Lab_4_Andrade

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Lab 4 Assignment - CS 4315

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1. Load the armada.csv file into a Pandas data frame.

[1]:
```
# Import the Pandas module for data frame operations
import pandas as pd

# Set the csv file name to a object, to avoid hard-coding
csv_file = 'armada.csv'

# Read-in the csv file as a Pandas data frame, as an object to be operated on␣
 ↪later
armada_df = pd.read_csv(filepath_or_buffer = csv_file)

# Preview the top 5 rows of the data frame
armada_df.head()
```

[1]:

	Battle	Year	Portuguese Ships	Dutch Ships	English Ships	Ratio of Portuguese Ships to Dutch/British Ships	Spanish Involvement	Portuguese Outcome
0	Bantam	1601	6	3	0	2.000	No	Draw
1	Malacca Strait	1606	14	11	0	1.273	No	Draw
2	Ilha das Naus	1606	6	9	0	0.667	No	Defeat
3	Pulo Butum	1606	7	9	0	0.778	No	
4	Surrat	1615	6	0	4	1.500	No	

```
3            Victory
4               Draw
```

2. Return a data frame that contains the rows associated with a Portuguese victory.

[2]:
```
# Set the column name and filter category
column_name = 'Portuguese Outcome'
col_val_filter = 'Victory'

# Select the applicable rows (Portuguese victories) by using the series␣
 ↪indexing (.loc for the row value)
armada_df.loc[armada_df[column_name] == col_val_filter]
```

[2]:

	Battle	Year	Portuguese Ships	Dutch Ships	English Ships	\
3	Pulo Butum	1606	7	9	0	
12	Goa	1638	6	8	0	
13	Colombo	1654	5	3	0	
17	Bahia	1625	35	20	0	
26	Recife	1653	14	5	0	

	Ratio of Portuguese Ships to Dutch/British Ships	Spanish Involvement	\
3	0.778	No	
12	0.750	No	
13	1.667	No	
17	1.750	Yes	
26	2.800	Yes	

	Portuguese Outcome
3	Victory
12	Victory
13	Victory
17	Victory
26	Victory

3. Return the average number of Portuguese ships present in the victories.

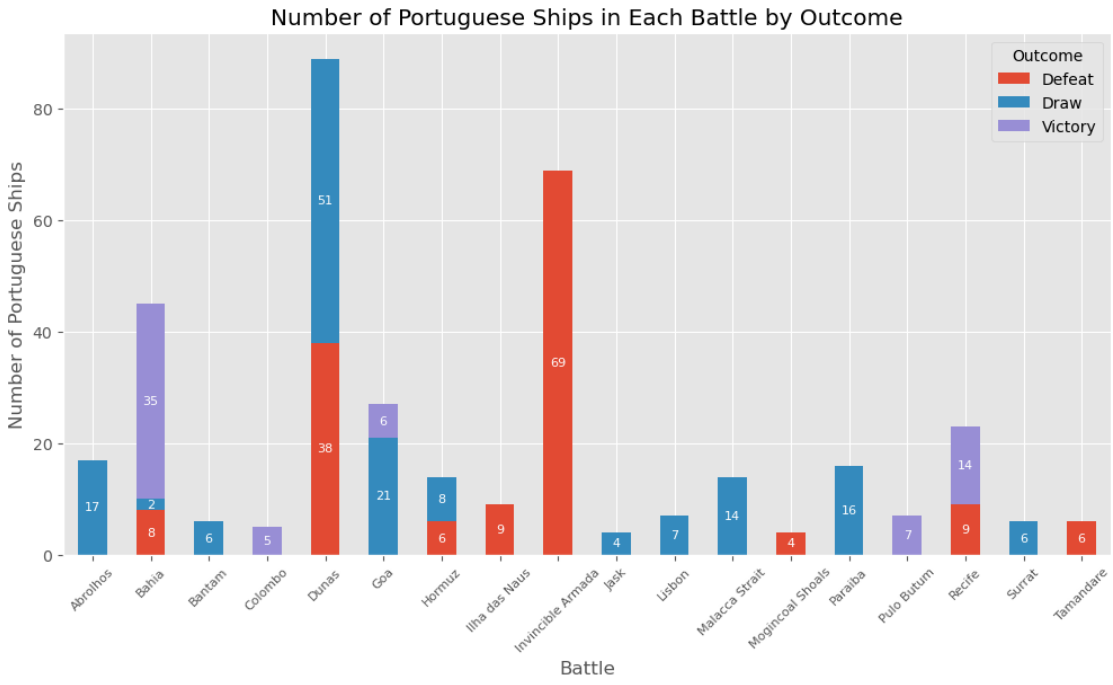
[3]:
```
# Add an index for the "Portuguese Ships" column with the .mean() function to␣
 ↪calculate the average
PT_vict_ships_avg = armada_df.loc[armada_df[column_name] ==␣
 ↪col_val_filter]['Portuguese Ships'].mean()

# Extract the length of the total ships present in Portuguese victories
PT_num_vict = len(armada_df.loc[armada_df[column_name] ==␣
 ↪col_val_filter]['Portuguese Ships'])

# Print the average number of Portuguese ships present in victories using␣
 ↪string formatting
```

```
print('Portugal had an average of %.2f ships in their %d recorded victories.' %␣
 ↪(PT_vict_ships_avg, PT_num_vict))
```

```
Portugal had an average of 13.40 ships in their 5 recorded victories.
```

