Machine Learning - Digital Assignment

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In [52]:

```python
import pandas as pd
import numpy as np
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
```

Exploring Data

In [53]:

```python
# Load data from CSV file
sales_data = pd.read_csv("bigmart_train.csv")

# Explore data
sales_data.head()
```

Out[53]:

	Item_Identifier	Item_Weight	Item_Fat_Content	Item_Visibility	Item_Type	Item_MRP	O
0	FDA15	9.30	Low Fat	0.016047	Dairy	249.8092	
1	DRC01	5.92	Regular	0.019278	Soft Drinks	48.2692	
2	FDN15	17.50	Low Fat	0.016760	Meat	141.6180	
3	FDX07	19.20	Regular	0.000000	Fruits and Vegetables	182.0950	
4	NCD19	8.93	Low Fat	0.000000	Household	53.8614	

Preprocessing Data

In [54]:

```python
# Check for null values
print(sales_data.isnull().sum())
```

```
Item_Identifier                 0
Item_Weight                  1463
Item_Fat_Content                0
Item_Visibility                 0
Item_Type                       0
Item_MRP                        0
Outlet_Identifier               0
Outlet_Establishment_Year       0
Outlet_Size                  2410
Outlet_Location_Type            0
Outlet_Type                     0
Item_Outlet_Sales               0
dtype: int64
```

In [55]:

```
# Fill missing values
sales_data["Item_Weight"].fillna(sales_data["Item_Weight"].mean(), inplace=T
sales_data["Outlet_Size"].fillna("Unknown", inplace=True)

# Convert categorical variables to numerical
sales_data = pd.get_dummies(sales_data, columns=["Item_Fat_Content",
                                                  "Outlet_Size", "Outlet_Loc
```

In [56]:

```
# Split data into training and test sets
X = sales_data.drop(["Item_Identifier", "Item_Outlet_Sales", "Outlet_Identif
y = sales_data["Item_Outlet_Sales"]
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, ran
```

Regression Model and Evaluation

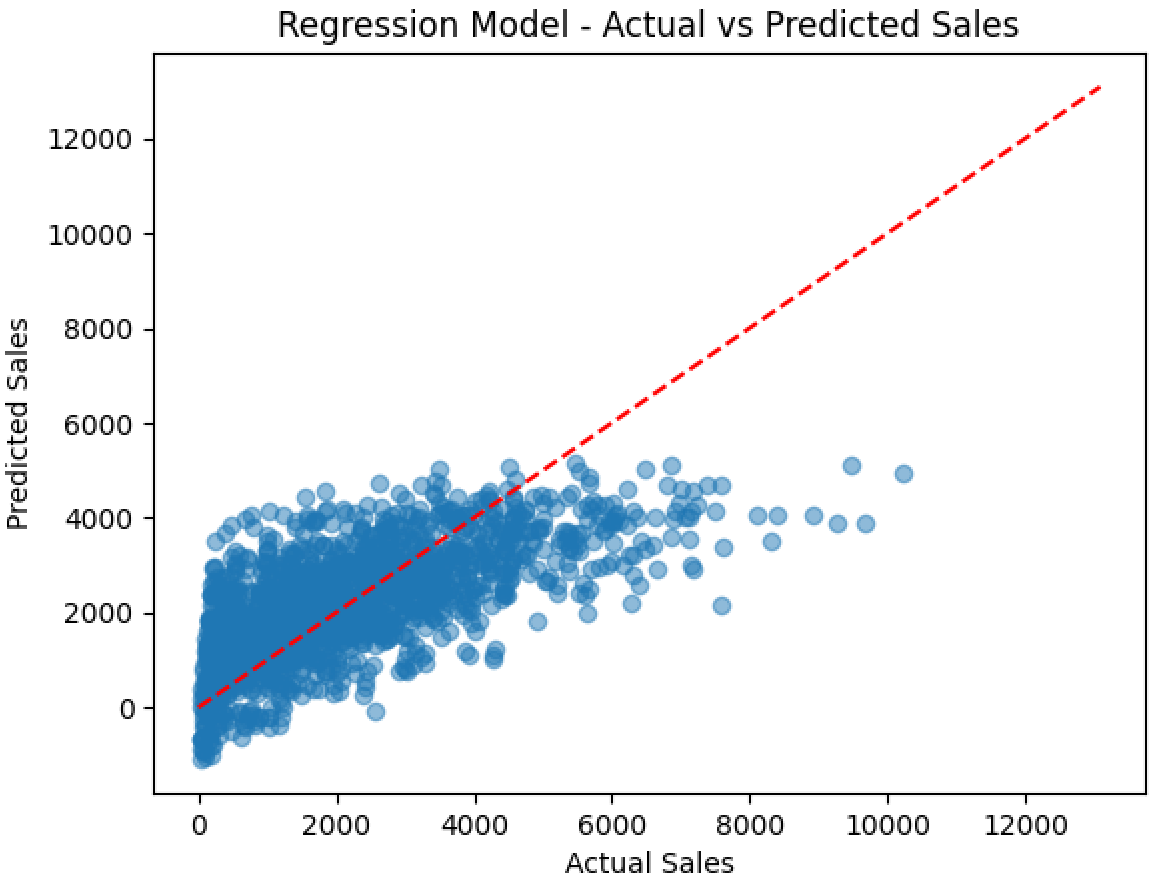
In [57]:

```
# Create and fit linear regression model
model = LinearRegression()
model.fit(X_train, y_train)

# Make predictions on test set
y_pred = model.predict(X_test)

# Evaluate model performance
print("Mean squared error: %.2f"
      % mean_squared_error(y_test, y_pred))
print('Coefficient of determination: %.2f'
      % r2_score(y_test, y_pred))
```

```
Mean squared error: 1460268.51
Coefficient of determination: 0.46
```

