이번 수업에서는

1. 행/ 열 추가
2. 원소 선택
3. 원소 변경

행 추가

- 객체.loc["새로운 행의 이름"] = 데이터값들 (리스트 또는 배열)

```
df.loc["상기"] = [95, 100, 80, 95]
```

[illegible]

[illegible]

	수학	영어	음악	체육
서준	90	98	85	100
우현	80	89	95	90
인아	70	95	100	90
상기	95	100	80	95

열 추가

- 객체["새로운 열의 이름"] = 데이터값들 (리스트 또는 배열)

```
df["미술"] = [80, 90, 95, 100]
```

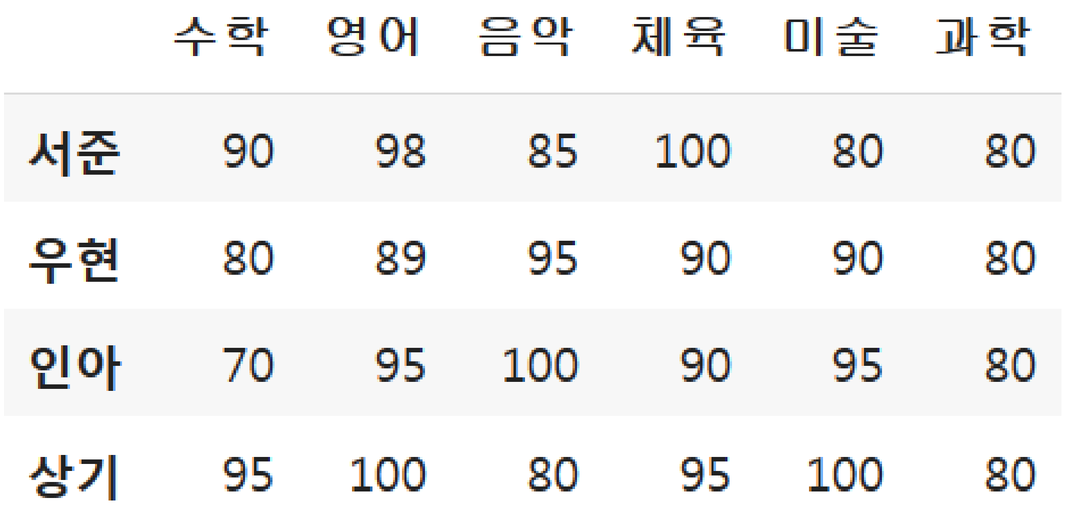
	수학	영어	음악	체육	미술
서준	90	98	85	100	80
우현	80	89	95	90	90
인아	70	95	100	90	95
상기	95	100	80	95	100

열 추가

➢ 객체["새로운 열의 이름"] = 데이터값들 (리스트 또는 배열)

```
df["과학"] = [80]
df["과학"] = 80
```

```
ValueError: Length of values does not match length of index
```

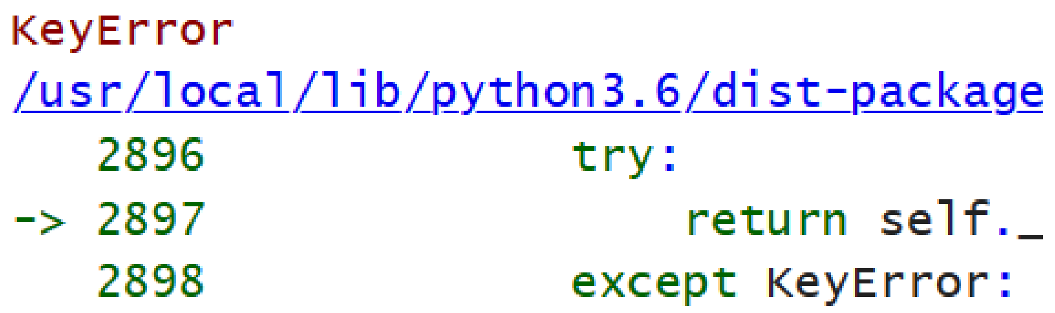


	수학	영어	음악	체육	미술	과학
서준	90	98	85	100	80	80
우현	80	89	95	90	90	80
인아	70	95	100	90	95	80
상기	95	100	80	95	100	80

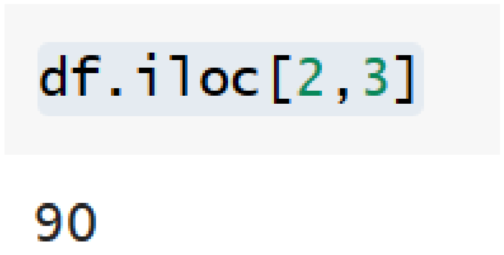
원소 선택(조회)

➢ 객체.iloc[행번호, 열번호]

```
df[2,3]                # pandas는 numpy 가 아니다
df.iloc[2,3]
df.iloc[2] [3]
```

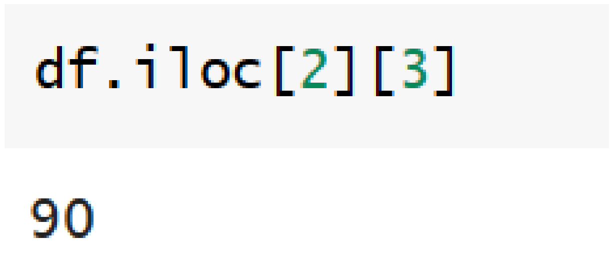


```
KeyError
/usr/local/lib/python3.6/dist-package
   2896                try:
-> 2897                    return self._
   2898                except KeyError:
```



```
df.iloc[2,3]
```

```
90
```



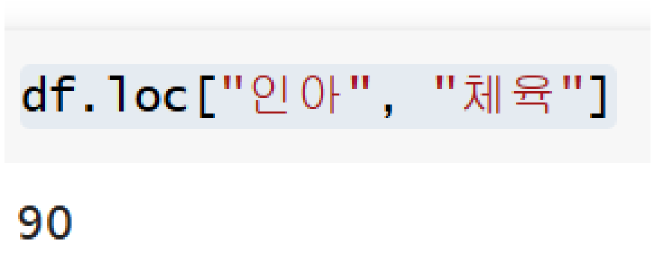
```
df.iloc[2][3]
```

```
90
```

원소 선택

➢ 객체.loc["행이름", "열이름"]

