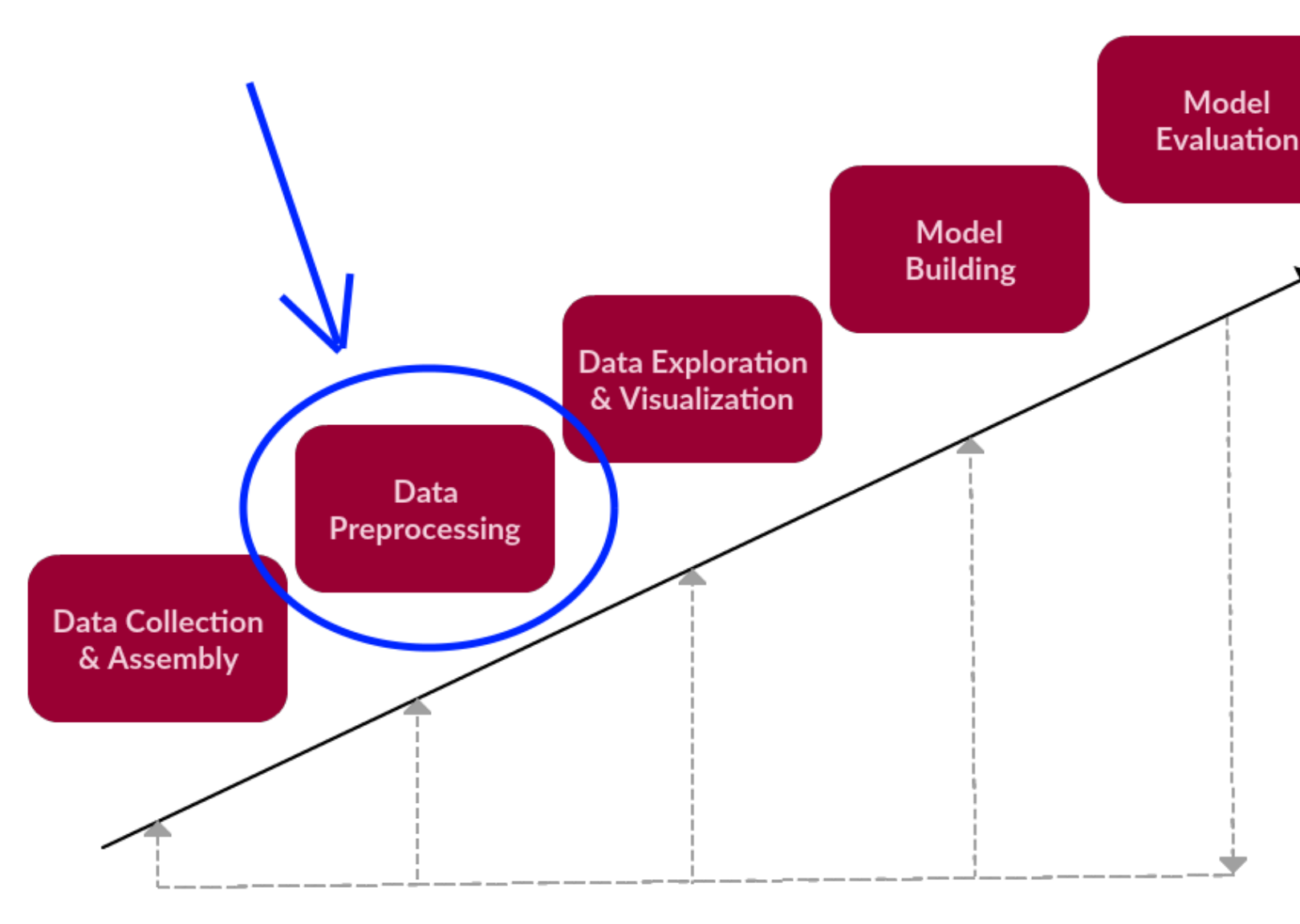
Data Preprocessing - Data Analysis

Data Preprocessing

It is used for maintaining the **Quality** of the data. It includes important factors like -

- Selecting the valid data variables
- Data editing is important in some aspects
- Maintaining uniformity in data values
- Manipulation of the data for achieving the above factors (Data Wrangling)



Credits - Image from Internet

In [ ]:

Classroom Management

Imagine you are the new teacher freshly appointed to manage the classroom.