In [58]:

```
# Plot the predicted values against the actual values
plt.scatter(y_test, y_pred, alpha=0.5)
plt.plot(np.linspace(0, max(y), 100), np.linspace(0, max(y), 100), 'r--')
plt.xlabel('Actual Sales')
plt.ylabel('Predicted Sales')
plt.title('Regression Model - Actual vs Predicted Sales')
plt.show()
```

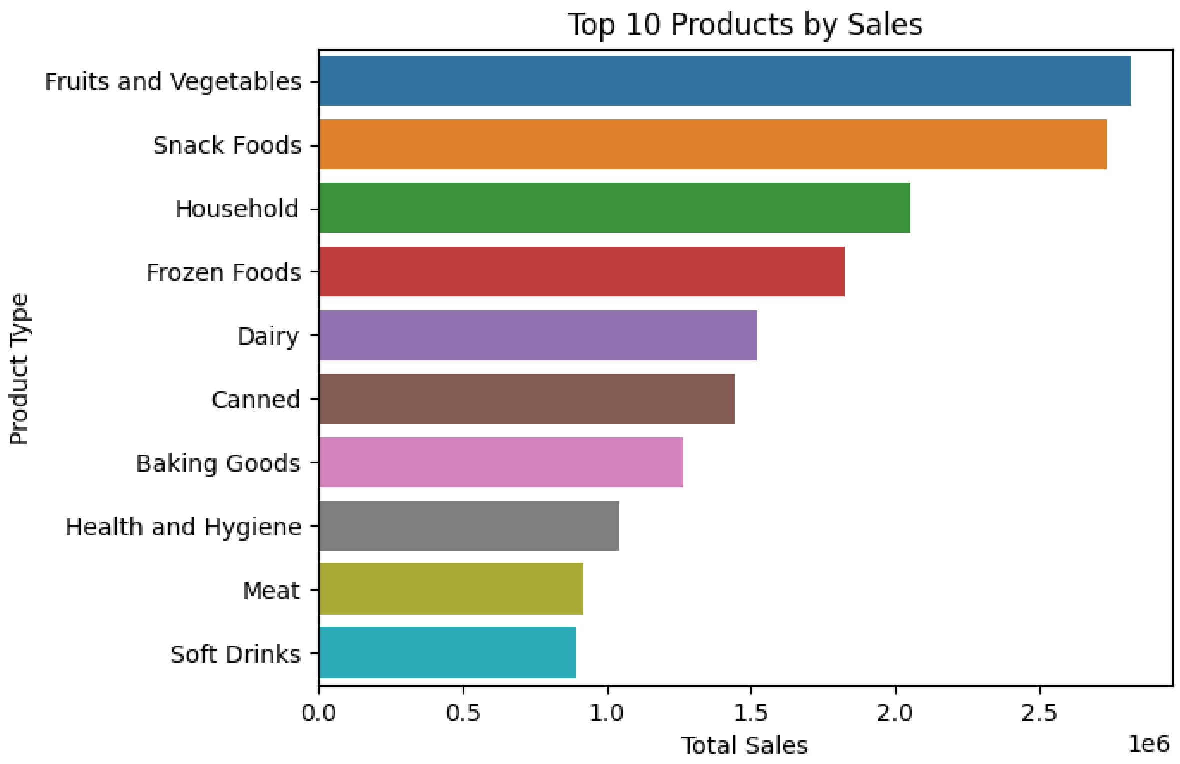


Top Products

In [60]:

```
# Visualize top products and stores with highest impact on sales
top_products = sales_data.groupby('Item_Type')['Item_Outlet_Sales'].sum().sc
print(top_products)

sns.barplot(x=top_products.values, y=top_products.index)