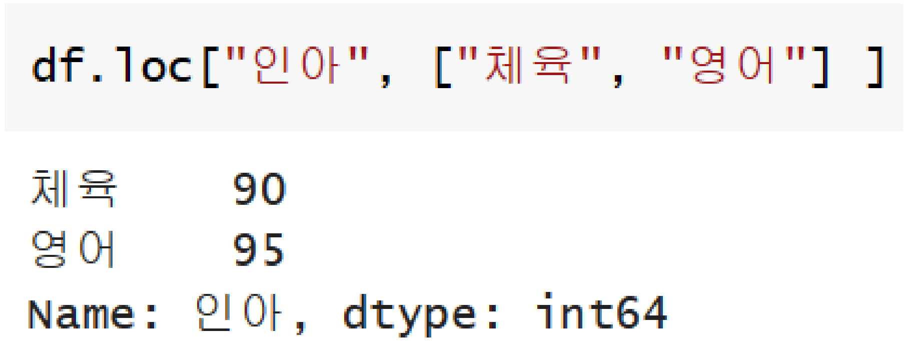
```
df.loc["인아", "체육"]
```



```
df.loc["인아", "체육"]
```

```
90
```

```
df.loc["인아", ["체육", "영어"] ]     # df.iloc[2, [3, 1] ]
```



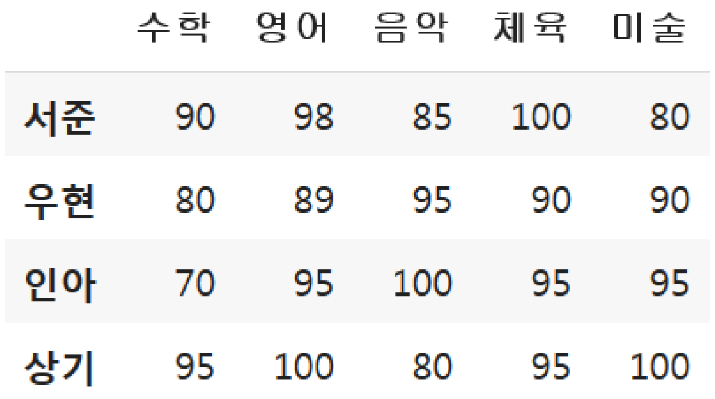
```
df.loc["인아", ["체육", "영어"] ]
```

```
체육    90
영어    95
Name: 인아, dtype: int64
```

원소 값 바꾸기

➤ **원소 선택 = 새로운 값**

```
# 인아의 체육점수를 95점으로
df.loc["인아", "체육"] = 95
```



	수학	영어	음악	체육	미술
서준	90	98	85	100	80
우현	80	89	95	90	90
인아	70	95	100	95	95
상기	95	100	80	95	100

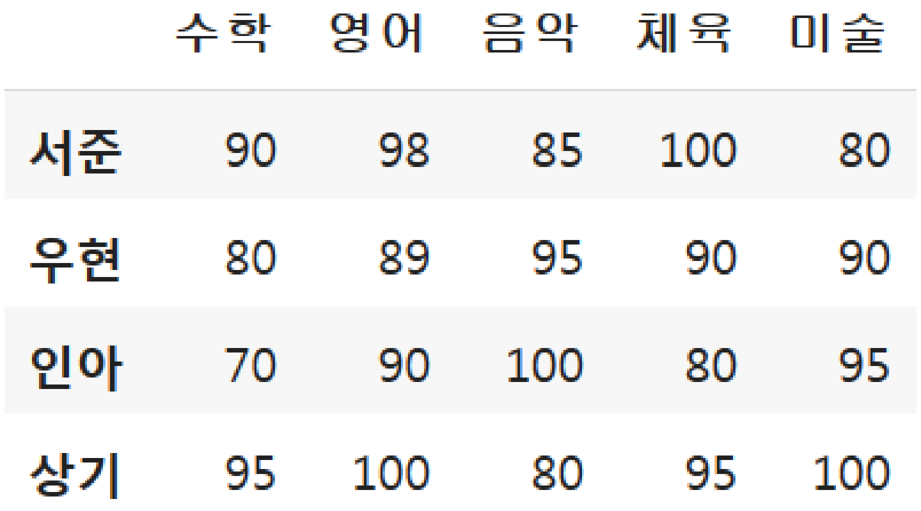
```
df.iloc[2, 3] = 90
df
```

원소 값 바꾸기

- Extract a diagonal or construct a diagona

➢ 여러 개를 바꾸려면

```
df.loc["인아", ["체육", "영어"] ]  = 80, 90
```



	수학	영어	음악	체육	미술
서준	90	98	85	100	80
우현	80	89	95	90	90
인아	70	90	100	80	95
상기	95	100	80	95	100

이번 수업에서는

1. 파일 읽기. csv, Excel   쓰기
2. 데이터 프레임 살펴보기
3. 기본 통계함수 적용해 보기

csv 파일 읽기

```python
df = pd.read_csv("https://raw.githubusercontent.com/plotly/datasets/master/auto-mpg.csv")
df
```

	mpg	cylinders	displacement	horsepower	weight	acceleration	model-year
0	18.0	8	307.0	130.0	3504	12.0	70
1	15.0	8	350.0	165.0	3693	11.5	70
2	18.0	8	318.0	150.0	3436	11.0	70
3	16.0	8	304.0	150.0	3433	12.0	70

```python
df.to_csv("mpg.csv")
```

excel 파일 읽기

```
df = pd.read_excel('http://qrc.depaul.edu/Excel_Files/Presidents.xls')
df
```

	President	Years in office	Year first inaugurated	Age at inauguration	State elected from	# of electoral votes
0	George Washington	8.0	1789	57	Virginia	69
1	John Adams	4.0	1797	61	Massachusetts	132
2	Thomas Jefferson	8.0	1801	57	Virginia	73

