```
In [1]: import pandas as pd
```

Data used for this tutorial:

Titanic data

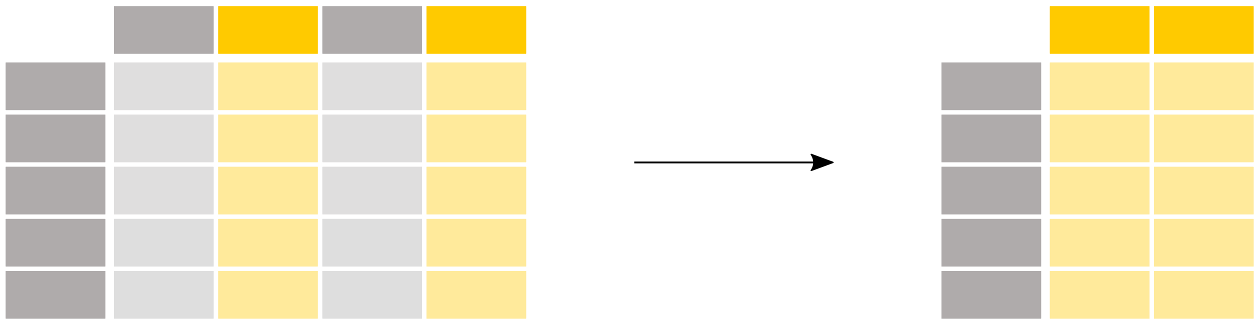
```
In [2]: titanic = pd.read_csv("data/titanic.csv")

In [3]: titanic.head()
Out[3]: 
   PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0            1         0       3  ...   7.2500   NaN         S
1            2         1       1  ...  71.2833   C85         C
2            3         1       3  ...   7.9250   NaN         S
3            4         1       1  ...  53.1000  C123         S
4            5         0       3  ...   8.0500   NaN         S

[5 rows x 12 columns]
```

How do I select a subset of a `DataFrame`?

How do I select specific columns from a `DataFrame`?



I'm interested in the age of the Titanic passengers.

```
In [4]: ages = titanic["Age"]

In [5]: ages.head()
Out[5]: 
0    22.0
1    38.0
2    26.0
3    35.0
4    35.0
Name: Age, dtype: float64
```

To select a single column, use square brackets `[]` with the column name of the column of interest.

Each column in a `DataFrame` is a `Series`. As a single column is selected, the returned object is a pandas `Series`. We can verify this by checking the type of the output:

```
In [6]: type(titanic["Age"])
Out[6]: pandas.core.series.Series
```

And have a look at the `shape` of the output:

```
In [7]: titanic["Age"].shape
Out[7]: (891,)
```

`DataFrame.shape` is an attribute (remember tutorial on reading and writing, do not use parentheses for attributes) of a pandas `Series` and `DataFrame` containing the number of rows and columns: *(nrows, ncolumns)*. A pandas Series is 1-dimensional and only the number of rows is returned.

I'm interested in the age and sex of the Titanic passengers.

```
In [8]: age_sex = titanic[["Age", "Sex"]]

In [9]: age_sex.head()
Out[9]: 
    Age     Sex
0  22.0    male
1  38.0  female
2  26.0  female
3  35.0  female
4  35.0    male
```

To select multiple columns, use a list of column names within the selection brackets `[]`.

Note

The inner square brackets define a Python list with column names, whereas the outer brackets are used to select the data from a pandas `DataFrame` as seen in the previous example.

The returned data type is a pandas DataFrame:

```
In [10]: type(titanic[["Age", "Sex"]])
Out[10]: pandas.core.frame.DataFrame
```

```
In [11]: titanic[["Age", "Sex"]].shape
Out[11]: (891, 2)
```

The selection returned a `DataFrame` with 891 rows and 2 columns. Remember, a `DataFrame` is 2-dimensional with both a row and column dimension.

To user guide For basic information on indexing, see the user guide section on indexing and selecting data.