plt.title("Top 10 Products by Sales")
plt.xlabel("Total Sales")
plt.ylabel("Product Type")
plt.show()
```

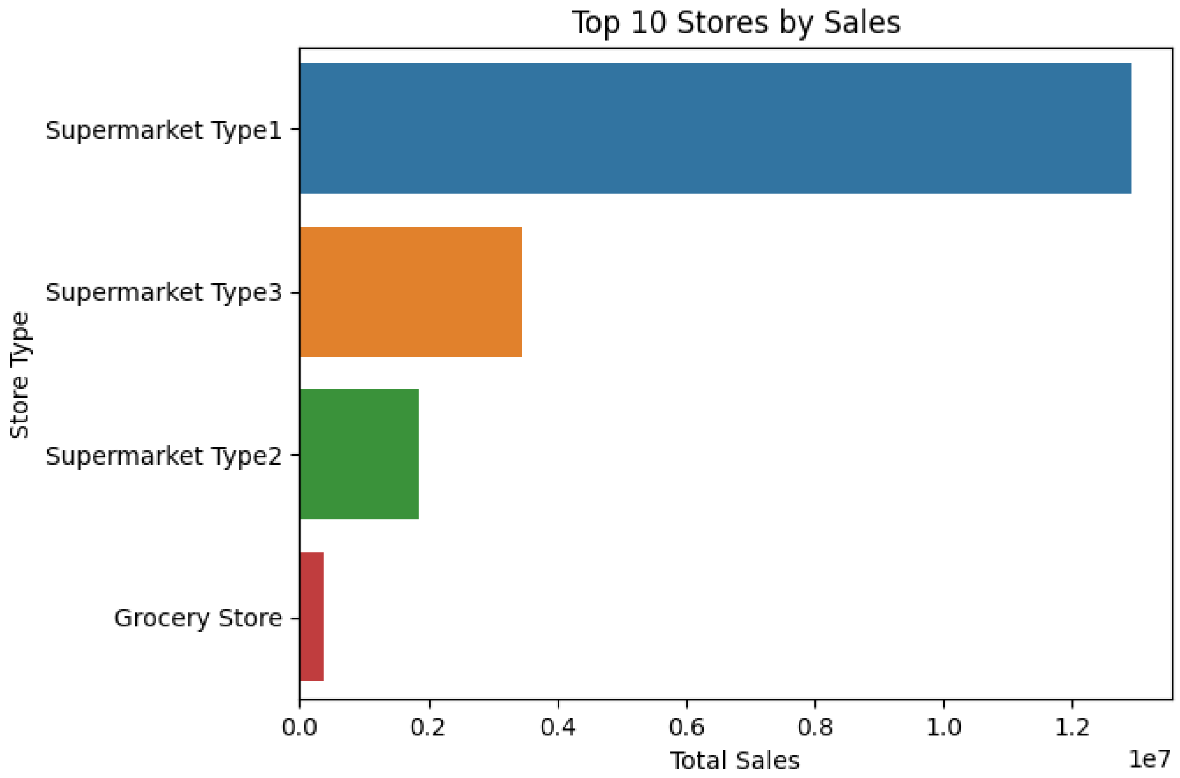
```
Item_Type
Fruits and Vegetables    2.820060e+06
Snack Foods              2.732786e+06
Household                2.055494e+06
Frozen Foods             1.825735e+06
Dairy                    1.522594e+06
Canned                   1.444151e+06
Baking Goods             1.265525e+06
Health and Hygiene       1.045200e+06
Meat                     9.175656e+05
Soft Drinks              8.928977e+05
Name: Item_Outlet_Sales, dtype: float64
```