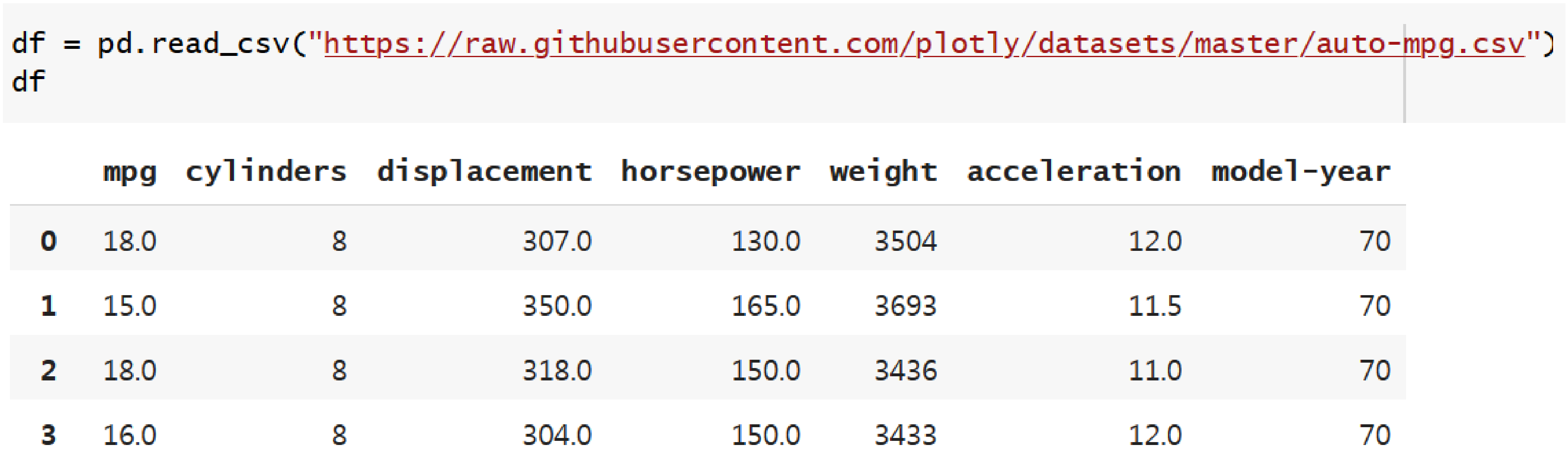
```
df.to_excel("President.xlsx")
```

데이터 프레임 살펴보기

- head( )
- tail( )
- describe( )

- shape
- dtypes

데이터프레임 살펴보기



```python
df = pd.read_csv("https://raw.githubusercontent.com/plotly/datasets/master/auto-mpg.csv")
df
```

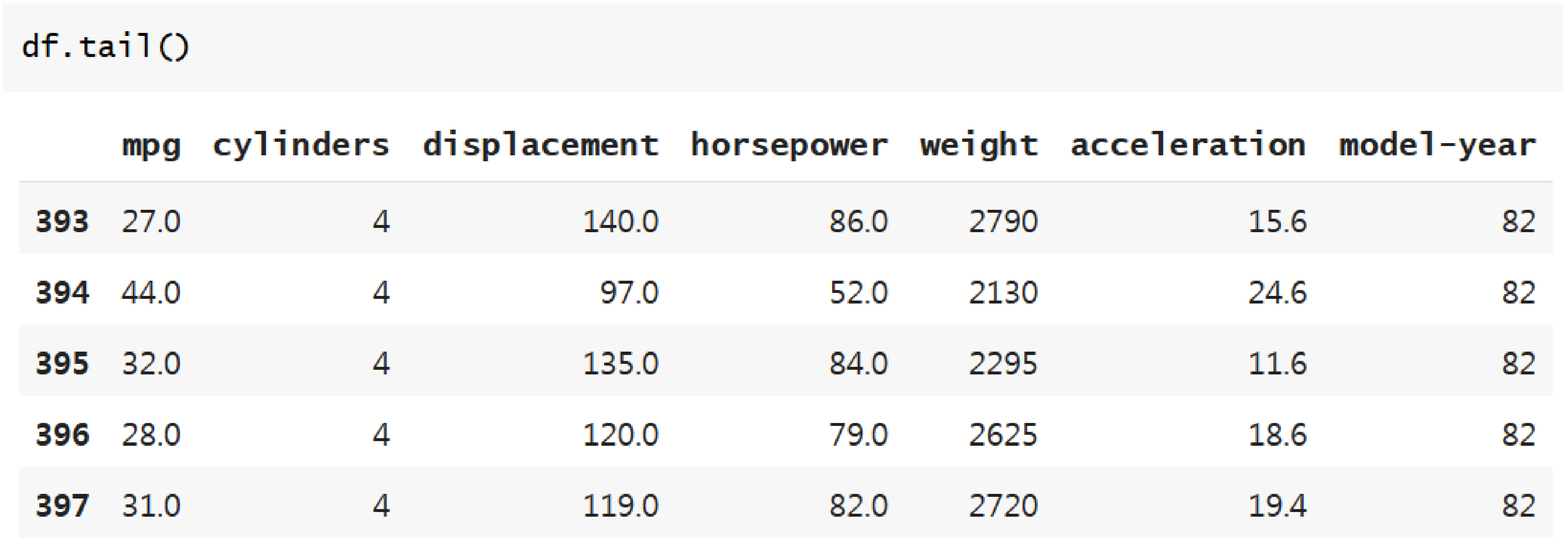
	mpg	cylinders	displacement	horsepower	weight	acceleration	model-year
0	18.0	8	307.0	130.0	3504	12.0	70
1	15.0	8	350.0	165.0	3693	11.5	70
2	18.0	8	318.0	150.0	3436	11.0	70
3	16.0	8	304.0	150.0	3433	12.0	70

