

PANDAS EXCERCISES

importing the panadas

```
In [64]: import numpy as np
import pandas as pd
```

creating a dataframe fruits

```
In [65]: fruits = pd.DataFrame({'Apples': [30, 41], 'Bananas': [10, 11]})

fruits
```

```
Out[65]:
```

	Apples	Bananas
0	30	21
1	41	11

creating a dataframe fruit_sales

```
In [66]: fruit_sales = pd.DataFrame({'Apples': [30, 41], 'Bananas': [10, 11],
                                     '2017 Sales': [1, 2], '2018 Sales': [1, 2]})

fruit_sales
```

```
Out[66]:
```

	Apples	Bananas	2017 Sales	2018 Sales
0	30	21	1	2
1	41	11	2	1

creating a series ingredients

```
In [67]: ingredients = pd.Series(['Flour': '4 cups', 'Milk': '1 Cup', 'Eggs': '2 large', 'Spam': '1 Can'])

ingredients
```

```
Out[67]:
```

	Flour	Milk	Eggs	Spam
0	4 cups	1 Cup	2 large	1 Can

reading the csv dataset of wine reviews into a DataFrame reviews

```
In [68]: reviews = pd.read_csv("~/KUBUNTU/DATASET/CSV_FILES/winemag-data_first150k.csv")

reviews.head()
```

```
Out[68]:
```

	Unnamed: 0	country	description	designation	points	price	province	region_1	region_2	variety	winery
0	0	US	This tremendous 100% varietal wine hails from ...	Martha's Vineyard	96	235.0	California	Napa Valley	Napa	Cabernet Sauvignon	Bodega Carmen Rodriguez
1	1	Spain	Ripe aromas of fig, blackberry and cassis are ...	Cardoium Selección Especial Reserva	96	110.0	Northern Spain	Toro	NaN	Tinta de Toro	Hedz Carmen Rodriguez
2	2	US	Mac Watson honors the memory of a wine once ma...	Special Selected Late Harvest	96	90.0	California	Knight Valley	Sonoma	Sauvignon Blanc	Macaulay
3	3	US	This spent 20 months in 30% new French oak, an...	Reserve	96	65.0	Oregon	Willamette Valley	Willamette Valley	Pinot Noir	Ponzi
4	4	France	This is the top wine from La Bégude, named aft...	La Brûlée	95	66.0	Provence	Bandol	NaN	Provence red blend	Domaine de la Bégude

describe the dataset

```
In [69]: desc = reviews.describe()

desc
```

```
Out[69]:
```

	Unnamed: 0	points	price
count	150930.000000	150930.000000	137235.000000
mean	75464.500000	87.888418	33.13482
std	43569.862402	3.222392	36.322536
min	0.000000	80.000000	4.000000
25%	37322.000000	86.000000	16.000000
50%	75464.500000	88.000000	24.000000
75%	113196.750000	90.000000	40.000000
max	150929.000000	100.000000	2300.000000

create and display a DataFrame called animals

```
In [70]: animals = pd.DataFrame({'Cows': [10, 20], 'Goats': [10, 15]}, index=[
                                     'Year 1', 'Year 2'])

animals
```

```
Out[70]:
```

	Cows	Goats
Year 1	12	22
Year 2	20	19

code to save this DataFrame to disk as a csv file with the name cows_and_goats.csv

```
In [71]: animals.to_csv("~/KUBUNTU/DATASET/CSV_FILES/cows_and_goats.csv")
```

select the description column from reviews and assign it to variable desc

```
In [72]: desc = reviews["description"]

desc
```

```
Out[72]:
```

	description
0	This tremendous 100% varietal wine hails from ...
1	Ripe aromas of fig, blackberry and cassis are ...
2	Mac Watson honors the memory of a wine once ma...
3	This spent 20 months in 30% new French oak, an...
4	This is the top wine from La Bégude, named aft...
5	Many people feel Fiano represents southern Ita...
6	Offers an intriguing nose with ginger, lime an...
7	This classic example comes from a cru vineyard...
8	A perfect salmon shade, with scents of peaches...
9	More Fiano. Grapes should taste like this. A r...
10	Deep, dense and pure from the opening bell, th...
11	Slightly gritty black-fruit aromas include a s...
12	Such country black-fruit aromas are tame and of...
13	This re-named vineyard was formerly bottled as...
14	The producer sources from two blocks of the vi...
15	Deep, dense and pure from the opening bell, th...

