🩹 2nd Exercise Notebook

Hands-On with Pandas: A Beginner's Exercise Notebook for Data Analysis

Welcome to your Pandas practice notebook! Pandas is one of the most powerful Python libraries for data analysis and is a cornerstone of python-based data analysis. In this notebook, you'll work through a series of exercises that will help you understand the structure and capabilities of Pandas, and apply them to real datasets.

1. Getting Started with Pandas

Pandas provides high-performance, easy-to-use data structures: `Series` (1D) and `DataFrame` (2D). It is particularly useful for cleaning, transforming, and analyzing structured data.

We'll begin by loading a dataset and doing some initial exploration.

```
import pandas as pd
import matplotlib.pyplot as plt
```

```
# ☑ Task for students: Load the Titanic dataset from seaborn into a pandas dataframe named df and display the first few rows

# Step 1: Import necessary libraries
import seaborn as sns

# Step 2: Load the Titanic dataset into a DataFrame named df
df = sns.load_dataset('titanic')

# Step 3: Display the first few rows
# print(df.head())

df.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
    text-align: right;
}
```

	survived	pclass	sex	age	sibsp	...	adult_male	deck	embark_town	alive	alone
0	0	3	male	22.00	1	...	True	NaN	Southampton	no	False
1	1	1	female	38.00	1	...	False	C	Cherbourg	yes	False
2	1	3	female	26.00	0	...	False	NaN	Southampton	yes	True
3	1	1	female	35.00	1	...	False	C	Southampton	yes	False

	survived	pclass	sex	age	sibsp	...	adult_male	deck	embark_town	alive	alone
4	0	3	male	35.00	0	...	True	NaN	Southampton	no	True

5 rows × 15 columns

Exercise 1.1

☑ Tasks for students: google how to do the following. configure pandas visualization: You can configure display settings, so your DataFrames look cleaner and are easier to interpret.

```
#  Display less columns and rows (10, 10)

pd.set_option('display.max_rows', 10)
pd.set_option('display.max_columns', 10)


# Align column headers nicely

# Center-align column headers
df.style.set_table_styles(
    [{'selector': 'th', 'props': [('text-align', 'center')]}]
)


# Set column width to 100 and precision to 2

# Set column width to 100
pd.set_option('display.max_colwidth', 100)

# Set precision to 2 for floating-point numbers
pd.set_option('display.precision', 2)




# Set float display precision to 2

pd.options.display.float_format = '{:.2f}'.format

# Example
df2 = pd.DataFrame({'A': [1.12345, 2.6789], 'B': [3.98765, 4.54321]})
# print(df)


# df2.head()

df.head()
```

```
.dataframe tbody tr th {
    vertical-align: top;
}

.dataframe thead th {
```

```
    text-align: right;
}
```

	survived	pclass	sex	age	sibsp	...	adult_male	deck	embark_town	alive	alone
row_1	0	3	male	22.00	1	...	True	NaN	Southampton	no	False
row_2	1	1	female	38.00	1	...	False	C	Cherbourg	yes	False
row_3	1	3	female	26.00	0	...	False	NaN	Southampton	yes	True
row_4	1	1	female	35.00	1	...	False	C	Southampton	yes	False
row_5	0	3	male	35.00	0	...	True	NaN	Southampton	no	True

5 rows × 15 columns

Exercise 1.2

☑ Task for students: Inspect the dataset:

- Use `.info()` to understand the structure
- Use `.describe()` to get summary statistics
- Count the number of missing values per column

```
# df.info()

#df.describe()


#df.isnull().sum()
```

2. Pandas Objects: Series and DataFrames

Everything in Pandas is built around `Series` and `DataFrame` objects. A `Series` is like a column in a spreadsheet, and a `DataFrame` is like the full table.