데이터프레임 살펴보기

```
df.head()
```

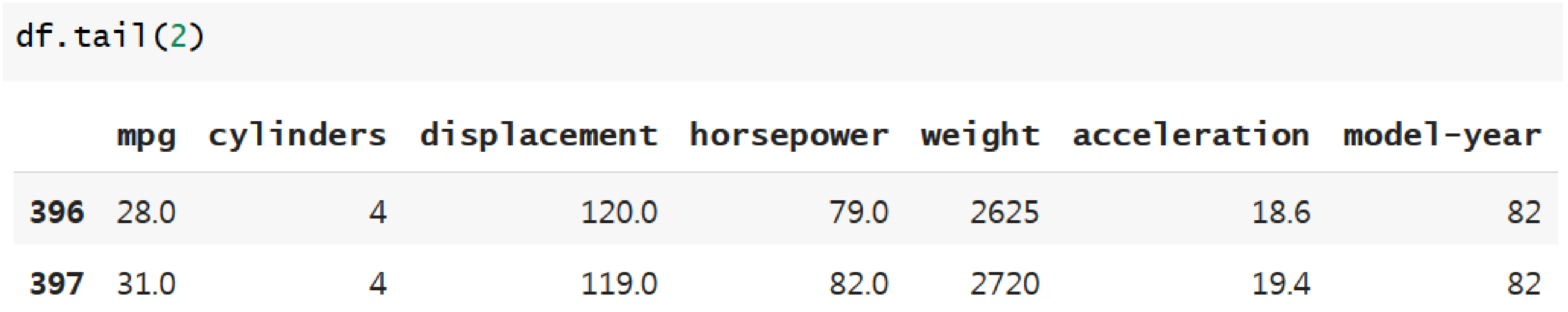
	mpg	cylinders	displacement	horsepower	weight	acceleration	model-year
0	18.0	8	307.0	130.0	3504	12.0	70
1	15.0	8	350.0	165.0	3693	11.5	70
2	18.0	8	318.0	150.0	3436	11.0	70
3	16.0	8	304.0	150.0	3433	12.0	70
4	17.0	8	302.0	140.0	3449	10.5	70

데이터프레임 살펴보기



```python
df.tail()
```

	mpg	cylinders	displacement	horsepower	weight	acceleration	model-year
393	27.0	4	140.0	86.0	2790	15.6	82
394	44.0	4	97.0	52.0	2130	24.6	82
395	32.0	4	135.0	84.0	2295	11.6	82
396	28.0	4	120.0	79.0	2625	18.6	82
397	31.0	4	119.0	82.0	2720	19.4	82



```python
df.tail(2)
```

	mpg	cylinders	displacement	horsepower	weight	acceleration	model-year
396	28.0	4	120.0	79.0	2625	18.6	82
397	31.0	4	119.0	82.0	2720	19.4	82

데이터프레임 살펴보기

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 398 entries, 0 to 397
Data columns (total 7 columns):
mpg             398 non-null float64
cylinders       398 non-null int64
displacement    398 non-null float64
horsepower      396 non-null float64
weight          398 non-null int64
acceleration    398 non-null float64
model-year      398 non-null int64
dtypes: float64(4), int64(3)
memory usage: 21.9 KB
```

```
df.shape
```

```
(398, 7)
```

```
df.dtypes
```

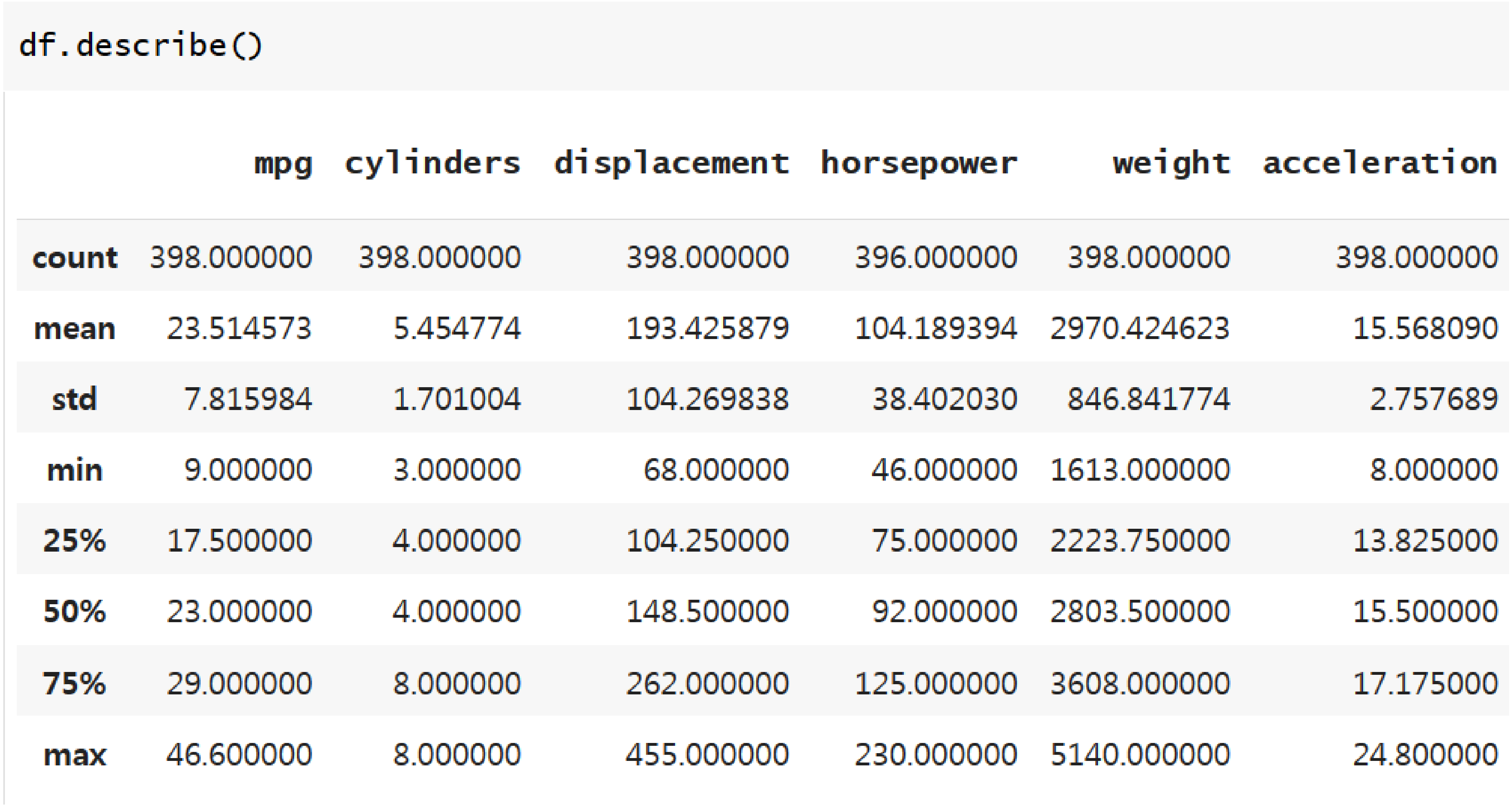
```
mpg             float64
cylinders         int64
displacement    float64
horsepower      float64
weight            int64
acceleration    float64
model-year        int64
dtype: object
```