select first column from description column of reviews and assign it to variable first_description

```
In [74]: first_description = reviews["description"][0]

first_description
```

```
Out[74]:
```

	description
0	This tremendous 100% varietal wine hails from ...

select first row of the data from reviews and assign it to first_row

```
In [75]: first_row = reviews.iloc[0]

first_row
```

```
Out[75]:
```

	Unnamed: 0	country	description	designation	points	price	province	region_1	region_2	variety	winery
0	0	US	This tremendous 100% varietal wine hails from ...	Martha's Vineyard	96	235.0	California	Napa Valley	Napa	Cabernet Sauvignon	Bodega Carmen Rodriguez

select the first 10 values from the description column in reviews and assign to variable first_descriptions

```
In [76]: first_descriptions = reviews["description"][:10]

first_descriptions
```

```
Out[76]:
```

	description
0	This tremendous 100% varietal wine hails from ...
1	Ripe aromas of fig, blackberry and cassis are ...
2	Mac Watson honors the memory of a wine once ma...
3	This spent 20 months in 30% new French oak, an...
4	This is the top wine from La Bégude, named aft...
5	Deep, dense and pure from the opening bell, th...
6	Slightly gritty black-fruit aromas include a s...
7	Such country black-fruit aromas are tame and of...
8	This re-named vineyard was formerly bottled as...
9	The producer sources from two blocks of the vi...

select the records with index labels 1,2,3,5,8 and assign to variable sample_reviews

```
In [77]: sample_reviews = reviews.iloc[[1, 2, 3, 5, 8]]

sample_reviews
```

```
Out[77]:
```

	Unnamed: 0	country	description	designation	points	price	province	region_1	region_2	variety	winery
1	1	Spain	Ripe aromas of fig, blackberry and cassis are ...	Cardoium Selección Especial Reserva	96	110.0	Northern Spain	Toro	NaN	Tinta de Toro	Bodega Carmen Rodriguez
2	2	US	Mac Watson honors the memory of a wine once ma...	Special Selected Late Harvest	96	90.0	California	Knight Valley	Sonoma	Sauvignon Blanc	Macaulay
3	3	US	This spent 20 months in 30% new French oak, an...	Reserve	96	65.0	Oregon	Willamette Valley	Willamette Valley	Pinot Noir	Ponzi
5	5	Spain	Deep, dense and pure from the opening bell, th...	Numanria	95	73.0	Northern Spain	Toro	NaN	Tinta de Toro	Numanria
8	8	US	This re-named vineyard was formerly bottled as...	Slice	95	65.0	Oregon	Chehalis Mountains	Willamette Valley	Pinot Noir	Bergstrom

create a variable df have country, province, region_1, region_2, columns with index labels 0,1,10,100

```
In [78]: df = reviews[["description", "country", "province",
                                     "region_1", "region_2"]].iloc[[0, 1, 10, 100]]

df
```

```
Out[78]:
```

	description	country	province	region_1	region_2
0	This tremendous 100% varietal wine hails from ...	US	California	Napa Valley	Napa
1	Ripe aromas of fig, blackberry and cassis are ...	Spain	Northern Spain	Toro	NaN
10	Deep, dense and pure from the opening bell, th...	Italy	Northeastern Italy	Collio	NaN
100	Juicy kiwi, lime blossom and sour apple candy ...	US	California	South Coast	South Coast

a variable df containing country and variety column first 100 records

```
In [79]: df = reviews[["country", "variety"]].iloc[:100]

df
```

```
Out[79]:
```

	country	variety
0	US	Cabernet Sauvignon
1	Spain	Tinta de Toro
2	US	Sauvignon Blanc
3	France	Pinot Noir
...
95	France	Malbec-Merlot
96	US	Chardonnay
97	US	Cabernet Sauvignon
98	France	Merlot-Malbec
99	France	Ugni Blanc-Colombard

create a dataframe italian_wines having reviews of wines made in Italy

```
In [80]: italian_wines = reviews.loc[reviews["country"] == "Italy"]

italian_wines
```

```
Out[80]:
```