Exercise 2.1

Create a `Series` and a `DataFrame` manually.

```
# ☑ Task for students: Create a Series containing [10, 20, 30] as values and ['a', 'b',
'c'] as indices and print it

import pandas as pd

# Create a Series
s = pd.Series([10, 20, 30], index=['a', 'b', 'c'])

# Print the Series
print(s)
```

```
a    10
b    20
c    30
dtype: int64
```

```
# ☑ Task for students: Create a DataFrame containing a dictionary with  names, ages, and cities of three imaginary people and print it



# Create a dictionary of data
data = {
    'Name': ['Alice', 'Bob', 'Charlie'],
    'Age': [25, 30, 22],
    'City': ['New York', 'Berlin', 'Tokyo']
}

# Convert dictionary to DataFrame
df2 = pd.DataFrame(data)

# Print the DataFrame
print(df2)
```

```
      Name  Age      City
0    Alice   25  New York
1      Bob   30    Berlin
2  Charlie   22     Tokyo
```

Exercise 2.2

☑ Task for students: Explore the components:

- `values`
- `index`
- `columns`

```
print("DataFrame Values:\n", df.values)
print("\nDataFrame Index:\n", df.index)
print("\nDataFrame Columns:\n", df.columns)
```

```
DataFrame Values:
 [[0 3 'male' ... 'Southampton' 'no' False]
 [1 1 'female' ... 'Cherbourg' 'yes' False]
 [1 3 'female' ... 'Southampton' 'yes' True]
 ...
 [0 3 'female' ... 'Southampton' 'no' False]
```

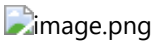
```
 [1 1 'male' ... 'Cherbourg' 'yes' True]
 [0 3 'male' ... 'Queenstown' 'no' True]]

DataFrame Index:
 RangeIndex(start=0, stop=891, step=1)

DataFrame Columns:
 Index(['survived', 'pclass', 'sex', 'age', 'sibsp', 'parch', 'fare',
       'embarked', 'class', 'who', 'adult_male', 'deck', 'embark_town',
       'alive', 'alone'],
      dtype='object')
```

3. Indexing and Selection

Selecting and filtering data is one of the most common tasks in data mining. Pandas provides powerful indexing options using `.loc`, `.iloc`, slicing, and Boolean masks.

 image.png

```
# ☑ Task for students: Use .loc (label-based) to print first or second row

df2.loc[1]

# Print the first row (label = 0)
#print("First Row:\n", df2.iloc[0])

# Print the second row (label = 1)
#print("\nSecond Row:\n", df2.loc[1])
```

```
Name       Bob
Age         30
City    Berlin
Name: 1, dtype: object
```

```
# the loc works with any values used in the index regardless of the type
df.index = [f"row_{i+1}" for i in range(len(df))]

df.loc["row_4"]
```

```
survived                1
pclass                  1
sex                female
age                 35.00
sibsp                   1
                  ...
adult_male          False
deck                    C
embark_town    Southampton
alive                  yes
```

```
alone                False
Name: row_4, Length: 15, dtype: object
```

```
# ☑ Task for students: Use .iloc (integer position-based) to print the first of the fifth row



print(df.iloc[4, 0])

print(df.iloc[4])
```

```
0
survived                 0
pclass                   3
sex                   male
age                  35.00
sibsp                    0
                   ...
adult_male            True
deck                   NaN
embark_town    Southampton
alive                   no
alone                 True
Name: row_5, Length: 15, dtype: object
```

Exercise 3.1

selection and selective printing

```
# ☑ Task for students: Select the first 5 rows where passengers are female

print(df[df['sex'] == 'female'].head(5))
```

```
        survived  pclass     sex   age  sibsp  ...  adult_male  deck  \
row_2          1       1  female 38.00      1  ...       False     C
row_3          1       3  female 26.00      0  ...       False   NaN
row_4          1       1  female 35.00      1  ...       False     C
row_9          1       3  female 27.00      0  ...       False   NaN
row_10         1       2  female 14.00      1  ...       False   NaN

        embark_town alive  alone
row_2     Cherbourg   yes  False
row_3   Southampton   yes   True
row_4   Southampton   yes  False
```

```
row_9   Southampton   yes  False
row_10    Cherbourg   yes  False

[5 rows x 15 columns]
```

```
# ☑ Task for students: Select all passengers under the age of 18

# Select passengers under 18
under_18 = df[df['age'] < 18]

# Display the result
print(under_18)
```

```
         survived  pclass     sex   age  sibsp  ...  adult_male  deck  \
row_8           0       3    male  2.00      3  ...       False   NaN
row_10          1       2  female 14.00      1  ...       False   NaN
row_11          1       3  female  4.00      1  ...       False     G
row_15          0       3  female 14.00      0  ...       False   NaN
row_17          0       3    male  2.00      4  ...       False   NaN
...           ...     ...     ...   ...    ...  ...         ...   ...
row_851         0       3    male  4.00      4  ...       False   NaN
row_853         0       3  female  9.00      1  ...       False   NaN
row_854         1       1  female 16.00      0  ...       False     D
row_870         1       3    male  4.00      1  ...       False   NaN
row_876         1       3  female 15.00      0  ...       False   NaN

         embark_town alive  alone
row_8    Southampton    no  False
row_10     Cherbourg   yes  False
row_11   Southampton   yes  False
row_15   Southampton    no   True
row_17    Queenstown    no  False
...              ...   ...    ...
row_851  Southampton    no  False
row_853    Cherbourg    no  False
row_854  Southampton   yes  False
row_870  Southampton   yes  False
row_876    Cherbourg   yes   True

[113 rows x 15 columns]
```

