# Worksheet 02

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## Topics

- Effective Programming

## Effective Programming

**a) What is a drawback of the top down approach?**

**Top down approach may lead to integration challenges.**

**b) What is a drawback of the bottom up approach?**

**Bottom-up approach can cause developers to lose sight of the overall project vision by focusing too much on the details of individual components.**

**c) What are 3 things you can do to have a better debugging experience?**

**Utilize a Debugger, Implement Unit Testing, Maintain Clean and Modular Code**

**d) (Optional) Follow along with the live coding. You can write your code here:**

In [ ]:

```

```

# Exercise

This exercise will use the Titanic dataset (https://www.kaggle.com/c/titanic/data). Download the file named `train.csv` and place it in the same folder as this notebook.

The goal of this exercise is to practice using pandas methods. If your:

1. code is taking a long time to run
2. code involves for loops or while loops
3. code spans multiple lines

look through the pandas documentation for alternatives. This cheat sheet may come in handy.

**a) Complete the code below to read in a filepath to the `train.csv` and returns the DataFrame.**

In [43]:

```
%pip install pandas
%pip install matplotlib

import pandas as pd

df = pd.read_csv('train.csv')
df.describe()
```

```
Requirement already satisfied: pandas in c:\users\73907\appdata\local\programs\python\pyt
hon311\lib\site-packages (2.2.0)
Requirement already satisfied: numpy<2,>=1.23.2 in c:\users\73907\appdata\local\programs\
python\python311\lib\site-packages (from pandas) (1.26.3)
Requirement already satisfied: python-dateutil>=2.8.2 in c:\users\73907\appdata\roaming\p
ython\python311\site-packages (from pandas) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in c:\users\73907\appdata\local\programs\pyth
on\python311\lib\site-packages (from pandas) (2024.1)
Requirement already satisfied: tzdata>=2022.7 in c:\users\73907\appdata\local\programs\py
thon\python311\lib\site-packages (from pandas) (2023.4)
Requirement already satisfied: six>=1.5 in c:\users\73907\appdata\roaming\python\python31
1\site-packages (from python-dateutil>=2.8.2->pandas) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
```

```
[notice] A new release of pip available: 22.3.1 -> 23.3.2
[notice] To update, run: python.exe -m pip install --upgrade pip
```

```
Requirement already satisfied: matplotlib in c:\users\73907\appdata\local\programs\python
\python311\lib\site-packages (3.8.2)
Requirement already satisfied: contourpy>=1.0.1 in c:\users\73907\appdata\local\programs\
python\python311\lib\site-packages (from matplotlib) (1.2.0)
Requirement already satisfied: cycler>=0.10 in c:\users\73907\appdata\local\programs\pyth
on\python311\lib\site-packages (from matplotlib) (0.12.1)
Requirement already satisfied: fonttools>=4.22.0 in c:\users\73907\appdata\local\programs
\python\python311\lib\site-packages (from matplotlib) (4.47.2)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\users\73907\appdata\local\programs
\python\python311\lib\site-packages (from matplotlib) (1.4.5)
Requirement already satisfied: numpy<2,>=1.21 in c:\users\73907\appdata\local\programs\py
thon\python311\lib\site-packages (from matplotlib) (1.26.3)
Requirement already satisfied: packaging>=20.0 in c:\users\73907\appdata\roaming\python\p
ython311\site-packages (from matplotlib) (23.2)
Requirement already satisfied: pillow>=8 in c:\users\73907\appdata\local\programs\python\
python311\lib\site-packages (from matplotlib) (10.2.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\users\73907\appdata\local\programs\
python\python311\lib\site-packages (from matplotlib) (3.1.1)
Requirement already satisfied: python-dateutil>=2.7 in c:\users\73907\appdata\roaming\pyt
hon\python311\site-packages (from matplotlib) (2.8.2)
Requirement already satisfied: six>=1.5 in c:\users\73907\appdata\roaming\python\python31
1\site-packages (from python-dateutil>=2.7->matplotlib) (1.16.0)
Note: you may need to restart the kernel to use updated packages.
```

```
[notice] A new release of pip available: 22.3.1 -> 23.3.2
[notice] To update, run: python.exe -m pip install --upgrade pip
```

Out[43]:

| | PassengerId | Survived | Pclass | Age | SibSp | Parch | Fare |
|---|---|---|---|---|---|---|---|
| **count** | 891.000000 | 891.000000 | 891.000000 | 714.000000 | 891.000000 | 891.000000 | 891.000000 |
| **mean** | 446.000000 | 0.383838 | 2.308642 | 29.699118 | 0.523008 | 0.381594 | 32.204208 |
| **std** | 257.353842 | 0.486592 | 0.836071 | 14.526497 | 1.102743 | 0.806057 | 49.693429 |
| **min** | 1.000000 | 0.000000 | 1.000000 | 0.420000 | 0.000000 | 0.000000 | 0.000000 |
| **25%** | 223.500000 | 0.000000 | 2.000000 | 20.125000 | 0.000000 | 0.000000 | 7.910400 |
| **50%** | 446.000000 | 0.000000 | 3.000000 | 28.000000 | 0.000000 | 0.000000 | 14.454200 |
| **75%** | 668.500000 | 1.000000 | 3.000000 | 38.000000 | 1.000000 | 0.000000 | 31.000000 |
| **max** | 891.000000 | 1.000000 | 3.000000 | 80.000000 | 8.000000 | 6.000000 | 512.329200 |