	Unnamed: 0	country	description	designation	points	price	province	region_1	region_2	variety	winery
10	10	Italy	Elegance, complexity and structure come togeth...	Ronco della Chiesa	95	80.0	Northeastern Italy	Collio	NaN	Friulano	Borgo del Tiglio
32	32	Italy	Underbrush, scorched earth, menthol and herb...	Vigna Piaggia	90	NaN	Tuscany	Brunello di Montalcino	NaN	Sangiovese	Abbadia Ardagna
35	35	Italy	Forest floor, berry filled and a little in the p...	Riserva	90	135.0	Tuscany	Brunello di Montalcino	NaN	Sangiovese	Carillon
37	37	Italy	Aromas of forest floor, violet, red berry and a...	NaN	90	29.0	Tuscany	Vino Nobile di Montalcino	NaN	Sangiovese	Avignonesi
38	38	Italy	This has a charming nose that boasts rose, vio...	NaN	90	23.0	Tuscany	Chianti Classico	NaN	Sangiovese	Casina di Cornia
...
150920	150920	Italy	Rich and mature aromas of smoke, earth and her...	Brut Riserva	91	19.0	Northeastern Italy	Trento	NaN	Champagne Blend	Lettrari
150922	150922	Italy	Made by 30-ish Roberta Grange has exploded...	Superiore	91	NaN	Northeastern Italy	Colli Orientali del Friuli	NaN	Tocai	Ronchi di Marcano
150925	150925	Italy	Many people feel Fiano represents southern Ita...	NaN	91	20.0	Southern Italy	Fiano di Avellino	NaN	White Blend	Feudi di San Gregorio
150927	150927	Italy	This classic example comes from a cru vineyard...	Terre di Dora	91	20.0	Southern Italy	Fiano di Avellino	NaN	White Blend	Terredora
150929	150929	Italy	More Pinot Grigio should taste like this. A r...	NaN	90	15.0	Northeastern Italy	Alto Adige	NaN	Pinot Grigio	Alois Lageder

23478 rows × 11 columns

create a dataframe top_oceania_wines with all reviews having atleast 95 points out of 100 for wines from Australia and New Zealand

```
In [81]: top_oceania_wines = reviews.loc[reviews["country"].isin(
                                     ["Australia", "New Zealand"]) & reviews["points"] >= 95]]

top_oceania_wines
```

```
Out[81]:
```

	Unnamed: 0	country	description	designation	points	price	province	region_1	region_2	variety	winery
2148	2148	Australia	Full-bodied and plush yet vibrant and imbued w...	The Factor	98	125.0	South Australia	Barossa Valley	NaN	Shiraz	Torbreck
2458	2458	Australia	This is a top example of the feminine side of S...	The Peake	96	150.0	South Australia	McLaren Vale	NaN	Cabernet Shiraz	Hickinbotham
3033	3033	Australia	This Cabernet equivalent to Grange has explode...	Bin 707	95	500.0	South Australia	South Australia	NaN	Cabernet Sauvignon	Penfolds
3044	3044	Australia	From vines planted in 1912, this has been an l...	Mount Eddowes Vineyard	95	200.0	South Australia	Eden Valley	NaN	Shiraz	Henschke
3047	3047	Australia	This is a throwback to those brash, flavou...	One	95	95.0	South Australia	Larghorne Creek	NaN	Red Blend	Heartland
...
122779	122779	Australia	If Standish's Relic is the feminine side of St...	The Standish Single Vineyard	96	135.0	South Australia	Barossa Valley	NaN	Shiraz	Standish
127614	127614	Australia	This stellar wine takes the feminine side of H...	Hill of Grace	95	625.0	South Australia	Eden Valley	NaN	Shiraz	Henschke
137383	137383	Australia	The 2007 Astralis impresses for its combinati...	Astralis	95	225.0	South Australia	Clarendon	NaN	Syrah	Clarendon Hills
150562	150562	Australia	As unevolved as they are, the dense and luxu...	Grange	96	185.0	South Australia	South Australia	NaN	Shiraz	Penfolds
150563	150563	Australia	Seamless luxury from stem to stem to stem to ...	RWT	95	70.0	South Australia	Barossa Valley	NaN	Shiraz	Penfolds

