# Reference guide: Data cleaning in Python

This reference guide contains common functions and methods that data professionals use to clean data. The reference guide contains three different tables of useful tools, each grouped by cleaning category: missing data, outliers, and label encoding. standard

## Missing data

The following pandas functions and methods are helpful when dealing with missing data.

### df.info()

 Description: A DataFrame method that returns a concise summary of the dataframe, including a 'non-null count,' which helps you know the number of missing values

#### **Example input:**

```
print(df)
print()
df.info()
```

```
        planet
        radius_km
        moons

        0 Mercury
        2440
        0

        1 Venus
        6052
        0

        2 Earth
        6371
        1

        3 Mars
        3390
        2

        4 Jupiter
        69911
        80

        5 Saturn
        58232
        83

        6 Uranus
        25362
        27

        7 Neptune
        24622
        14
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8 entries, 0 to 7
Data columns (total 3 columns):
planet 8 non-null object
radius_km 8 non-null int64
moons 8 non-null int64
dtypes: int64(2), object(1)
memory usage: 272.0+ bytes
```

## df.isna() / isnull()

 Description: A pandas function that returns a same-sized Boolean array indicating whether each value is null (you can also use pd.isnull() as an alias). Note that this function also exists as a DataFrame method.

### **Example input:**

```
print(df)
print('\n After pd.isnull(): \n')
pd.isnull(df)
```

#### **Example output:**

```
Planet radius_km moons

Mercury 2440 NaN

Venus 6052 NaN

Earth 6371 1.0

Mars 3390 NaN

Jupiter 69911 80.0

Saturn 58232 83.0

Uranus 25362 27.0

Neptune 24622 14.0

After pd.isnull():

Planet radius_km moons

False False True

False False True

False False False

False False False
```

## pd.notna() / notnull()

6 False False False 7 False False False

• **Description:** A pandas function that returns a same-sized Boolean array indicating whether each value is NOT null (you can also use pd.notnull() as an alias). Note that this function also exists as a DataFrame method.

### **Example input:**

```
print(df)
print('\n After notnull(): \n')
pd.notnull(df)
```

### **Example output:**

```
        Planet
        radius_km
        moons

        0
        Mercury
        2440
        NaN

        1
        Venus
        6052
        NaN

        2
        Earth
        6371
        1.0

        3
        Mars
        3390
        NaN

        4
        Jupiter
        69911
        80.0

        5
        Saturn
        58232
        83.0

        6
        Uranus
        25362
        27.0

        7
        Neptune
        24622
        14.0

After notnull():

Planet radius_km moons

True False

True False

True True False

True True

True True

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```

## df.fillna()

 Description: A DataFrame method that fills in missing values using specified method

### **Example input:**

```
print(df)
print('\n After fillna(): \n')
df.fillna(2)
```

```
animal class color legs
0 cardinal Aves red NaN
1 gecko Reptilia green 4.0
2 raven Aves black NaN

After fillna():

animal class color legs
0 cardinal Aves red 2.0
1 gecko Reptilia green 4.0
2 raven Aves black 2.0
```

The following image shows a value of 2.3 replacing a NaN in a data cell.



## df.replace()

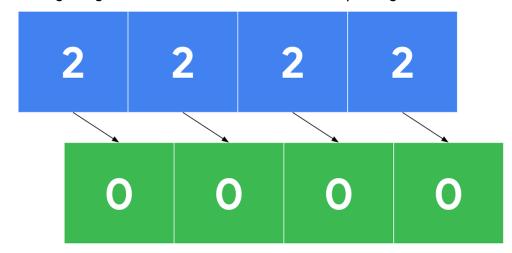
• **Description:** A DataFrame method that replaces specified values with other specified values. Can also be applied to pandas Series.

### **Example input:**