You want to know how many students are good in -

```
1. sports
2. academics
3. creative work
4. marketing
```

Based on the students data, you have to conclude **who** can do well in **what**.

Dataset description

You are given the **data of the students** that included the following variables -

- Age
- Gender
- Address
- Father's occupation
- Mother's occupation
- Place of birth
- Height - ft
- Weight - kg
- Prev sports performance
- Prev academics performance
- Voluntary experience
- Extra co-curricular activities
- Arts and Design

Note - For our conveneince all the data values are numericals.

In [ ]:

How do we convert a **" feeling "** into a number?

- We can measure a **" feeling "** into a number through a **" scale range "**
- If the scale is **1** to **4**, then we can term -
  - 1 → Not Satisfied
  - 2 → Slightly Satisfied
  - 3 → Satisfied
  - 4 → Highly Satisfied

In [ ]:

Sports

Scenario 1

Considering the variables that are direclty related -

- Height
- Weight
- Prev sports performance

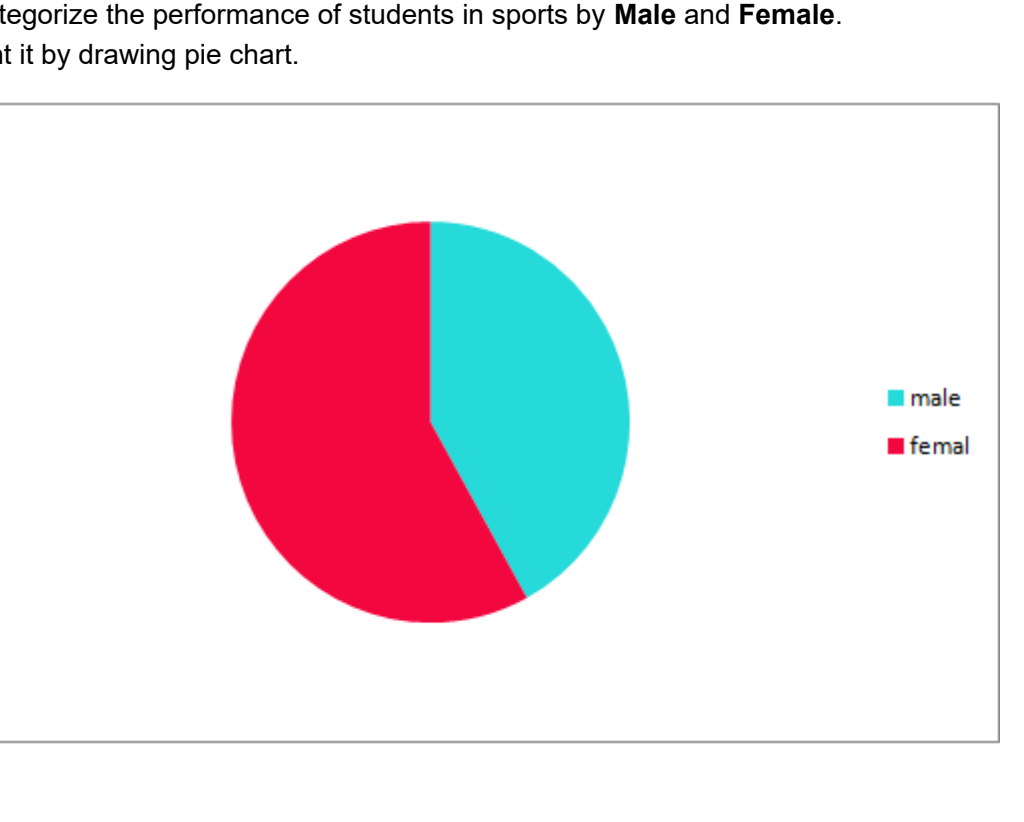
Based on this, you can only get the information of a student irrespective of **gender**.

Scenario 2

Considering the other important factors like **gender** in order to categorize as per **Male related sports** and **Female related sports**.

- Gender
- Height
- Weight
- Prev sports performance

1. Based on this, you can categorize the performance of students in sports by **Male** and **Female**.
2. Visually, you can represent it by drawing pie chart.



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Scenario 3

If you want to do further research on how good the person is performing in other areas, you can do so by considering -

- Gender
- Height
- Weight
- Prev sports performance
- Voluntary experience
- Extra co-curricular activities
- Prev academics performace (may be or may not be)

1. With this, you conclude the overall students performance on sports
2. Since you are a kind teacher and well wisher of student, you can give the student a proper career guidance.