82 rows × 11 columns

find the median of the points column

```
In [82]: median_points = reviews["points"].median()

median_points
```

```
Out[82]:
```

	points
0	87.888418

what countries in dataset

```
In [83]: countries_unique = reviews["country"].unique()

countries_unique
```

```
Out[83]:
```

	country
0	US
1	Spain
2	US
3	France
...	...
150920	Italy
150922	Italy
150925	Italy
150927	Italy
150929	Italy

create reviews_per_country variable mapping countries to the count of reviews of wines from that country

```
In [84]: reviews_per_country = reviews["country"].value_counts()

reviews_per_country
```

```
Out[84]:
```

	country	count
0	US	23478
1	France	23478
2	Spain	8298
3	Italy	23478
4	Argentina	5831
5	Portugal	5832
6	Australia	8298
7	New Zealand	3326
8	Austria	3657
9	Germany	2452
10	South Africa	2258
11	France	8298
12	Israel	636
13	Hungary	231
14	Canada	136
15	Romania	139
16	Slovenia	94
17	Uruguay	92
18	Croatia	89
19	Bulgaria	77
20	Moldova	71
21	Mexico	63
22	Turkey	52
23	Georgia	43
24	Lebanon	37
25	Cyprus	31
26	Brazil	25
27	Chad	1
28	Madagascar	14
29	Serbia	14
30	Morocco	12
31	England	9
32	Luxembourg	9
33	India	8
34	Lithuania	8
35	Czech Republic	6
36	Switzerland	6
37	Switzerland	4
38	Bosnia and Herzegovina	4
39	South Korea	3
40	Egypt	3
41	China	3
42	Slovakia	2
43	Albania	2
44	Montenegro	2
45	Japan	2
46	Tunisia	2
47	Guatemala	1
48	South Africa	1

create centered_price having version of price column with mean value subtracted

```
In [85]: centered_price = reviews["price"] - reviews["price"].mean()

centered_price
```

```
Out[85]:
```

	centered_price
0	-201.868038
1	74.848516
2	96.868516
3	31.848516
4	32.868516
...	...
150920	-0.131482
150922	-0.131482
150927	-13.131482
150929	16.848516
150929	-18.131482

create variable bargain_wine with the title of the wine with the highest points-to-price ratio

```
In [86]: bargain_idx = (reviews["points"] / reviews["price"]).idxmax()

bargain_wine = reviews.loc[bargain_idx]["winery"]

bargain_wine
```

```
Out[86]:
```

	winery
0	Bodega Carmen Rodriguez

create a series descriptor_counts to count how many the words "tropical" or "fruity" appear

```
In [87]: trop = reviews["description"].map(lambda desc: "tropical" in desc).sum()

fruit = reviews["description"].map(lambda desc: "fruity" in desc).sum()

descriptor_counts = pd.Series([trop, fruit], index=["tropical", "fruity"])

descriptor_counts
```

```
Out[87]:
```

	tropical	fruity
0	1	1
1	1	1
2	1	1
3	1	1
4	1	1

create variable star_ratings with number of strgs regarding the each review in dataset

```
In [88]: def rating(row):
    if row.country == "Canada":
        return 3
    elif row.points >= 90:
        return 4
    elif row.points >= 85:
        return 3
    else:
        return 2

star_ratings = reviews.apply(rating, axis="columns")

star_ratings
```

```
Out[88]:
```

	star_ratings
0	3
1	3
2	3
3	3
4	3
...	...
150920	2
150922	2
150927	2
150929	2
150929	2
Length: 150930, dtype: int64	

create series whose index is variety and whose value counts how many review each person wrote

```
In [89]: reviews_written = reviews.groupby('variety').variety.count()

reviews_written
```

```
Out[89]:
```

	variety	count
0	Agiorgitiko	129
1	Aglianico	317
2	Akum	1
3	Akum	1
4	Albana	17
...
150920	Zinfandel-Rotgipfler	1


```
In [95]: dtype = reviews.points.dtype

dtype
```

```
Out[95]: dtype('float64')
```