Top Stores

In [61]:
```
top_stores = sales_data.groupby('Outlet_Type')['Item_Outlet_Sales'].sum().sc
print(top_stores)



sns.barplot(x=top_stores.values, y=top_stores.index)
plt.title("Top 10 Stores by Sales")
plt.xlabel("Total Sales")
plt.ylabel("Store Type")
plt.show()
```

```
Outlet_Type
Supermarket Type1    1.291734e+07
Supermarket Type3    3.453926e+06
Supermarket Type2    1.851823e+06
Grocery Store        3.680343e+05
Name: Item_Outlet_Sales, dtype: float64
```

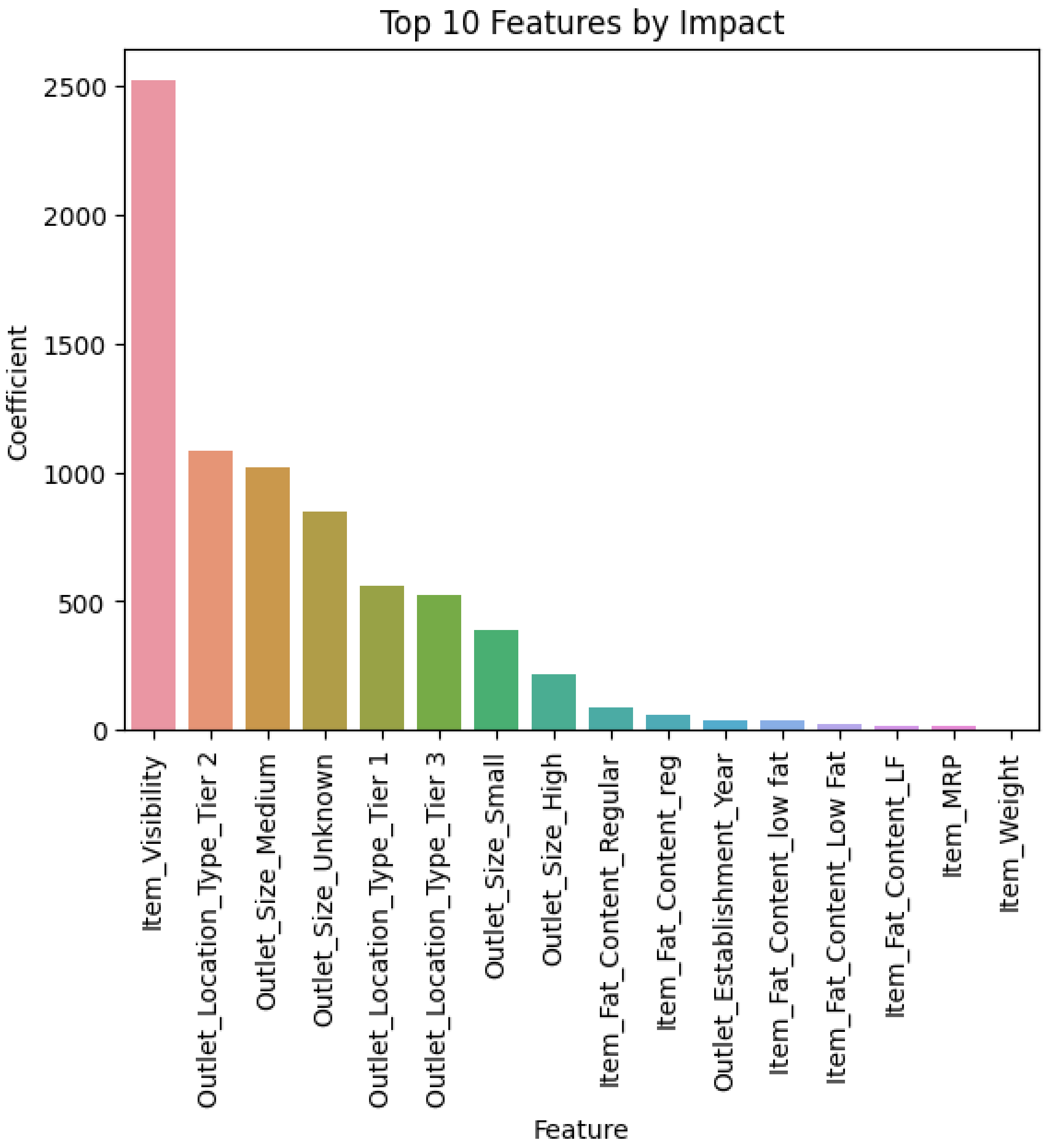


Top Features

In [76]:

```
# Identify features with the highest impact on sales
coefficients = pd.DataFrame({'Features': X.columns, 'Coefficients': abs(mode
coefficients = coefficients.sort_values('Coefficients', ascending=False)
print(coefficients.head(10))