In [ ]:

Academics

Scenario 1

Considering the variables that are directly related -

- Prev academics peroformance

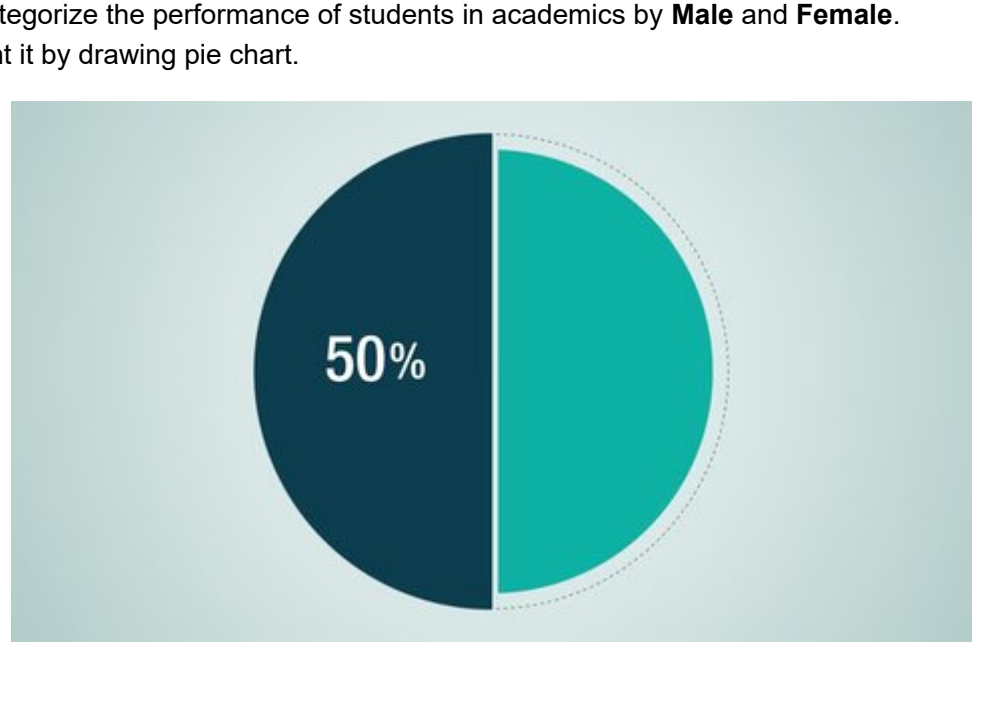
Based on this, you can only get the information of student irrespective of **gender**.

Scenario 2

Considering the other important factors like **gender** to categorize **Male** and **Female** separately.

- Gender
- Prev academics performance

1. Based on this, you can categorize the performance of students in academics by **Male** and **Female**.
2. Visually, you can represent it by drawing pie chart.



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Scenario 3

If you want to further research on why a particular student is **lagging behind** or **excelling ahead**, you can do so by considering -

- Address
- Father's occupation
- Mother's occupation
- Prev academics performance
- Gender (for categorizing in terms of gender)

and later on, you can decide whether to change your teaching methodology or not.

In [ ]:

Note -

- Data Analyst should be wise enough to select the important data variables.
- This helps to get proper insights pertaining to the problem statement that he/she is assigned to do.

In [ ]:

Let's make our hands dirty

data source → http://wiki.stat.ucla.edu/socr/index.php/SOCR_Data_Dinov_020108_HeightsWeights

In [1]:
```python
import pandas as pd
import numpy as np
```

In [2]:
```python
df = pd.read_csv('students_hw.csv')
df.head()
```

Out[2]:

	Height(Inches)	Weight(Pounds)
0	65.78	112.99
1	71.52	136.49
2	69.40	153.03
3	68.22	142.34
4	67.79	144.30

Check the length of the `df`

In [3]:
```python
# shape
df.shape
```

Out[3]: `(200, 2)`

Data Preprocessing

Check for `NaN`

In [4]:
```python
# isnull().any()
df.isnull().any()
```

Out[4]:
```
Height(Inches)    True
Weight(Pounds)    True
dtype: bool
```

In [5]:
```python
# list of columns
df.columns
```

Out[5]: `Index(['Height(Inches)', 'Weight(Pounds)'], dtype='object')`

In [6]:
```python
def check_for_nan(dframe):
    """
    dframe → pandas data frame object
    returns `nan_places` a dictionary of column names and the `nan_indices`
    """
    nan_places = {}

    for col in dframe.columns:
        indices = list(np.where(dframe[col].isnull())[0])
        nan_places[col] = indices

    return nan_places
```

In [7]:
```python
check_for_nan(dframe=df)
```

Out[7]: `{'Height(Inches)': [10, 32], 'Weight(Pounds)': [19]}`

- In the column `Height(Inches)`, there are two `NaN` values at indices `10` and `32`.
- In the column `Weight(Pounds)`, there is one `NaN` value at index `19`.