4. Operations in Pandas

Pandas allows you to perform element-wise and column-wise operations efficiently. These include arithmetic operations, aggregations, and applying custom functions.

```
# ☑ Task for students: calculate mean age per gender and class

# Calculate mean age per gender and class
```

```
mean_age = df.groupby(['sex', 'pclass'])['age'].mean()

# Display the result
print(mean_age)
```

```
sex     pclass
female  1        34.61
        2        28.72
        3        21.75
male    1        41.28
        2        30.74
        3        26.51
Name: age, dtype: float64
```

Exercise 4.1

```
# ☑ Task for students: add a column for fare per age

# Add a new column 'fare_per_age'
df['fare_per_age'] = df['fare'] / df['age']

# Display the first few rows to check
print(df[['fare', 'age', 'fare_per_age']].head())
```

```
       fare   age  fare_per_age
row_1  7.25 22.00          0.33
row_2 71.28 38.00          1.88
row_3  7.92 26.00          0.30
row_4 53.10 35.00          1.52
row_5  8.05 35.00          0.23
```

```
# ☑ Task for students: Use `.mean()` and `.median()` to summarize it

# Calculate mean
mean_fare_per_age = df['fare_per_age'].mean()

# Calculate median
median_fare_per_age = df['fare_per_age'].median()

print("Mean fare per age:", mean_fare_per_age)
print("Median fare per age:", median_fare_per_age)
```

```
Mean fare per age: 2.391840712969448
Median fare per age: 0.5652173913043478
```

☑ 5. Task for students: Mini Data Mining Project: Exploring Titanic Data

Now it's your turn to apply what you've learned to gain insights from the Titanic dataset.

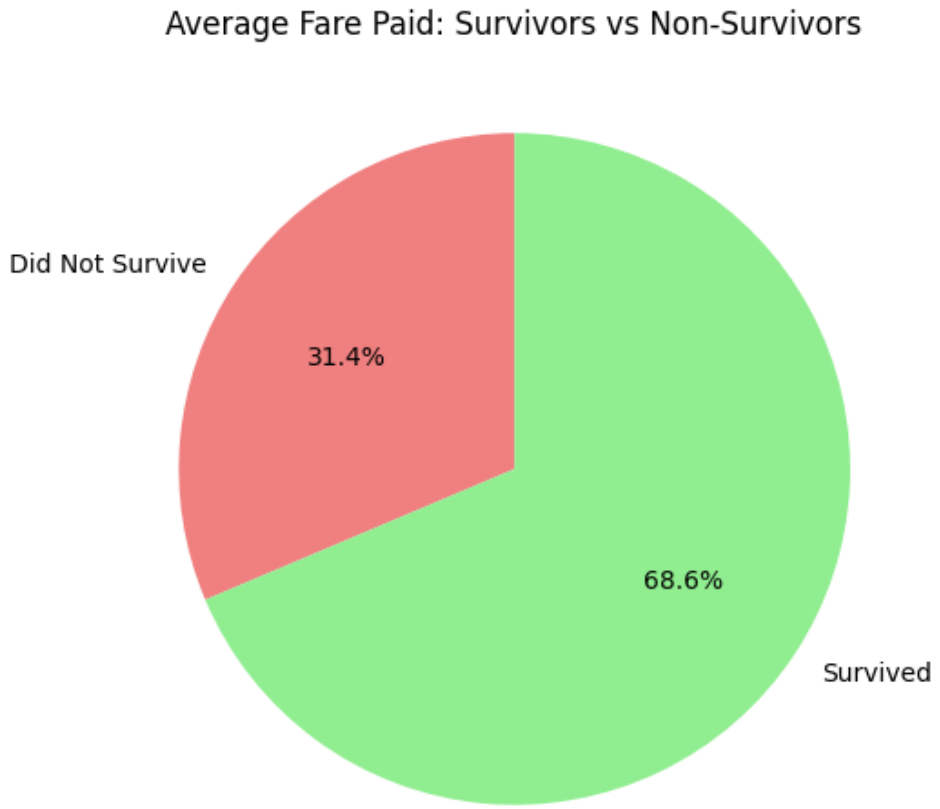
Questions:

1. What's the average fare paid by survivors vs non-survivors? try plotting it in a pie chart.
2. Who had a higher survival rate: children (<16) or adults?
3. What's the most common port of embarkation?
4. Clean the data (e.g., fill or drop missing values in 'age' or 'embarked')
5. Use `groupby`, `value_counts`, and filtering to answer the questions
6. Try plotting with seaborn (e.g., `sns.histplot`, `sns.barplot`) and with `pandas.DataFrame.plot.pie`

```
# print the average fare paid by survivors vs non-survivors using a pie chart


# Calculate average fare by survival
avg_fare = df.groupby('survived')['fare'].mean()

# Plot pie chart
plt.figure(figsize=(6,6))
plt.pie(avg_fare, labels=['Did Not Survive', 'Survived'],
        autopct='%1.1f%%', colors=['lightcoral', 'lightgreen'], startangle=90)
plt.title('Average Fare Paid: Survivors vs Non-Survivors')
plt.show()
```




```
# Create a new column for age group


# Calculate survival rate per group


# Step 1: Create age groups
bins = [0, 12, 18, 35, 60, 120]  # Define age bins
labels = ['Child', 'Teen', 'Adult', 'Middle-Aged', 'Senior']  # Labels for bins
df['age_group'] = pd.cut(df['age'], bins=bins, labels=labels)

# Step 2: Calculate survival rate per age group
survival_rate = df.groupby('age_group')['survived'].mean()

print(survival_rate)
```

```
age_group
Child         0.58
Teen          0.43
Adult         0.38
Middle-Aged   0.40
Senior        0.23
Name: survived, dtype: float64


C:\Users\USERTEST\AppData\Local\Temp\ipykernel_22160\1730043664.py:13: FutureWarning: The
```

```
default of observed=False is deprecated and will be changed to True in a future version of
pandas. Pass observed=False to retain current behavior or observed=True to adopt the future
default and silence this warning.
  survival_rate = df.groupby('age_group')['survived'].mean()
```

```
# find and print the most common port of embarkation

# Find the most common port of embarkation
most_common_port = df['embarked'].mode()[0]

print("The most common port of embarkation is:", most_common_port)

#df.head()
```

```
The most common port of embarkation is: S
```

```
# clean the data (e.g., fill or drop missing values in 'age' or 'embarked')

# Check missing values
print("Missing values before cleaning:")
print(df[['age', 'embarked']].isna().sum())


# 1️⃣ Fill missing 'age' values with the median age
df['age'].fillna(df['age'].median())

# 2️⃣ Fill missing 'embarked' values with the most common port (mode)
df['embarked'].fillna(df['embarked'].mode()[0])

# 3️⃣ Optionally, drop any remaining rows with missing critical values (optional)
df.dropna(subset=['fare', 'sex'])

# Verify the cleaning
print("\nMissing values after cleaning:")
print(df[['age', 'embarked']].isna().sum())
```

```
Missing values before cleaning:
age         0
embarked    0
dtype: int64

Missing values after cleaning:
age         0
embarked    0
dtype: int64
```

```
# find and print survival rate for children (<16) and adults

# Create a new column 'group' for children and adults
df['group'] = df['age'].apply(lambda x: 'child' if x < 16 else 'adult')

# Calculate survival rate for each group
survival_rates = df.groupby('group')['survived'].mean() * 100

# Print results
print("Survival Rate by Age Group (%):")
print(survival_rates)
```

```
Survival Rate by Age Group (%):
group
adult   36.26
child   59.04
Name: survived, dtype: float64
```