sns.barplot(x=coefficients['Features'], y=coefficients['Coefficients'])
plt.title("Top 10 Features by Impact")
plt.xlabel("Feature")
plt.ylabel("Coefficient")
plt.xticks(rotation=90)

plt.show()
```

```
                     Features  Coefficients
1             Item_Visibility   2517.592201
14  Outlet_Location_Type_Tier 2   1084.745801
10         Outlet_Size_Medium   1019.878513
12        Outlet_Size_Unknown    843.111798
13  Outlet_Location_Type_Tier 1    562.198749
15  Outlet_Location_Type_Tier 3    522.547052
11          Outlet_Size_Small    390.243726
9            Outlet_Size_High    213.477011
6     Item_Fat_Content_Regular     90.952854
8         Item_Fat_Content_reg     57.804941
```

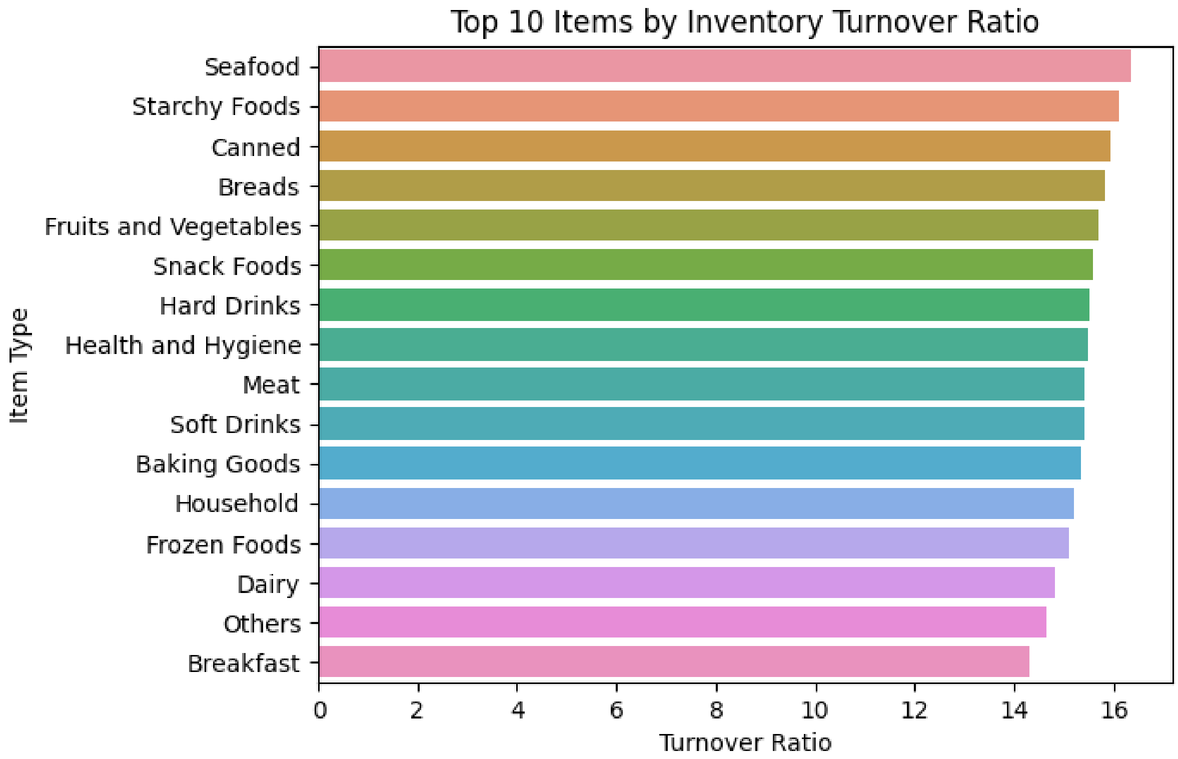


Optimizing Inventory

In [62]:

