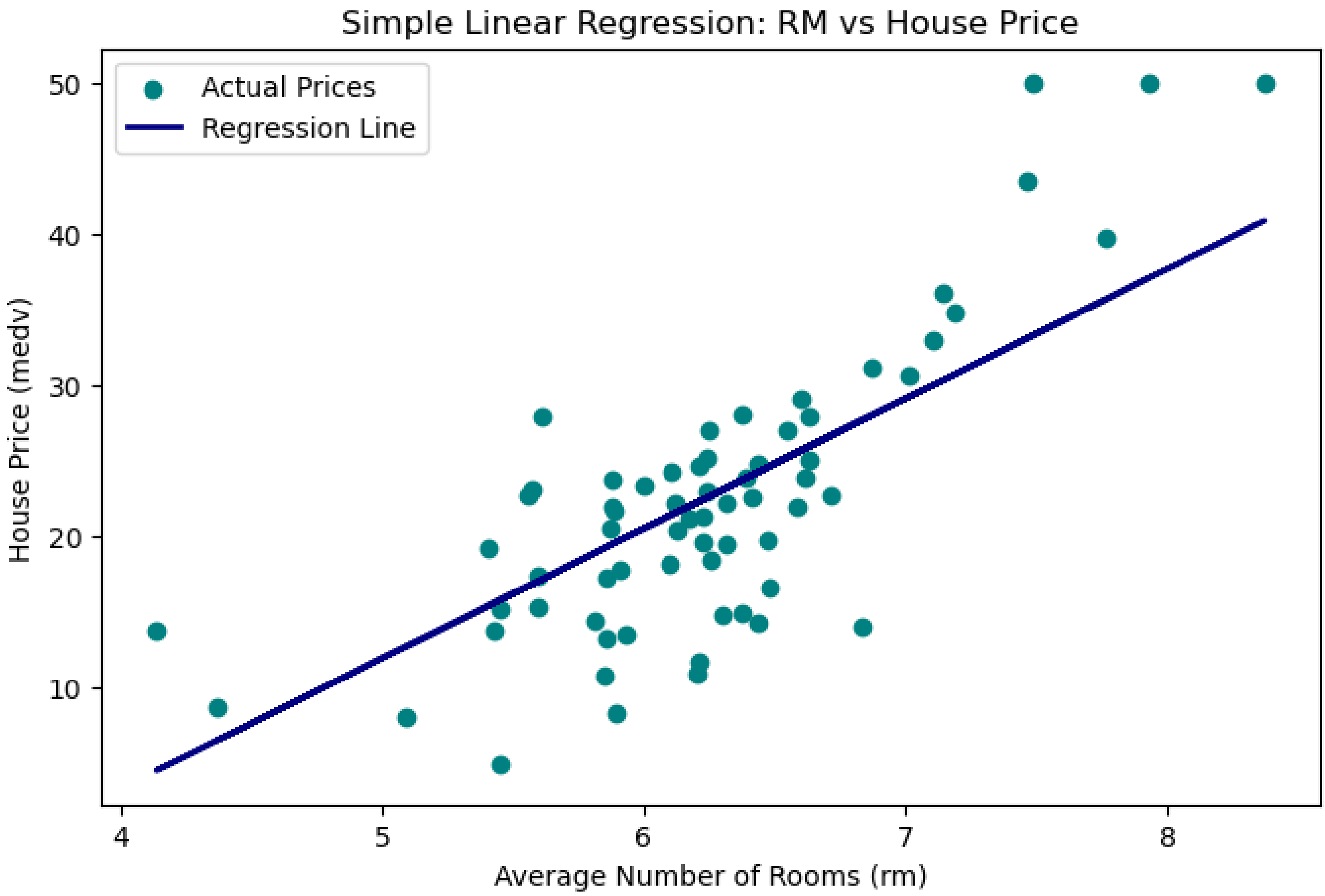
In [10]:
```
single_model = LinearRegression()
single_model.fit(X_train, y_train)
```