```
print(df)
print('\n After replace(): \n')
df.replace('Aves', 'bird')
```

```
animal
           class color legs
  cardinal
             Aves red
1
    gecko Reptilia green
2
    raven
             Aves black
                           2
After replace():
    animal class color legs
                           2
0 cardinal
             bird
                   red
1
    gecko Reptilia green
                           4
    raven bird black
```

The following image shows that four 2s in cells are replacing 0s.



## df.dropna()

• **Description:** A DataFrame method that removes rows or columns that contain missing values, depending on the axis you specify.

#### **Example input:**

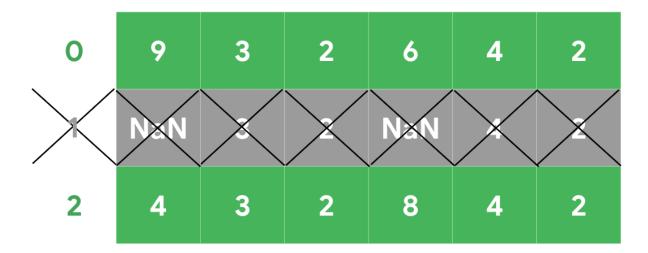
```
print('Original df: \n \n', df)
print('\n After dropna(axis=0): \n')
print(df.dropna(axis=0))

print('\n After dropna(axis=1): \n')
print(df.dropna(axis=1))
```

```
Original df:
  animal
         class color legs
 NaN Aves red
                      2
1 gecko Reptilia green
                        4
                       2
2 raven Aves NaN
After dropna(axis=0):
 animal
          class color legs
1 gecko Reptilia green 4
After dropna(axis=1):
    class legs
     Aves
```

```
1 Reptilia 4
2 Aves 2
```

The following image shows a sequence of numbers with missing value data cells being removed.



## **Outliers**

The following tools are helpful when dealing with outliers in a dataset.

## df.describe()

• **Description:** A DataFrame method that returns general statistics about the dataframe which can help determine outliers

### **Example input:**

```
print(df)
print()
df.describe()
```

	planet	radius_km	moons
0	Mercury	$2\overline{4}40$	0
1	Venus	6052	0
2	Earth	6371	1
3	Mars	3390	2
4	Jupiter	69911	80
5	Saturn	58232	83
6	Uranus	25362	27
7	Neptune	24622	14

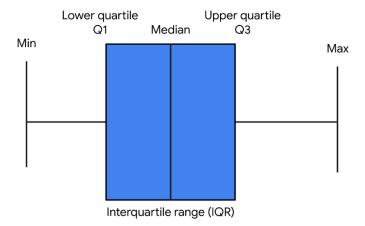
	radius_km	moons
count	8.000000	8.00000
mean	24547.500000	25.87500
std	26191.633528	35.58265
min	2440.000000	0.0000
25%	5386.500000	0.75000
50%	15496.500000	8.00000
75%	33579.500000	40.25000
max	69911.000000	83.00000

### sns.boxplot()

• **Description:** A seaborn function that generates a box plot. Data points beyond 1.5x the interquartile range are considered outliers.

### **Example:**

The following image shows an example graph of a box plot with min, max, lower and upper quartiles, and the median labeled.



## Label encoding

The following tools are helpful when performing label encoding.

## df.astype()

• **Description:** A DataFrame method that allows you to encode its data as a specified dtype. Note that this method can also be used on Series objects.

#### **Example input:**

print(df)

```
print('\n Original dtypes of df: \n')
print(df.dtypes)
print('\n dtypes after casting \'class\' column as categorical: \n')
df['class'] = df['class'].astype('category')
print(df.dtypes)
```

#### **Example output:**

```
animal class color legs

0 cardinal Aves red 2

1 gecko Reptilia green 4

2 raven Aves black 2

Original dtypes of df:

animal object
class object
color object
legs int64
dtype: object

dtypes after casting 'class' column as categorical:

animal object
class category
color object
legs int64
dtype: object
```

### **Series.cat.codes**

 Description: A Series attribute that returns the numeric category codes of the series

#### **Example input:**