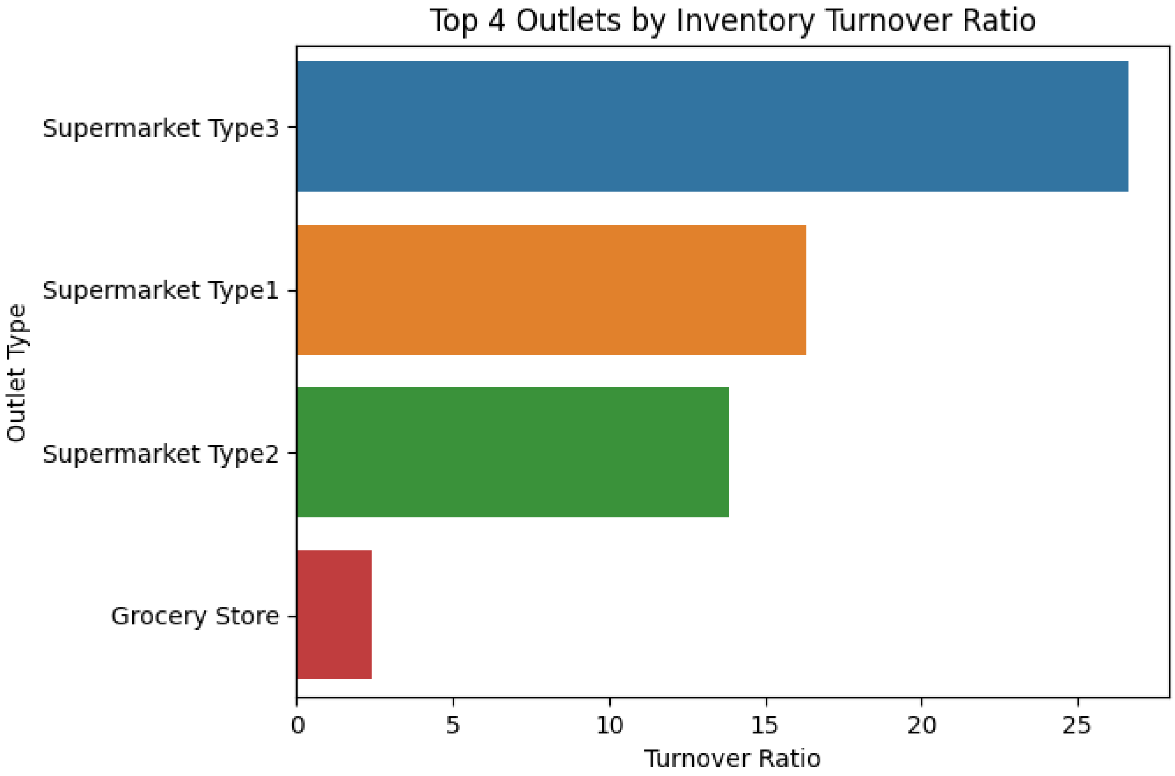
```
# Optimize inventory management
sales_data["Inventory_Turnover_Ratio"] = sales_data["Item_Outlet_Sales"] / s
inventory_data = sales_data.groupby("Item_Type")["Inventory_Turnover_Ratio"]
print("Top 10 Items with Highest Inventory Turnover Ratio:")
print(inventory_data[:10])
sns.barplot(x=inventory_data.values, y=inventory_data.index)
plt.title("Top 10 Items by Inventory Turnover Ratio")
plt.xlabel("Turnover Ratio")
plt.ylabel("Item Type")
plt.show()
```

```
Top 10 Items with Highest Inventory Turnover Ratio:
Item_Type
Seafood                  16.363936
Starchy Foods            16.093951
Canned                   15.930103
Breads                   15.823497
Fruits and Vegetables    15.691076
Snack Foods              15.598895
Hard Drinks              15.522628
Health and Hygiene       15.495294
Meat                     15.420095
Soft Drinks              15.418828
Name: Inventory_Turnover_Ratio, dtype: float64
```



```
In [63]: store_inventory_data = sales_data.groupby("Outlet_Type")["Inventory_Turnover
         print("Top 4 Outlets with Highest Inventory Turnover Ratio:")
         print(store_inventory_data[:4])
         sns.barplot(x=store_inventory_data.values, y=store_inventory_data.index)
         plt.title("Top 4 Outlets by Inventory Turnover Ratio")
         plt.xlabel("Turnover Ratio")
         plt.ylabel("Outlet Type")
         plt.show()
```

```
Top 4 Outlets with Highest Inventory Turnover Ratio:
Outlet_Type
Supermarket Type3    26.608982
Supermarket Type1    16.339585
Supermarket Type2    13.851706
Grocery Store         2.413176
Name: Inventory_Turnover_Ratio, dtype: float64
```


Top 4 Outlets by Inventory Turnover Ratio
Outlet Type
Supermarket Type3
Supermarket Type1
Supermarket Type2
Grocery Store
0
5
10
15
20
25
Turnover Ratio