What can we do for those?

- Remove the entire row which ever column has a `NaN`.

For this, we will remove the rows which ever column has `NaN`. In total, there are 3 rows that need to be removed.

Remove 3 rows

- axis (0) → row
- axis (1) → column

In [8]:
```python
# pdf
# dropna
pdf = df.dropna(axis=0)
```

check the length of `pdf`

In [9]:
```python
# shape
pdf.shape
```

Out[9]: `(197, 2)`

Since the index of the data frame is not in order, we need to reindex the index values to get the perfect order.

In [10]:
```python
# head
pdf.head(12)
```

Out[10]:

	Height(Inches)	Weight(Pounds)
0	65.78	112.99
1	71.52	136.49
2	69.40	153.03
3	68.22	142.34
4	67.79	144.30
5	68.70	123.30
6	69.80	141.49
7	70.01	136.46
8	67.90	112.37
9	66.78	120.67
11	67.62	114.14
12	68.30	125.61

Reset the index

In [11]:
```python
# rdf
# reset with drop
pdf = pdf.reset_index(drop=True)
```

In [12]:
```python
# shape
pdf.shape
```

Out[12]: `(197, 2)`

In [13]:
```python
# head
pdf.head(12)
```

Out[13]:

	Height(Inches)	Weight(Pounds)
0	65.78	112.99
1	71.52	136.49
2	69.40	153.03
3	68.22	142.34
4	67.79	144.30
5	68.70	123.30
6	69.80	141.49
7	70.01	136.46
8	67.90	112.37
9	66.78	120.67
10	67.62	114.14
11	68.30	125.61

Check if `Height(Inches)` < 40

In [14]:
```python
# inch_thresh
inch_thresh = 40
```

In [15]:
```python
# filter with <
pdf[pdf['Height(Inches)'] < 40]
```

Out[15]:

	Height(Inches)	Weight(Pounds)
68	30.84	134.02
93	36.29	120.03

Remove the rows where `Height(Inches)` < 40

- In the above case, we can see two values where height is less than 40.
- We remove by specifying the index values in `drop()` method.

In [16]:
```python
# drop by index
rdf = pdf.drop(index=[68, 93], axis=0)
```

In [17]:
```python
# shape
rdf.shape
```

Out[17]: `(195, 2)`

Reset the index

In [18]:
```python
# hdf
# drop = True
hdf = rdf.reset_index(drop=True)
```

In [19]:
```python
# shape
hdf.shape
```

Out[19]: `(195, 2)`

Since the index of the data frame is not in order, we need to reindex the index values to get the perfect order.

Categorize the data

In [20]:
```python
# avg_height → mean
avg_height = hdf['Height(Inches)'].mean()
```

In [21]:
```python
avg_height
```

Out[21]: `67.95584615384617`

In [22]:
```python
# round()
avg_height = round(avg_height)
```

In [23]:
```python
avg_height
```

Out[23]: `68`

In [24]:
```python
# write code
# height_cat -> consider round()

height_cat = []

for i in hdf['Height(Inches)'].to_list():
    if round(i) < avg_height:
        height_cat.append('Short')
    elif round(i) == avg_height:
        height_cat.append('Average')
    else:
        height_cat.append('Tall')
```

In [25]:
```python
# check len
len(height_cat)
```

Out[25]: `195`

In [26]:
```python
# display
print(height_cat)
```

```
['Short', 'Tall', 'Tall', 'Average', 'Average', 'Tall', 'Tall', 'Tall', 'Average', 'Short', 'Averag
e', 'Average', 'Short', 'Average', 'Tall', 'Short', 'Tall', 'Tall', 'Average', 'Tall', 'Short', 'Aver
age', 'Average', 'Short', 'Tall', 'Short', 'Short', 'Short', 'Tall', 'Short', 'Tall', 'Tall', 'Tall',
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t', 'Tall', 'Short', 'Short', 'Average', 'Average', 'Tall']
```

