```
# import library
import pandas as pd
import numpy as np
```

```
# import data
cement = pd.read_csv('https://github.com/ybifoundation/Dataset/raw/main/Concrete%20Compressive%20Strength.csv')
```

```
# view data
cement.head()
```

	Cement (kg in a m^3 mixture)	Blast Furnace Slag (kg in a m^3 mixture)	Fly Ash (kg in a m^3 mixture)	Water (kg in a m^3 mixture)	Superplasticizer (kg in a m^3 mixture)	Coarse Aggregate (kg in a m^3 mixture)	Fine Aggregate (kg in a m^3 mixture)
0	540.0	0.0	0.0	162.0	2.5	1040.0	676.0
1	540.0	0.0	0.0	162.0	2.5	1055.0	676.0
2	332.5	142.5	0.0	228.0	0.0	932.0	594.0
3	332.5	142.5	0.0	228.0	0.0	932.0	594.0
4	198.6	132.4	0.0	192.0	0.0	978.4	825.5

```
# info of data
cement.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1030 entries, 0 to 1029
Data columns (total 9 columns):
 #   Column                                          Non-Null Count  Dtype
---  ------                                          --------------  -----
 0   Cement (kg in a m^3 mixture)                    1030 non-null   float64
 1   Blast Furnace Slag (kg in a m^3 mixture)        1030 non-null   float64
                                                                     float64
                                                                     float64
                                                                     float64
 5   Coarse Aggregate (kg in a m^3 mixture)          1030 non-null   float64
 6   Fine Aggregate (kg in a m^3 mixture)            1030 non-null   float64
 7   Age (day)                                       1030 non-null   int64
 8   Concrete Compressive Strength(MPa, megapascals) 1030 non-null   float64
dtypes: float64(8), int64(1)
memory usage: 72.5 KB
```

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```
# summary statistics
cement.describe()
```

	Cement (kg in a m^3 mixture)	Blast Furnace Slag (kg in a m^3 mixture)	Fly Ash (kg in a m^3 mixture)	Water (kg in a m^3 mixture)	Superplasticizer (kg in a m^3 mixture)	Co Aggre (kg mixt
count	1030.000000	1030.000000	1030.000000	1030.000000	1030.000000	1030.00
mean	281.165631	73.895485	54.187136	181.566359	6.203112	972.91
std	104.507142	86.279104	63.996469	21.355567	5.973492	77.75
min	102.000000	0.000000	0.000000	121.750000	0.000000	801.00
25%	192.375000	0.000000	0.000000	164.900000	0.000000	932.00
50%	272.900000	22.000000	0.000000	185.000000	6.350000	968.00
75%	350.000000	142.950000	118.270000	192.000000	10.160000	1029.40
max	540.000000	359.400000	200.100000	247.000000	32.200000	1145.00

```
# checkmax for missing 540.000000 value 359.400000 200.100000 247.000000 32.200000 1145.000000 992.600000 365.000000 82.599225
cement.isna().sum()
```

```
Cement (kg in a m^3 mixture)                        0
Blast Furnace Slag (kg in a m^3 mixture)            0
```

```
Fly Ash (kg in a m^3 mixture)                            0
Water (kg in a m^3 mixture)                              0
Superplasticizer (kg in a m^3 mixture)                   0
Coarse Aggregate (kg in a m^3 mixture)                   0
Fine Aggregate (kg in a m^3 mixture)                     0
Age (day)                                                0
Concrete Compressive Strength(MPa, megapascals)          0
dtype: int64
```

```
# check for categories
cement.nunique()
```

```
Cement (kg in a m^3 mixture)                             280
Blast Furnace Slag (kg in a m^3 mixture)                 187
Fly Ash (kg in a m^3 mixture)                            163
Water (kg in a m^3 mixture)                              205
Superplasticizer (kg in a m^3 mixture)                   155
Coarse Aggregate (kg in a m^3 mixture)                   284
Fine Aggregate (kg in a m^3 mixture)                     304
Age (day)                                                 14
Concrete Compressive Strength(MPa, megapascals)          938
dtype: int64
```