```
df.size
```

```
2786
```

데이터프레임 살펴보기

➢ describe( ) 기초통계량



```
df.describe()
```

	mpg	cylinders	displacement	horsepower	weight	acceleration
count	398.000000	398.000000	398.000000	396.000000	398.000000	398.000000
mean	23.514573	5.454774	193.425879	104.189394	2970.424623	15.568090
std	7.815984	1.701004	104.269838	38.402030	846.841774	2.757689
min	9.000000	3.000000	68.000000	46.000000	1613.000000	8.000000
25%	17.500000	4.000000	104.250000	75.000000	2223.750000	13.825000
50%	23.000000	4.000000	148.500000	92.000000	2803.500000	15.500000
75%	29.000000	8.000000	262.000000	125.000000	3608.000000	17.175000
max	46.600000	8.000000	455.000000	230.000000	5140.000000	24.800000

데이터프레임 살펴보기

- count( ) 빈도수

```
df.count()
```

```
mpg             398
cylinders       398
displacement    398
horsepower      396
weight          398
acceleration    398
model-year      398
dtype: int64
```

- value_counts( ) 중복제거한 unique 한 개수

```
df['cylinders'].value_counts()
```

```
4    204
8    103
6     84
3      4
5      3
Name: cylinders, dtype: int64
```

기초통계량 직접 계산하기

```
df.mean()
```

```
mpg               23.514573
cylinders          5.454774
displacement     193.425879
horsepower       104.189394
weight          2970.424623
acceleration      15.568090
model-year        76.010050
dtype: float64
```

```
df['mpg'].mean()
```

```
23.514572864321615
```

```
df.std()
```

```
mpg               7.815
cylinders         1.701
displacement    104.269
horsepower       38.402
weight          846.841
acceleration      2.757
model-year        3.697
dtype: float64
```

```
df.var()
```

```
mpg                 61.
cylinders            2.
displacement     10872.
horsepower        1474.
weight          717140.
acceleration         7.
model-year          13.
dtype: float64
```

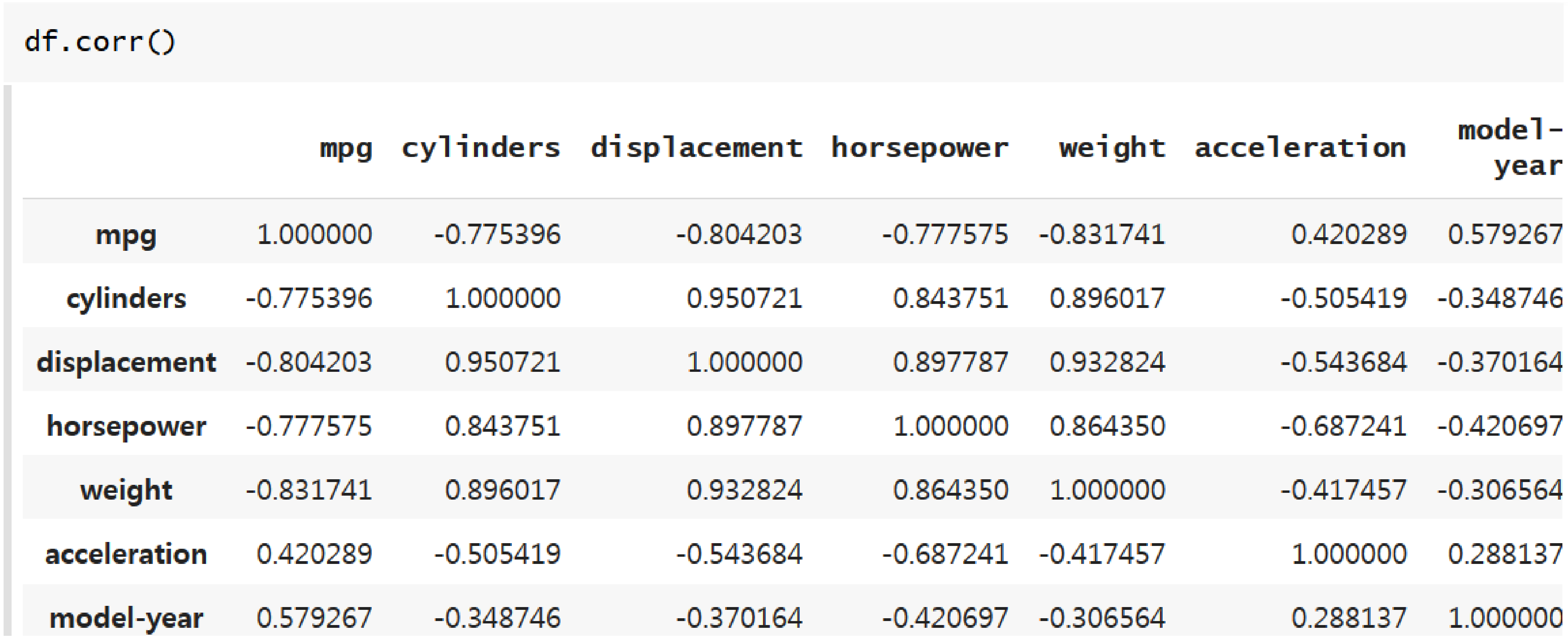
```
df.median()
```

```
mpg               23.0
cylinders          4.0
displacement     148.5
horsepower        92.0
weight          2803.5
acceleration      15.5
model-year        76.0
dtype: float64
```