**b) Complete the code so it returns the number of rows that have at least one empty column value**

In [44]:

```
print("there are " +  str(df.isna().any(axis=1).sum()) + " rows with at least one empty
value")
```

```
there are 708 rows with at least one empty value
```

**c) Complete the code below to remove all columns with more than 200 NaN values**

In [45]:

```
df = df.dropna(axis=1, thresh=len(df) - 200)
df.columns
```

Out[45]:

```
Index(['PassengerId', 'Survived', 'Pclass', 'Name', 'Sex', 'Age', 'SibSp',
       'Parch', 'Ticket', 'Fare', 'Embarked'],
      dtype='object')
```

**d) Complete the code below to replaces `male` with 0 and `female` with 1**

In [46]:

```
df['Sex'] = df['Sex'].replace({'male': 0, 'female': 1})
df.head()
```

```
C:\Users\73907\AppData\Local\Temp\ipykernel_21816\48985843.py:1: FutureWarning: Downcasting behavior in `replace` is deprecated and will be removed in a future version. To retain the old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  df['Sex'] = df['Sex'].replace({'male': 0, 'female': 1})
```

Out[46]:

| | PassengerId | Survived | Pclass | Name | Sex | Age | SibSp | Parch | Ticket | Fare | Embarked |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 1 | 0 | 3 | Braund, Mr. Owen Harris | 0 | 22.0 | 1 | 0 | A/5 21171 | 7.2500 | S |
| **1** | 2 | 1 | 1 | Cumings, Mrs. John Bradley (Florence Briggs Th... | 1 | 38.0 | 1 | 0 | PC 17599 | 71.2833 | C |
| **2** | 3 | 1 | 3 | Heikkinen, Miss. Laina | 1 | 26.0 | 0 | 0 | STON/O2. 3101282 | 7.9250 | S |
| **3** | 4 | 1 | 1 | Futrelle, Mrs. Jacques Heath (Lily May Peel) | 1 | 35.0 | 1 | 0 | 113803 | 53.1000 | S |
| **4** | 5 | 0 | 3 | Allen, Mr. William Henry | 0 | 35.0 | 0 | 0 | 373450 | 8.0500 | S |

**e) Complete the code below to add four columns `First Name`, `Middle Name`, `Last Name`, and `Title` corresponding to the value in the `name` column.**

**For example: `Braund, Mr. Owen Harris` would be:**

| First Name | Middle Name | Last Name | Title |
|---|---|---|---|
| Owen | Harris | Braund | Mr |

**Anything not clearly one of the above 4 categories can be ignored.**

In [47]:

```
def extract_name_parts(name):
    parts = name.split(' ')
    last_name = parts[0][: -1]
    title = parts[1][: -1]
    first_name = parts[2]
    middle_name = ''
    if len(parts) > 3:
        middle_name = parts[3]
    return first_name, middle_name, last_name, title

df[['First Name', 'Middle Name', 'Last Name', 'Title']] = df.apply(lambda x: pd.Series(extract_name_parts(x['Name'])), axis=1)

df.head()
```

Out[47]:

| | PassengerId | Survived | Pclass | Name | Sex | Age | SibSp | Parch | Ticket | Fare | Embarked | First Name | Middle Name |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

|  | PassengerId | Survived | Pclass | Name | Sex | Age | SibSp | Parch | Ticket | Fare | Embarked | First Name | Middle Name |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 3 | Braund, Mr. Owen Harris | 0 | 22.0 | 1 | 0 | A/5 21171 | 7.2500 | S | Owen | Harris | E |
| 1 | 2 | 1 | 1 | Cumings, Mrs. John Bradley (Florence Briggs Th... | 1 | 38.0 | 1 | 0 | PC 17599 | 71.2833 | C | John | Bradley | Cu |
| 2 | 3 | 1 | 3 | Heikkinen, Miss. Laina | 1 | 26.0 | 0 | 0 | STON/O2. 3101282 | 7.9250 | S | Laina |  | Heil |
| 3 | 4 | 1 | 1 | Futrelle, Mrs. Jacques Heath (Lily May Peel) | 1 | 35.0 | 1 | 0 | 113803 | 53.1000 | S | Jacques | Heath | F |
| 4 | 5 | 0 | 3 | Allen, Mr. William Henry | 0 | 35.0 | 0 | 0 | 373450 | 8.0500 | S | William | Henry |  |