```
# visualize pairplot
import seaborn as sns
sns.pairplot(cement)
```

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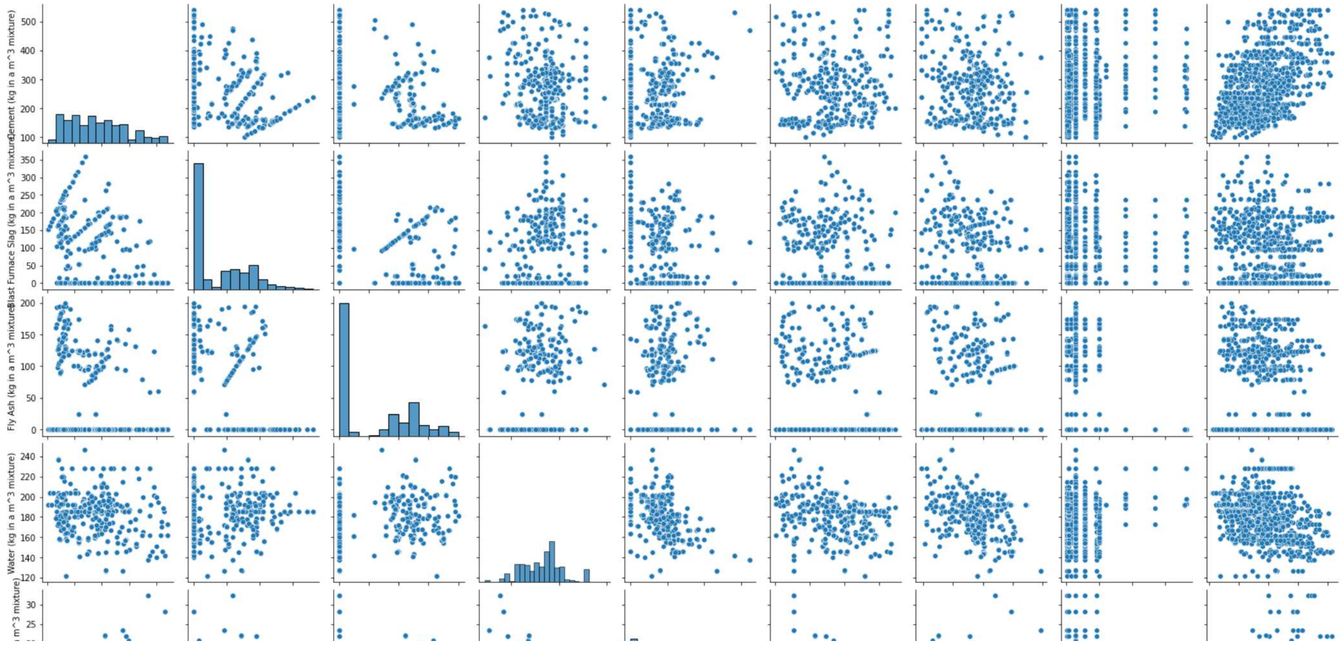
```
<seaborn.axisgrid.PairGrid at 0x7fece6cbbc70>
```



```
# columns name
cement.columns
```

```
Index(['Cement (kg in a m^3 mixture)',
       'Blast Furnace Slag (kg in a m^3 mixture)',
       'Fly Ash (kg in a m^3 mixture)', 'Water (kg in a m^3 mixture)',
       'Superplasticizer (kg in a m^3 mixture)',
       'Coarse Aggregate (kg in a m^3 mixture)',
       'Fine Aggregate (kg in a m^3 mixture)', 'Age (day)',
       'Concrete Compressive Strength(MPa, megapascals) '],
      dtype='object')
```

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```
y=cement['Concrete Compressive Strength(MPa, megapascals) ']
```

```
# define X
```

```
X=cement[['Cement (kg in a m^3 mixture)',
'Blast Furnace Slag (kg in a m^3 mixture)',
'Fly Ash (kg in a m^3 mixture)', 'Water (kg in a m^3 mixture)',
'Superplasticizer (kg in a m^3 mixture)',
'Coarse Aggregate (kg in a m^3 mixture)',
'Fine Aggregate (kg in a m^3 mixture)', 'Age (day)']]
```

```
# split data
from sklearn.model_selection import train_test_split
X_train,X_test,y_train,y_test=train_test_split(X,y,train_size=0.7,random_state=2559)
```

```
# verify shape
X_train.shape,X_test.shape,y_train.shape,y_test.shape
```

```
((721, 8), (309, 8), (721,), (309,))
```

```
# select model
from sklearn.linear_model import LinearRegression
model=LinearRegression()
```

```
# train model
model.fit(X_train,y_train)
```

```
LinearRegression()
```

```
# predict with model
y_pred=model.predict(X_test)
```

```
# model evaluation
from sklearn.metrics import mean_absolute_error,mean_absolute_percentage_error,mean_squared_error
```

```
# model MAE
mean_absolute_error(y_test,y_pred)
```

```
7.814891951068712
```

```
# model MAPE
mean_absolute_percentage_error(y_test,y_pred)
```

```
0.28040027489426594
```

```
# model MSE
mean_squared_error(y_test,y_pred)
```

```
102.62674212692517
```

```
# future prediction
X.sample()
```

	Cement (kg in a m^3 mixture)	Blast Furnace Slag (kg in a m^3 mixture)	Fly Ash (kg in a m^3 mixture)	Water (kg in a m^3 mixture)	Superplasticizer (kg in a m^3 mixture)	Coarse Aggregate (kg in a m^3 mixture)	Fin Aggregat (kg in m^ mixture
342	297.16	0.0	117.54	174.8	9.52	1022.8	753.4

```
# define X_new
X_new=X.sample()
X_new
```

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	mixture)	in a m^3 mixture)	mixture)	mixture)	mixture)	e e a m^3 mixture)	Fin Aggregat (kg in m^ mixture
977	313.3	145.0	0.0	178.5	8.0	1001.9	688

```
# predict for X_new
model.predict(X_new)
```

```
array([40.09980209])
```