```
df.max()
```

```
mpg               46.6
cylinders          8.0
displacement     455.0
horsepower       230.0
weight          5140.0
acceleration      24.8
model-year        82.0
dtype: float64
```

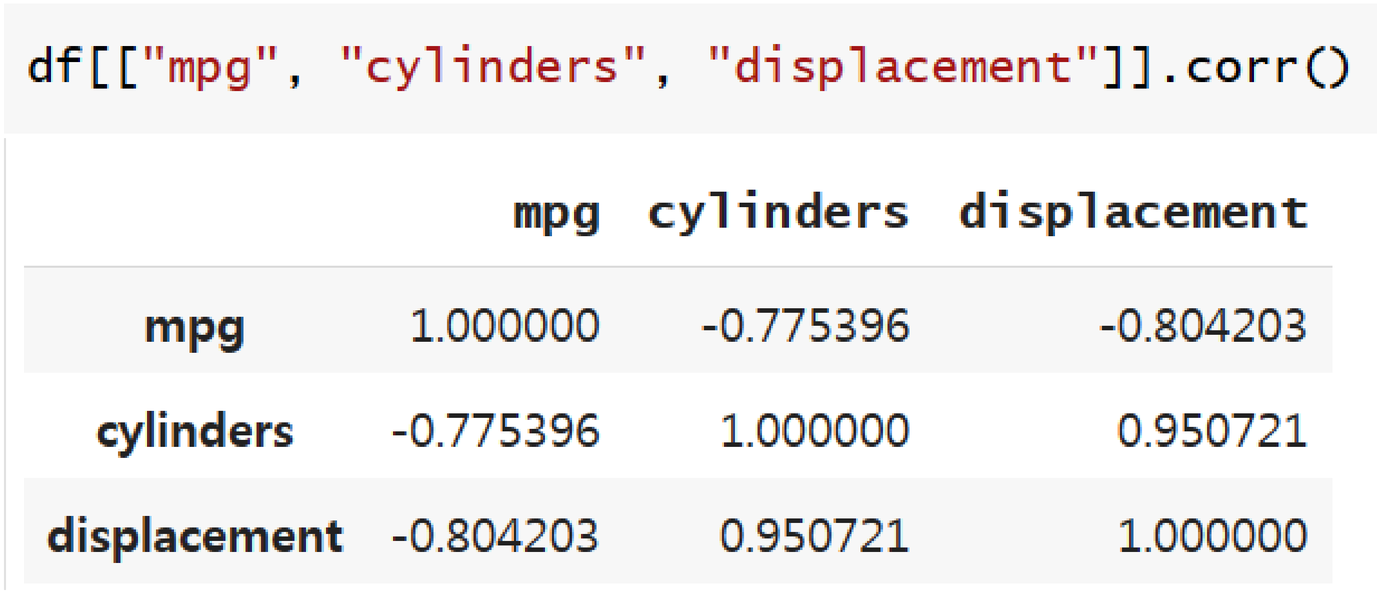
상관계수 구하기



```
df.corr()
```

	mpg	cylinders	displacement	horsepower	weight	acceleration	model-year
mpg	1.000000	-0.775396	-0.804203	-0.777575	-0.831741	0.420289	0.579267
cylinders	-0.775396	1.000000	0.950721	0.843751	0.896017	-0.505419	-0.348746
displacement	-0.804203	0.950721	1.000000	0.897787	0.932824	-0.543684	-0.370164
horsepower	-0.777575	0.843751	0.897787	1.000000	0.864350	-0.687241	-0.420697
weight	-0.831741	0.896017	0.932824	0.864350	1.000000	-0.417457	-0.306564
acceleration	0.420289	-0.505419	-0.543684	-0.687241	-0.417457	1.000000	0.288137
model-year	0.579267	-0.348746	-0.370164	-0.420697	-0.306564	0.288137	1.000000

상관계수 구하기



```python
df[["mpg", "cylinders", "displacement"]].corr()
```

	mpg	cylinders	displacement
mpg	1.000000	-0.775396	-0.804203
cylinders	-0.775396	1.000000	0.950721
displacement	-0.804203	0.950721	1.000000

이번 수업에서는

결측치

결측치란

- 결측치란

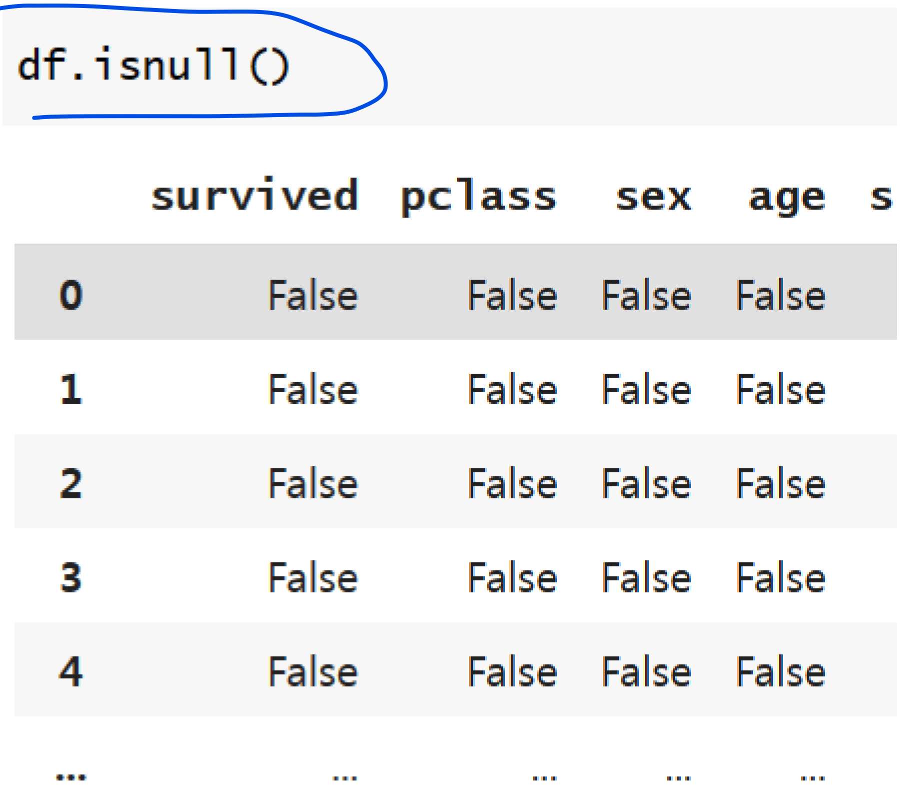
```
import seaborn as sns
import pandas as pd
import numpy as np

df = sns.load_dataset('titanic')
df.head()
```

	survived	pclass	sex	age	sibsp	parch	fare	embarked	class	who	adult_male
0	0	3	male	22.0	1	0	7.2500	S	Third	man	True
1	1	1	female	38.0	1	0	71.2833	C	First	woman	False
2	1	3	female	26.0	0	0	7.9250	S	Third	woman	False
3	1	1	female	35.0	1	0	53.1000	S	First	woman	False
4	0	3	male	35.0	0	0	8.0500	S	Third	man	True