```
# Cast 'class' column as categorical
df['class'] = df['class'].astype('category')

print('\n \'class\' column: \n')
print(df['class'])

print('\n Category codes of \'class\' column: \n')
```

```
df['class'].cat.codes
```

### **Example output:**

```
'class' column:

0     Aves
1     Reptilia
2     Aves
Name: class, dtype: category
Categories (2, object): [Aves, Reptilia]

Category codes of 'class' column:

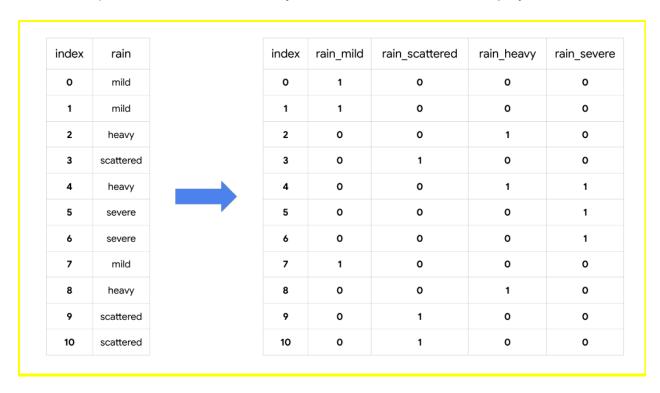
0     0
1     1
2     0
dtype: int8
```

### get\_dummies()

• **Description:** Converts categorical values into new binary columns—one for each different category

### **Example:**

The following image shows a rain column with values of mild, scattered, heavy, and severe is replaced with four new binary columns—one for each category.



### **LabelEncoder()**

• **Description:** A transformer from scikit-learn.preprocessing that encodes specified categories or labels with numeric codes. Note that when building predictive models it should only be used on target variables (i.e., y data).

#### **Example:**

#### It can be used to normalize labels:

```
from sklearn.preprocessing import LabelEncoder
# Instantiate LabelEncoder()
encoder = LabelEncoder()
data = [1, 2, 2, 6]
# Fit to the data
encoder.fit(data)
# Transform the data
transformed = encoder.transform(data)
# Reverse the transformation
inverse = encoder.inverse transform(transformed)
print('Data =', data)
print('\n Classes: \n', encoder.classes )
print('\n Encoded (normalized) classes: \n', transformed)
print('\n Reverse from encoded classes to original: \n', inverse)
Output:
Data = [1, 2, 2, 6]
Classes:
 [1 2 6]
Encoded (normalized) classes:
 [0 1 1 2]
 Reverse from encoded classes to original:
 [1 2 2 6]
```

It can be used to convert categorical labels into numeric:

```
from sklearn.preprocessing import LabelEncoder
# Instantiate LabelEncoder()
encoder = LabelEncoder()
data = ['paris', 'paris', 'tokyo', 'amsterdam']
# Fit to the data
encoder.fit(data)
# Transform the data
transformed = encoder.transform(data)
# New data
new data = [0, 2, 1, 1, 2]
# Get classes of new data
inverse = encoder.inverse transform(new data)
print('Data =', data)
print('\n Classes: \n', list(encoder.classes ))
print('\n Encoded classes: \n', transformed)
print('\n New data =', new data)
print('\n Convert new data to original classes: \n', list(inverse))
Output:
Data = ['paris', 'paris', 'tokyo', 'amsterdam']
 ['amsterdam', 'paris', 'tokyo']
Encoded classes:
 [1 1 2 0]
New data = [0, 2, 1, 1, 2]
 Convert new data to original classes:
 ['amsterdam', 'tokyo', 'paris', 'paris', 'tokyo']
```

# Key takeaways

There are many tools that data professionals can use to perform data cleaning on a wide range of data. The information you learn from missing data, outliers, and transforming categorical to numeric data will help you prepare datasets for further analysis throughout your career.