Out[10]:
```
▾ LinearRegression
LinearRegression()
```

In [11]:
```
y_pred_single = single_model.predict(X_test)

print("Coefficient:", single_model.coef_)
print("Intercept:", single_model.intercept_)
print("Mean Squared Error:", mean_squared_error(y_test, y_pred_single))
print("R2 Score:", r2_score(y_test, y_pred_single))
```

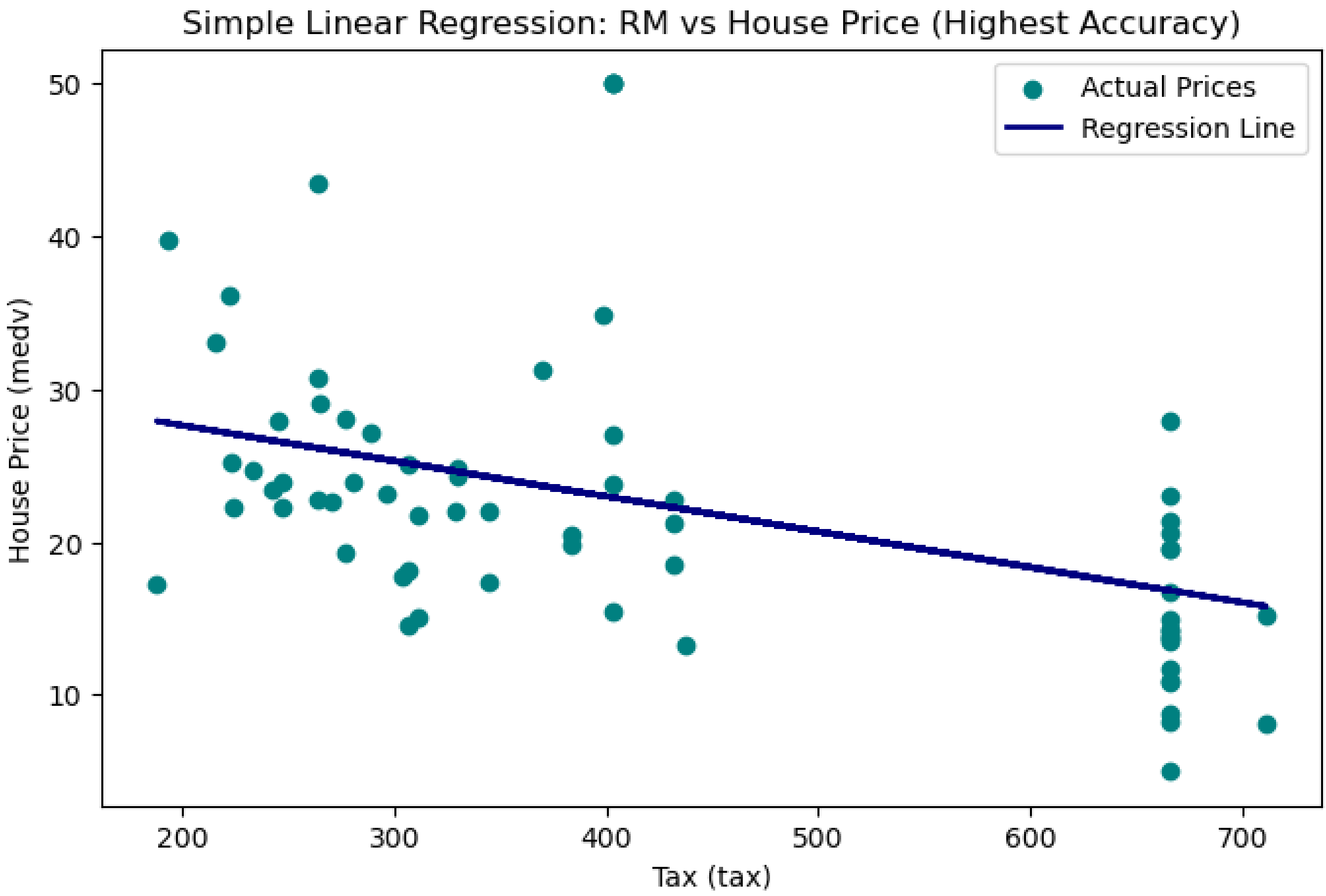
```
Coefficient: [8.58442449]
Intercept: -30.96185860010203
Mean Squared Error: 36.361622515889756
R2 Score: 0.5959747117709422
```