```
df.info()
```

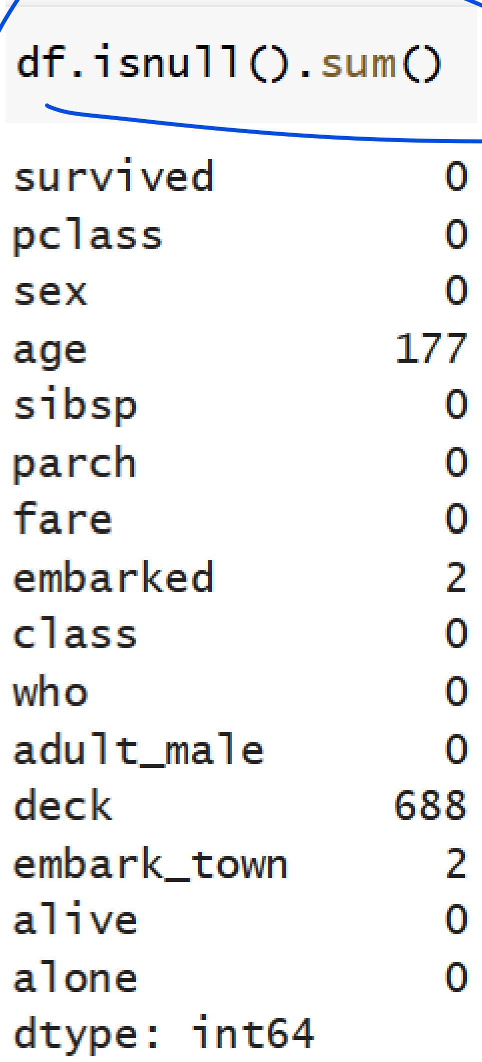
```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 15 columns):
survived       891 non-null int64
pclass         891 non-null int64
sex            891 non-null object
age            714 non-null float64
sibsp          891 non-null int64
parch          891 non-null int64
fare           891 non-null float64
embarked       889 non-null object
class          891 non-null category
who            891 non-null object
adult_male     891 non-null bool
deck           203 non-null category
embark_town    889 non-null object
alive          891 non-null object
alone          891 non-null bool
dtypes: bool(2), category(2), float64(2), int64(4), object(5)
memory usage: 80.6+ KB
```

결측치 존재



```python
df.isnull()
```

	survived	pclass	sex	age	s
0	False	False	False	False	
1	False	False	False	False	
2	False	False	False	False	
3	False	False	False	False	
4	False	False	False	False	
...	...	...	...	...	



```python
df.isnull().sum()
```

```
survived         0
pclass           0
sex              0
age            177
sibsp            0
parch            0
fare             0
embarked         2
class            0
who              0
adult_male       0
deck           688
embark_town      2
alive            0
alone            0
dtype: int64
```

결측치 삭제

```
df1 =df.copy()
```

```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 15 columns):
survived       891 non-null int64
pclass         891 non-null int64
sex            891 non-null object
age            714 non-null float64
sibsp          891 non-null int64
parch          891 non-null int64
fare           891 non-null float64
embarked       889 non-null object
class          891 non-null category
who            891 non-null object
adult_male     891 non-null bool
deck           203 non-null category
```

[제목 없음]

```
df1.dropna().info()   # 행 삭제
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 182 entries, 1 to 889
Data columns (total 15 columns):
survived       182 non-null int64
pclass         182 non-null int64
sex            182 non-null object
age            182 non-null float64
sibsp          182 non-null int64
parch          182 non-null int64
fare           182 non-null float64
embarked       182 non-null object
class          182 non-null category
who            182 non-null object
adult_male     182 non-null bool
deck           182 non-null category
```

결측치 삭제

```
df1.dropna(axis =1).info()  # 열 삭제
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 11 columns):
survived      891 non-null int64
pclass        891 non-null int64
sex           891 non-null object
sibsp         891 non-null int64
parch         891 non-null int64
fare          891 non-null float64
class         891 non-null category
who           891 non-null object
adult_male    891 non-null bool
alive         891 non-null object
alone         891 non-null bool
dtypes: bool(2), category(1), float64(1), int64(4), object(3)
memory usage: 58.5+ KB
```

결측치 대체

```
# 평균값으로 대체하기
mean_age = df2['age'].mean()
df2['age'].fillna(mean_age, inplace= True)
df2['age'].isnull()
```

```
0      False
1      False
2      False
3      False
4      False
       ...
886    False
887    False
888    False
889    False
890    False
Name: age, Length: 891, dtype: bool
```