Create a Series from entries in the `points` column, but convert the entries to strings.

```
In [96]: point_strings = reviews.points.astype(str)

point_strings
```

```
Out[96]:
0      95
1      85
2      95
3      88
4      95
150925   91
150926   91
150927   91
150928   90
150929   89
Name: points, Length: 150930, dtype: object
```

How many reviews in the dataset are missing a price?

```
In [97]: n_missing_prices = reviews.price.isnull().sum()

n_missing_prices
```

```
Out[97]: 0
```

Create a Series counting the number of times each value occurs in the `region_1` field. This field is often missing data, so replace missing values with Unknown. Sort in descending order.

```
In [98]: reviews_per_region = reviews.region_1.fillna(
        'Unknown').value_counts().sort_values(ascending=False)

reviews_per_region
```

```
Out[98]:
Napa Valley      6299
Columbia Valley (wa)  4475
Renssela     3059
Russian River Valley  2571
Remondolo      1
Cotes du Roussillon Villages Carremany  1
Vin de Pays de la Vallée de l'Aude  1
Rivesaltes Rose  1
Prince Edward County  1
Name: region_1, Length: 1237, dtype: int64
```

`region_1` and `region_2` are pretty uninformative names for locale columns in the dataset. Create a copy of `reviews` with these columns renamed to `region` and `locale`, respectively.

```
In [99]: renamed = reviews.rename(columns=dict(region_1='region', region_2='locale'))

renamed
```

```
Out[99]:
```

	Unnamed: 0	country	description	designation	points	price	province	region	locale	variety	winery
0	0	US	This tremendous 100% varietal wine hails from ...	Martha's Vineyard	96	235.0	California	Napa Valley	Napa	Cabernet Sauvignon	Heitz
1	1	Spain	Ripe aromas of fig, blackberry and cassis are ...	Carodorum Selección Especial Reserva	96	110.0	Northern Spain	Toro	NaN	Tinta de Toro	Bodega Carmen Rodríguez
2	2	US	Mac Watson honors the memory of a wine once ma...	Special Selected Late Harvest	96	90.0	California	Knights Valley	Sonoma	Sauvignon Blanc	Macaulay
3	3	US	This spent 20 months in 30% new French oak, an...	Reserve	96	65.0	Oregon	Willamette Valley	Willamette Valley	Pinot Noir	Ponzi
4	4	France	This is the top wine from La Biguade, named aft...	La Brûlée	95	66.0	Provence	Bandol	NaN	Provence red blend	Domaine de la Béguéde
...
150925	150925	Italy	Many people feel Fiano represents southern Ita...	NaN	91	20.0	Southern Italy	Fiano di Avellino	NaN	White Blend	Feudi di San Gregorio
150926	150926	France	Offers an intriguing nose with scents of peach...	Cuvée Prestige	91	27.0	Champagne	Champagne	NaN	Champagne Blend	H.Germain
150927	150927	Italy	This classic example comes from a cru vineyard...	Terre di Dora	91	20.0	Southern Italy	Fiano di Avellino	NaN	White Blend	Terredora
150928	150928	France	A perfect salmon shade, with scents of peaches...	Grand Brut Rose	90	52.0	Champagne	Champagne	NaN	Champagne Blend	Gosset
150929	150929	Italy	More Pinot Grigios should taste like this. A f...	NaN	90	15.0	Northeastern Italy	Alto Adige	NaN	Pinot Grigio	Alois Lageder

150930 rows x 11 columns

Set the index name in the dataset to `wines`.

```
In [100]: reindexed = reviews.rename_axis('wines', axis='rows')

reindexed
```

```
Out[100]:
```