In [12]:
```
plt.figure(figsize=(8,5))
plt.scatter(X_test, y_test, color='Teal', label='Actual Prices')
plt.plot(X_test, y_pred_single, color='Navy', linewidth=2, label='Regression Line')
plt.xlabel("Average Number of Rooms (rm)")
plt.ylabel("House Price (medv)")
plt.title("Simple Linear Regression: RM vs House Price")
plt.legend()
plt.show()
```



In [49]:
```
X_best = data[['tax']]
y = data['medv']

X_train, X_test, y_train, y_test = train_test_split(
    X_best, y, test_size=0.2, random_state=42
)

model_best = LinearRegression()
model_best.fit(X_train, y_train)

y_pred_best = model_best.predict(X_test)

print("Coefficient:", model_best.coef_)
print("Intercept:", model_best.intercept_)
print("Mean Squared Error:", mean_squared_error(y_test, y_pred_best))
print("R2 Score:", r2_score(y_test, y_pred_best))

plt.figure(figsize=(8,5))
plt.scatter(X_test, y_test, color='Teal', label='Actual Prices')
plt.plot(X_test, y_pred_best, color='Navy', linewidth=2, label='Regression Line')
plt.xlabel("Tax (tax)")
plt.ylabel("House Price (medv)")
plt.title("Simple Linear Regression: RM vs House Price (Highest Accuracy)")
plt.legend()
plt.show()
```

```
Coefficient: [-0.02316981]
Intercept: 32.25593991159057
Mean Squared Error: 67.47367565652733
R2 Score: 0.25027902033003224
```



In [13]:
```
X = data.drop('medv', axis=1)
y = data['medv']
```

In [14]:
```
X_train, X_test, y_train, y_test = train_test_split(
    X, y, test_size=0.2, random_state=42
)
```

In [15]:
```
multi_model = LinearRegression()
multi_model.fit(X_train, y_train)
```

Out[15]:
```
▾ LinearRegression
LinearRegression()
```

In [16]:
```
coefficients = pd.DataFrame({
    'Feature': X.columns,
    'Coefficient': multi_model.coef_
})

coefficients
```

Out[16]:

	Feature	Coefficient
0	ID	-0.004902
1	crim	-0.070217
2	zn	0.061337
3	indus	-0.024444
4	chas	4.174129
5	nox	-14.787057
6	rm	3.397953
7	age	-0.014945
8	dis	-1.863079
9	rad	0.421680
10	tax	-0.013171
11	ptratio	-0.734327
12	black	0.008077
13	lstat	-0.637599