```
df2['age'].isnull().sum()
```

```
0
```

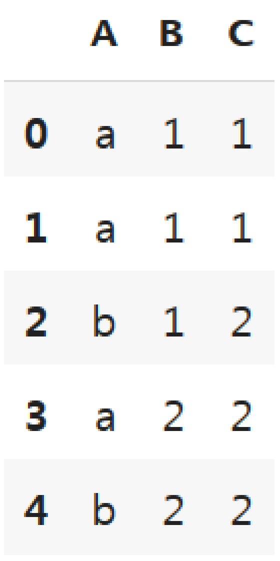
중복데이터

```
df = pd.DataFrame({'A' : ['a','a', 'b', 'a', 'b'],
                  'B' : [1, 1, 1, 2, 2],
                   'C' : [1, 1, 2, 2, 2]})
df
```

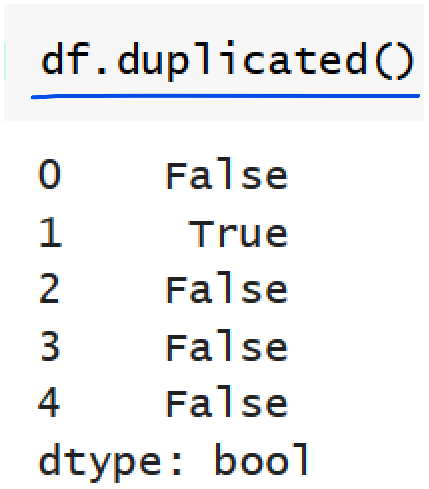
	A	B	C
0	a	1	1
1	a	1	1
2	b	1	2
3	a	2	2
4	b	2	2

df.duplicated( )

- 중복된 행의 개수

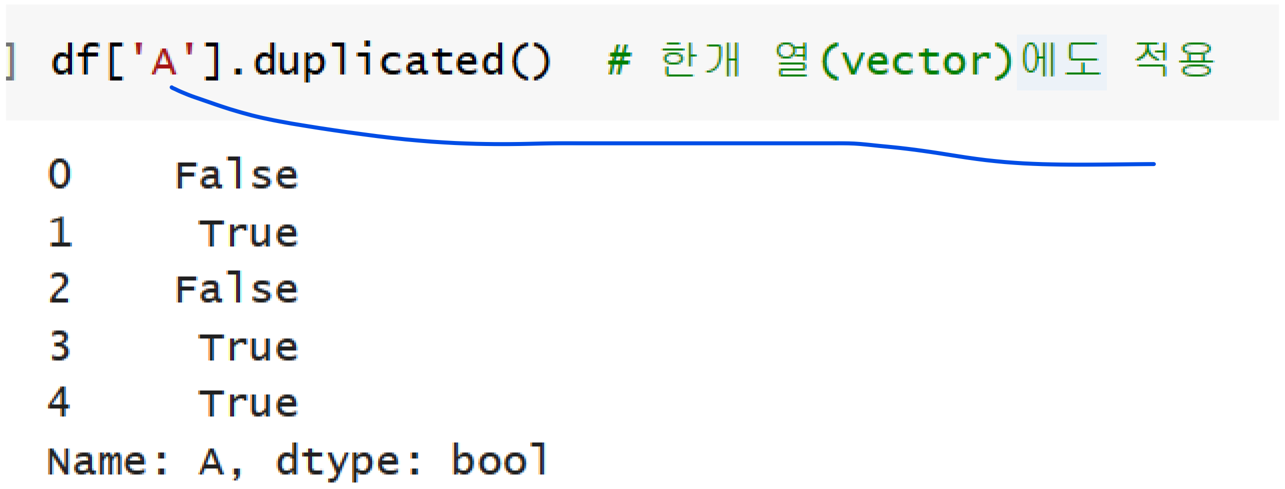


	A	B	C
0	a	1	1
1	a	1	1
2	b	1	2
3	a	2	2
4	b	2	2



```
df.duplicated()
```

```
0    False
1     True
2    False
3    False
4    False
dtype: bool
```



```
] df['A'].duplicated()  # 한개 열(vector)에도 적용
```

```
0    False
1     True
2    False
3     True
4     True
Name: A, dtype: bool
```

중복행 제거

	A	B	C
0	a	1	1
1	a	1	1
2	b	1	2
3	a	2	2
4	b	2	2

```
df.drop_duplicates()
```

	A	B	C
0	a	1	1
2	b	1	2
3	a	2	2
4	b	2	2

- 저장하려면 inplace = True

이번 수업에서는

데이터프레임 합치기 (concat)

concat

- Series + Series

```
E = pd.Series(['e0','e1','e2','e3'], name = 'e')
F = pd.Series(['f0','f1','f2'], name = 'f', index = [3,4,5])
G = pd.Series(['g0','g1','g2','g3'], name = 'g')
```

```
E

0      e0
1      e1
2      e2
3      e3
Name: e,
```

```
F

3      f0
4      f1
5      f2
Name: f,
```

```
G

0      g0
1      g1
2      g2
3      g3
Name: g,
```

- axis = 0 이 기본값이다

```
pd.concat([E, F])
```

```
0      e0
1      e1
2      e2
3      e3
3      f0
4      f1
5      f2
```

```
pd.concat([E, G])
```

```
0      e0
1      e1
2      e2
3      e3
0      g0
1      g1
2      g2
3      g3
```

- index에 맞게 병합

```
pd.concat([E, G], axis = 1 )
```

	e	g
0	e0	g0
1	e1	g1
2	e2	g2
3	e3	g3

```
pd.concat([E, F], axis = 1 )
```

	e	f
0	e0	NaN
1	e1	NaN
2	e2	NaN
3	e3	f0
4	NaN	f1
5	NaN	f2

- 결과물은 Series 이거나 DataFrame 이다

```
type(pd.concat([E, G], axis = 0 )  )
```

```
pandas.core.series.Series
```

```
type(pd.concat([E, G], axis = 1 ))
```

```
pandas.core.frame.DataFrame
```

concat

- DataFrame + DataFrame

```
df1 = pd.DataFrame({'a':['a0','a1','a2'],
                   'b':['b0','b1','b2'],
                   'c':['c0','c1','c2']},
                  index = [0,1,2])

df2 = pd.DataFrame({'b':['b2','b3','b4'],
                   'c':['c2','c3','c4'],
                   'd':['d2','d3','d4']},
                   index = [1,2,3])
```

```
df1
```

	a	b	c
0	a0	b0	c0
1	a1	b1	c1
2	a2	b2	c2

```
df2
```

	b	c	d
1	b2	c2	d2
2	b3	c3	d3
3	b4	c4	d4

```
pd.concat([df1,df2])
```

	a	b	c	d
0	a0	b0	c0	NaN
1	a1	b1	c1	NaN
2	a2	b2	c2	NaN
1	NaN	b2	c2	d2
2	NaN	b3	c3	d3
3	NaN	b4	c4	d4

```
df1
```

	a	b	c
0	a0	b0	c0
1	a1	b1	c1
2	a2	b2	c2

```
df2
```

	b	c	d
1	b2	c2	d2
2	b3	c3	d3
3	b4	c4	d4

```python
pd.concat([df1,df2], ignore_index=True)
```

	a	b	c	d
0	a0	b0	c0	NaN
1	a1	b1	c1	NaN
2	a2	b2	c2	NaN
3	NaN	b2	c2	d2
4	NaN	b3	c3	d3
5	NaN	b4	c4	d4

```
pd.concat([df1,df2], axis = 1)
```

	a	b	c	b	c	d
0	a0	b0	c0	NaN	NaN	NaN
1	a1	b1	c1	b2	c2	d2
2	a2	b2	c2	b3	c3	d3
3	NaN	NaN	NaN	b4	c4	d4

```
df1
```

	a	b	c
0	a0	b0	c0
1	a1	b1	c1
2	a2	b2	c2

```
df2
```

	b	c	d
1	b2	c2	d2
2	b3	c3	d3
3	b4	c4	d4

```python
pd.concat([df1,df2], axis = 1, join = 'inner')
```

	a	b	c	b	c	d
1	a1	b1	c1	b2	c2	d2
2	a2	b2	c2	b3	c3	d3