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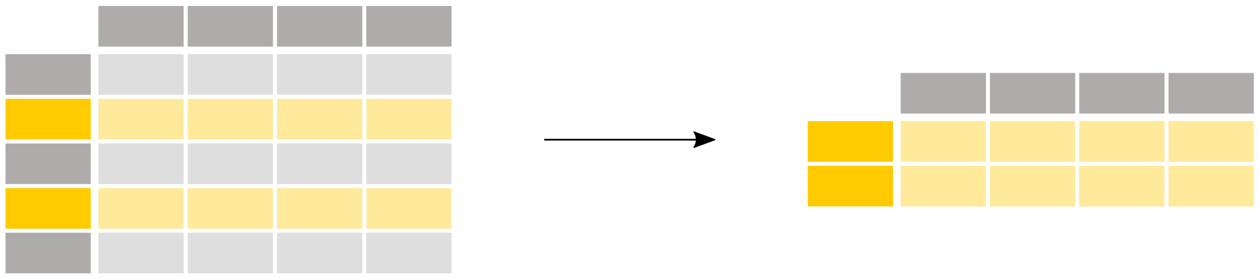

I’m interested in the passengers older than 35 years.

```
In [12]: above_35 = titanic[titanic["Age"] > 35]

In [13]: above_35.head()
Out[13]: 
    PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
1             2         1       1  ...  71.2833   C85         C
6             7         0       1  ...  51.8625   E46         S
11           12         1       1  ...  26.5500  C103         S
13           14         0       3  ...  31.2750   NaN         S
15           16         1       2  ...  16.0000   NaN         S

[5 rows x 12 columns]
```

To select rows based on a conditional expression, use a condition inside the selection brackets `[]`.

The condition inside the selection brackets `titanic["Age"] > 35` checks for which rows the `Age` column has a value larger than 35:

```
In [14]: titanic["Age"] > 35
Out[14]: 
0      False
1       True
2      False
3      False
4      False
       ...  
886    False
887    False
888    False
889    False
890    False
Name: Age, Length: 891, dtype: bool
```

The output of the conditional expression (`>`, but also `==`, `!=`, `<`, `<=`,... would work) is actually a pandas `Series` of boolean values (either `True` or `False`) with the same number of rows as the original `DataFrame`. Such a `Series` of boolean values can be used to filter the `DataFrame` by putting it in between the selection brackets `[]`. Only rows for which the value is `True` will be selected.

We know from before that the original Titanic `DataFrame` consists of 891 rows. Let’s have a look at the number of rows which satisfy the condition by checking the `shape` attribute of the resulting `DataFrame` `above_35`:

```
In [15]: above_35.shape
Out[15]: (217, 12)
```

I’m interested in the Titanic passengers from cabin class 2 and 3.

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```
In [16]: class_23 = titanic[titanic["Pclass"].isin([2, 3])]

In [17]: class_23.head()
Out[17]: 
   PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0            1         0       3  ...   7.2500   NaN         S
2            3         1       3  ...   7.9250   NaN         S
4            5         0       3  ...   8.0500   NaN         S
5            6         0       3  ...   8.4583   NaN         Q
7            8         0       3  ...  21.0750   NaN         S

[5 rows x 12 columns]
```

Similar to the conditional expression, the `isin()` conditional function returns a `True` for each row the values are in the provided list. To filter the rows based on such a function, use the conditional function inside the selection brackets `[]`. In this case, the condition inside the selection brackets `titanic["Pclass"].isin([2, 3])` checks for which rows the `Pclass` column is either 2 or 3.

The above is equivalent to filtering by rows for which the class is either 2 or 3 and combining the two statements with an `|` (or) operator:

```
In [18]: class_23 = titanic[(titanic["Pclass"] == 2) | (titanic["Pclass"] == 3)]

In [19]: class_23.head()
Out[19]: 
   PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0            1         0       3  ...   7.2500   NaN         S
2            3         1       3  ...   7.9250   NaN         S
4            5         0       3  ...   8.0500   NaN         S
5            6         0       3  ...   8.4583   NaN         Q
7            8         0       3  ...  21.0750   NaN         S

[5 rows x 12 columns]
```

Note

When combining multiple conditional statements, each condition must be surrounded by parentheses `()`. Moreover, you can not use `or`/`and` but need to use the `or` operator `|` and the `and` operator `&`.

To user guide   See the dedicated section in the user guide about boolean indexing or about the isin function.

I want to work with passenger data for which the age is known.

```
In [20]: age_no_na = titanic[titanic["Age"].notna()]

In [21]: age_no_na.head()
Out[21]: 
   PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0            1         0       3  ...   7.2500   NaN         S
1            2         1       1  ...  71.2833   C85         C
2            3         1       3  ...   7.9250   NaN         S
3            4         1       1  ...  53.1000  C123         S
4            5         0       3  ...   8.0500   NaN         S