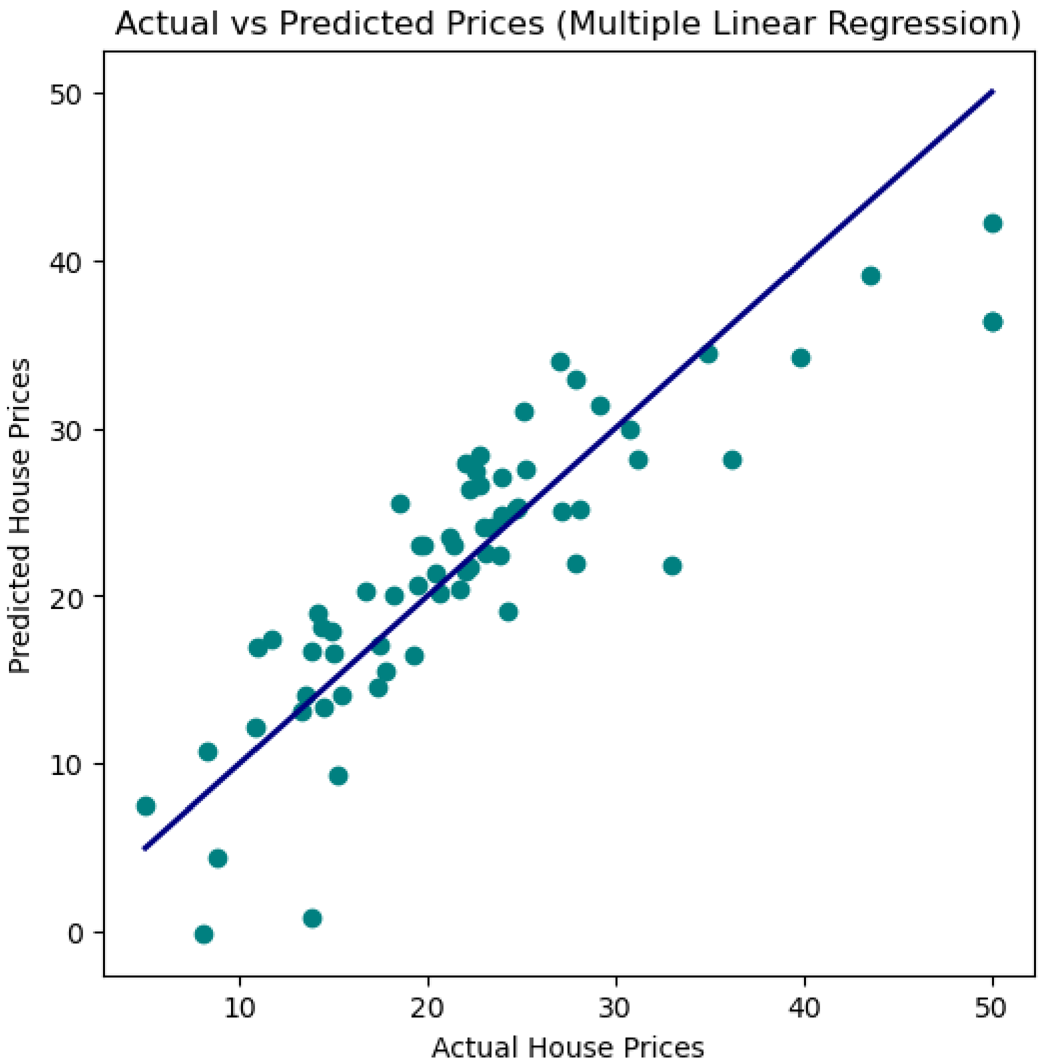
In [17]:

```
y_pred_multi = multi_model.predict(X_test)

print("Mean Squared Error:", mean_squared_error(y_test, y_pred_multi))
print("R2 Score:", r2_score(y_test, y_pred_multi))
```

```
Mean Squared Error: 23.411701826598417
R2 Score: 0.7398653051224349
```

In [18]:

```
plt.figure(figsize=(6,6))
plt.scatter(y_test, y_pred_multi, color='Teal')
plt.xlabel("Actual House Prices")
plt.ylabel("Predicted House Prices")
plt.title("Actual vs Predicted Prices (Multiple Linear Regression)")
plt.plot([y_test.min(), y_test.max()],
         [y_test.min(), y_test.max()],
         color='Navy', linewidth=2)
plt.show()
```


Actual vs Predicted Prices (Multiple Linear Regression)
Predicted House Prices
Actual House Prices
0
10
20
30
40
50
10
20
30
40
50

```
In [ ]:
```