**f) Complete the code below to replace all missing ages with the average age**

In [48]:

```
df['Age'] = df['Age'].fillna(df['Age'].mean())
df.head()
```

Out[48]:

|  | PassengerId | Survived | Pclass | Name | Sex | Age | SibSp | Parch | Ticket | Fare | Embarked | First Name | Middle Name |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 3 | Braund, Mr. Owen Harris | 0 | 22.0 | 1 | 0 | A/5 21171 | 7.2500 | S | Owen | Harris | E |
| 1 | 2 | 1 | 1 | Cumings, Mrs. John Bradley (Florence Briggs Th... | 1 | 38.0 | 1 | 0 | PC 17599 | 71.2833 | C | John | Bradley | Cu |
| 2 | 3 | 1 | 3 | Heikkinen, Miss. Laina | 1 | 26.0 | 0 | 0 | STON/O2. 3101282 | 7.9250 | S | Laina |  | Heil |
| 3 | 4 | 1 | 1 | Futrelle, Mrs. Jacques Heath (Lily May Peel) | 1 | 35.0 | 1 | 0 | 113803 | 53.1000 | S | Jacques | Heath | F |
| 4 | 5 | 0 | 3 | Allen, Mr. William Henry | 0 | 35.0 | 0 | 0 | 373450 | 8.0500 | S | William | Henry |  |

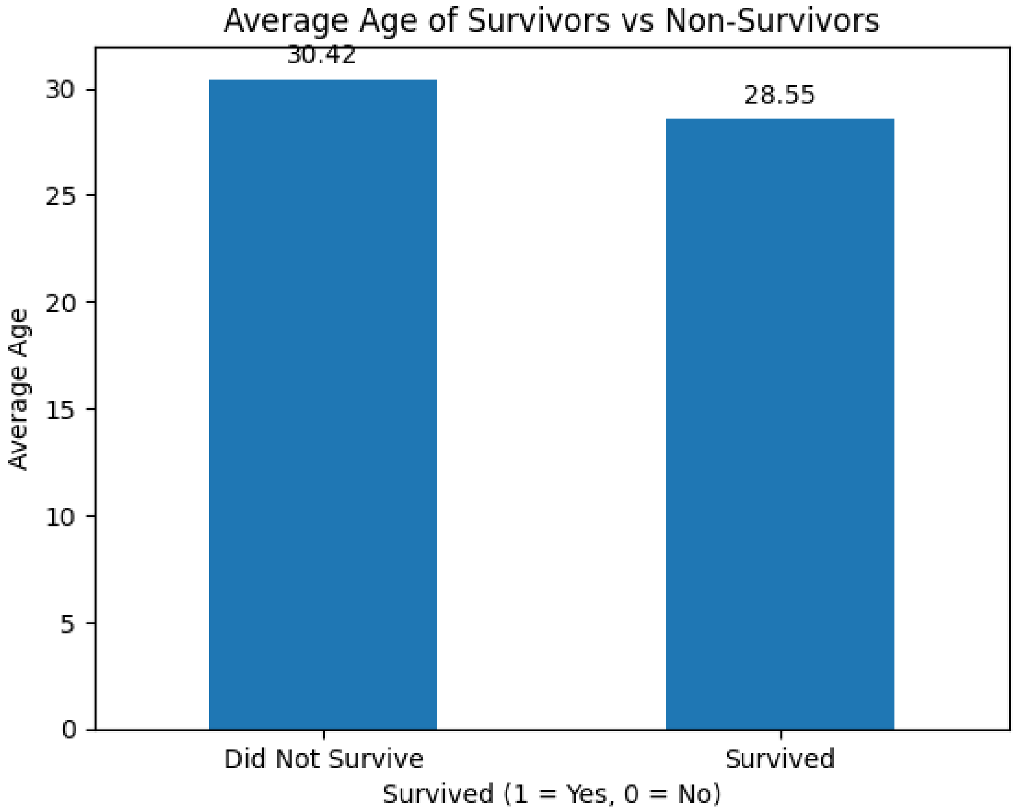
**g) Plot a bar chart of the average age of those that survived and did not survive. Briefly comment on what you observe.**

In [49]:

```
import matplotlib.pyplot as plt
average_ages = df.groupby('Survived')['Age'].mean()


ax = average_ages.plot(kind='bar')
```

```
plt.title('Average Age of Survivors vs Non-Survivors')
plt.xlabel('Survived (1 = Yes, 0 = No)')
plt.ylabel('Average Age')
plt.xticks(ticks=[0, 1], labels=['Did Not Survive', 'Survived'], rotation=0)
for p in ax.patches:
    ax.annotate(f'{p.get_height():.2f}',
                (p.get_x() + p.get_width() / 2., p.get_height()),
                ha='center', va='center',
                xytext=(0, 9),
                textcoords='offset points')
plt.show()
```



**My observations: Average age of those that survived is higher than those that did not survive. but the difference is not significant.**