Make a new column `height_category` in the dataframe - `hdf`

In [27]:
```python
hdf.head()
```

Out[27]:

	Height(Inches)	Weight(Pounds)
0	65.78	112.99
1	71.52	136.49
2	69.40	153.03
3	68.22	142.34
4	67.79	144.30

In [28]:
```python
# new column
hdf['height_cat'] = height_cat
```

In [29]:
```python
# check head
hdf.head()
```

Out[29]:

	Height(Inches)	Weight(Pounds)	height_cat
0	65.78	112.99	Short
1	71.52	136.49	Tall
2	69.40	153.03	Tall
3	68.22	142.34	Average
4	67.79	144.30	Average

Plotting the pie chart to show

- how many are short
- how many are tall

Take `value_counts()` of `height_category` variable

In [30]:
```python
hdf['height_cat'].value_counts()
```

Out[30]:
```
Short      79
Tall       74
Average    42
Name: height_cat, dtype: int64
```

In [31]:
```python
# df_pie → to_frame
df_pie = hdf['height_cat'].value_counts().to_frame()
```

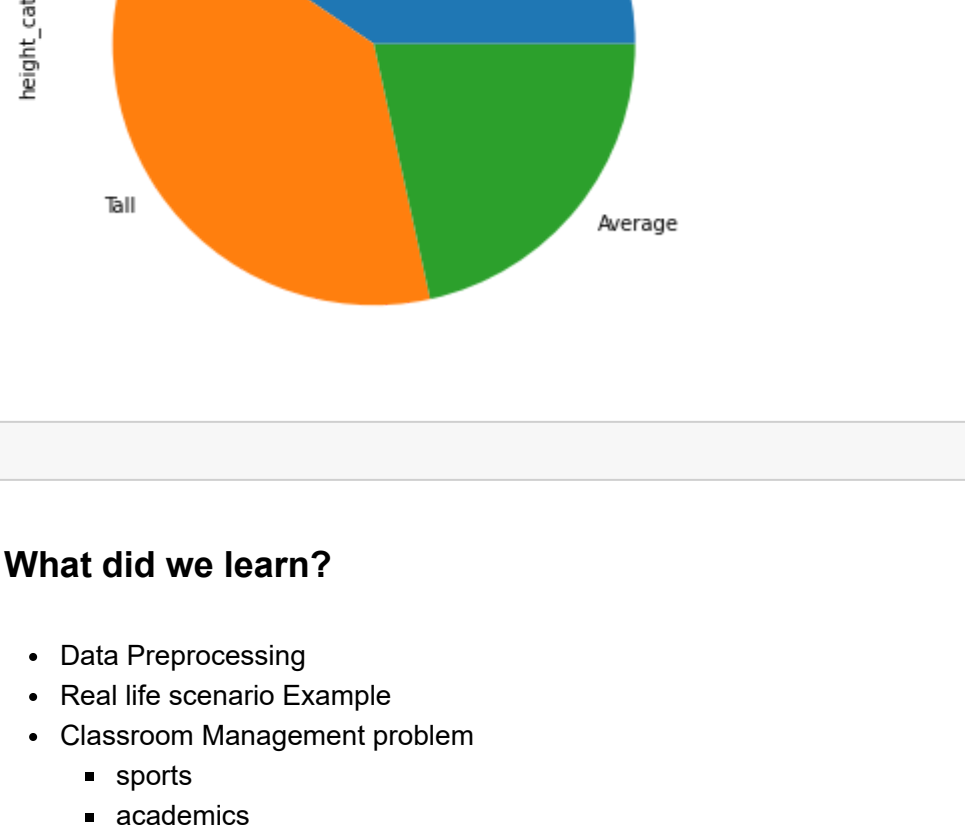
In [32]:
```python
# display df_pie
df_pie
```

Out[32]:

	height_cat
Short	79
Tall	74
Average	42

In [33]:
```python
# plot pie of df_pie with size (width=10, height=6)
df_pie.plot(kind='pie', figsize=(10, 6), subplots=True)
```

Out[33]: `array([<AxesSubplot:ylabel='height_cat'>], dtype=object)`



In [ ]:

What did we learn?

- Data Preprocessing
- Real life scenario Example
- Classroom Management problem
  - sports
  - academics
  - creative work
  - marketing
- Getting hands dirty by writing code
- Plotting the pie chart for showing categorization