4. Create a bar plot with title and axis labels that visualizes the number of Portuguese ships in each battle (each battle is identified by the location and the year), whether a victory or not.

[4]:
```
import pandas as pd
import matplotlib.pyplot as plt

# Apply R's ggplot grid and background styling
plt.style.use('ggplot')

# Group by Battle and Portuguese Outcome, then sum the Portuguese Ships for␣
 ↪each group
grouped_df = armada_df.groupby(['Battle', 'Portuguese Outcome'])['Portuguese␣
 ↪Ships'].sum().unstack()

# Create a bar plot
fig, ax = plt.subplots(figsize=(12, 6))
grouped_df.plot(kind='bar', stacked=True, ax=ax)

# Annotate bars with the number of ships for each battle outcome
for p in ax.patches:
    width = p.get_width()
    height = p.get_height()
    x, y = p.get_xy()
    if height > 0:  # Display annotation only for non-zero heights
        ax.annotate(f'{height:.0f}', (x + width / 2, y + height / 2),
                    ha='center', va='center', fontsize=8, color='white')

plt.title('Number of Portuguese Ships in Each Battle by Outcome')
plt.xlabel('Battle')
plt.xticks(rotation = 45, size = 8)
plt.ylabel('Number of Portuguese Ships')
plt.legend(title='Outcome')

# Remove the right and top border (spines) and add a grid for better␣
 ↪visualization
plt.gca().spines['right'].set_visible(False)
plt.gca().spines['top'].set_visible(False)

plt.show()
```



5. Return a data frame that contains the rows where the Portuguese outnumbered their opponent.

[5]:
```
# Select the applicable rows (Ratio > 1) by using the series indexing (.loc for the row value)
armada_df.loc[armada_df['Ratio of Portuguese Ships to Dutch/British Ships'] > 1.000]
```

[5]:

	Battle	Year	Portuguese Ships	Dutch Ships	English Ships	Ratio of Portuguese Ships to Dutch/British Ships	Spanish Involvement
0	Bantam	1601	6	3	0	2.000	No
1	Malacca Strait	1606	14	11	0	1.273	No
4	Surrat	1615	6	0	4	1.500	No
7	Hormuz	1622	6	0	5		
10	Goa	1636	6	4	0		
13	Colombo	1654	5	3	0		
15	Invincible Armada	1588	69	0	31		
17	Bahia	1625	35	20	0		
20	Abrolhos	1631	17	16	0		
22	Dunas	1639	51	11	0		
26	Recife	1653	14	5	0		

7	1.200	No
10	1.500	No
13	1.667	No
15	2.226	Yes
17	1.750	Yes
20	1.063	Yes
22	4.636	Yes
26	2.800	Yes

	Portuguese Outcome
0	Draw
1	Draw
4	Draw
7	Defeat
10	Draw
13	Victory
15	Defeat
17	Victory
20	Draw
22	Draw
26	Victory