[5 rows x 12 columns]
```

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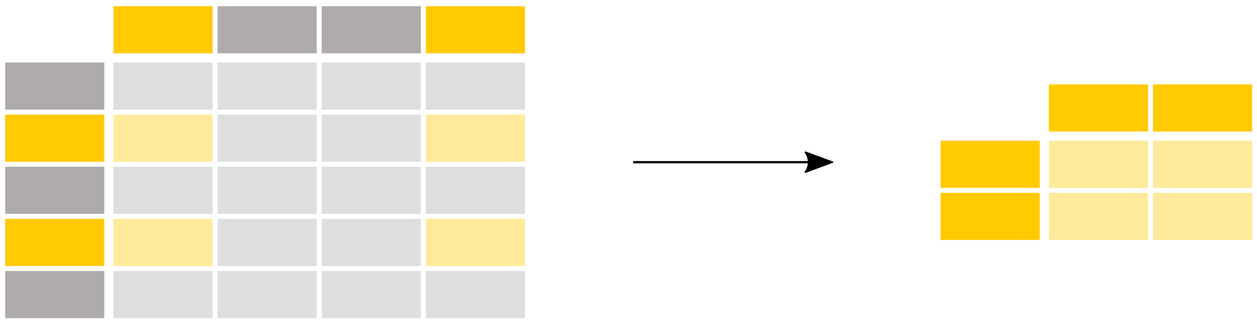
The `notna()` conditional function returns a `True` for each row the values are not a `Null` value. As such, this can be combined with the selection brackets `[]` to filter the data table.

You might wonder what actually changed, as the first 5 lines are still the same values. One way to verify is to check if the shape has changed:

```
In [22]: age_no_na.shape
Out[22]: (714, 12)
```

To user guide For more dedicated functions on missing values, see the user guide section about handling missing data.

How do I select specific rows and columns from a `DataFrame`?



I'm interested in the names of the passengers older than 35 years.

```
In [23]: adult_names = titanic.loc[titanic["Age"] > 35, "Name"]

In [24]: adult_names.head()
Out[24]: 
1     Cumings, Mrs. John Bradley (Florence Briggs Th...
6                               McCarthy, Mr. Timothy J
11                             Bonnell, Miss. Elizabeth
13                          Andersson, Mr. Anders Johan
15                     Hewlett, Mrs. (Mary D Kingcome) 
Name: Name, dtype: object
```

In this case, a subset of both rows and columns is made in one go and just using selection brackets `[]` is not sufficient anymore. The `loc`/`iloc` operators are required in front of the selection brackets `[]`. When using `loc`/`iloc`, the part before the comma is the rows you want, and the part after the comma is the columns you want to select.

When using the column names, row labels or a condition expression, use the `loc` operator in front of the selection brackets `[]`. For both the part before and after the comma, you can use a single label, a list of labels, a slice of labels, a conditional expression or a colon. Using a colon specifies you want to select all rows or columns.

I'm interested in rows 10 till 25 and columns 3 to 5.

```
In [25]: titanic.iloc[9:25, 2:5]
Out[25]: 
    Pclass                                 Name     Sex
9        2  Nasser, Mrs. Nicholas (Adele Achem)  female
```

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```
12       3      Saundercock, Mr. William Henry    male
13       3         Andersson, Mr. Anders Johan    male
..     ...                                 ...     ...
20       2                Fynney, Mr. Joseph J    male
21       2               Beesley, Mr. Lawrence    male
22       3         McGowan, Miss. Anna "Annie"  female
23       1        Sloper, Mr. William Thompson    male
24       3       Palsson, Miss. Torborg Danira  female

[16 rows x 3 columns]
```

Again, a subset of both rows and columns is made in one go and just using selection brackets `[]` is not sufficient anymore. When specifically interested in certain rows and/or columns based on their position in the table, use the `iloc` operator in front of the selection brackets `[]`.

When selecting specific rows and/or columns with `loc` or `iloc`, new values can be assigned to the selected data. For example, to assign the name `anonymous` to the first 3 elements of the fourth column:

```
In [26]: titanic.iloc[0:3, 3] = "anonymous"

In [27]: titanic.head()
Out[27]: 
   PassengerId  Survived  Pclass  ...     Fare Cabin  Embarked
0            1         0       3  ...   7.2500   NaN         S
1            2         1       1  ...  71.2833   C85         C
2            3         1       3  ...   7.9250   NaN         S
3            4         1       1  ...  53.1000  C123         S
4            5         0       3  ...   8.0500   NaN         S

[5 rows x 12 columns]
```

To user guide   See the user guide section on different choices for indexing to get more insight in the usage of `loc` and `iloc`.

REMEMBER

- When selecting subsets of data, square brackets `[]` are used.
- Inside these brackets, you can use a single column/row label, a list of column/row labels, a slice of labels, a conditional expression or a colon.
- Select specific rows and/or columns using `loc` when using the row and column names.
- Select specific rows and/or columns using `iloc` when using the positions in the table.
- You can assign new values to a selection based on `loc`/`iloc`.