	Unnamed: 0	country	description	designation	points	price	province	region_1	region_2	variety	winery	
wines	0	0	US	This tremendous 100% varietal wine hails from ...	Martha's Vineyard	96	235.0	California	Napa Valley	Napa	Cabernet Sauvignon	Heitz
1	1	Spain	Ripe aromas of fig, blackberry and cassis are ...	Carodorum Selección Especial Reserva	96	110.0	Northern Spain	Toro	NaN	Tinta de Toro	Bodega Carmen Rodríguez	
2	2	US	Mac Watson honors the memory of a wine once ma...	Special Selected Late Harvest	96	90.0	California	Knights Valley	Sonoma	Sauvignon Blanc	Macaulay	
3	3	US	This spent 20 months in 30% new French oak, an...	Reserve	96	65.0	Oregon	Willamette Valley	Willamette Valley	Pinot Noir	Ponzi	
4	4	France	This is the top wine from La Biguade, named aft...	La Brûlée	95	66.0	Provence	Bandol	NaN	Provence red blend	Domaine de la Béguéde	
...	
150925	150925	Italy	Many people feel Fiano represents southern Ita...	NaN	91	20.0	Southern Italy	Fiano di Avellino	NaN	White Blend	Feudi di San Gregorio	
150926	150926	France	Offers an intriguing nose with scents of peach...	Cuvée Prestige	91	27.0	Champagne	Champagne	NaN	Champagne Blend	H.Germain	
150927	150927	Italy	This classic example comes from a cru vineyard...	Terre di Dora	91	20.0	Southern Italy	Fiano di Avellino	NaN	White Blend	Terredora	
150928	150928	France	A perfect salmon shade, with scents of peaches...	Grand Brut Rose	90	52.0	Champagne	Champagne	NaN	Champagne Blend	Gosset	
150929	150929	Italy	More Pinot Grigios should taste like this. A f...	NaN	90	15.0	Northeastern Italy	Alto Adige	NaN	Pinot Grigio	Alois Lageder	

150930 rows x 11 columns

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NUMPY EXCERCISES

=====

NumPy Creating Array

importing the numpy library

Create a NumPy ndarray Object

```
In [101]: arr = np.array([1, 2, 3, 4, 5])

print(arr)

print(type(arr))
```

```
Out[101]: array([1, 2, 3, 4, 5])
dtype: int64
```

Use a tuple to create a NumPy array:

```
In [102]: arr = np.array((1, 2, 3, 4, 5))

print(arr)
```

```
Out[102]: array([1, 2, 3, 4, 5])
```

Create a 0-D array with value 42

```
In [103]: arr = np.array(42)

print(arr)
```

```
Out[103]: 42
```

Create a 1-D array containing the values 1,2,3,4,5:

```
In [104]: arr = np.array([1, 2, 3, 4, 5])

print(arr)
```

```
Out[104]: array([1, 2, 3, 4, 5])
```

Create a 2-D array containing two arrays with the values 1,2,3 and 4,5,6:

```
In [105]: arr = np.array([[1, 2, 3], [4, 5, 6]])

print(arr)
```

```
Out[105]: array([[1, 2, 3],
                  [4, 5, 6]])
```

Create a 3-D array with two 2-D arrays, both containing two arrays with the values 1,2,3 and 4,5,6:

```
In [106]: arr = np.array([[[1, 2, 3], [4, 5, 6]], [[1, 2, 3], [4, 5, 6]]])

print(arr)
```

```
Out[106]: array([[[1, 2, 3],
                  [4, 5, 6]],
                 [[1, 2, 3],
                  [4, 5, 6]]])
```

Check how many dimensions the arrays have:

```
In [107]: a = np.array(42)
b = np.array([1, 2, 3, 4, 5])
c = np.array([[[1, 2, 3], [4, 5, 6]], [[1, 2, 3], [4, 5, 6]]])
d = np.array([[[[1, 2, 3], [4, 5, 6]], [[1, 2, 3], [4, 5, 6]]], [[1, 2, 3], [4, 5, 6]]])

print(a.ndim)
print(b.ndim)
print(c.ndim)
print(d.ndim)
```

```
Out[107]: 0
1
3
4
```

Create an array with 5 dimensions and verify that it has 5 dimensions:

```
In [108]: arr = np.array([[[[[[1, 2, 3], [4, 5, 6]], [[1, 2, 3], [4, 5, 6]]], [[1, 2, 3], [4, 5, 6]]], [[1, 2, 3], [4, 5, 6]]])

print(arr)

print('number of dimensions: ', arr.ndim)
```

```
Out[108]: array([[[[[[1, 2, 3], [4, 5, 6]], [[1, 2, 3], [4, 5, 6]]], [[1, 2, 3], [4, 5, 6]]], [[1, 2, 3], [4, 5, 6]]])
5
number of dimensions: 5
```

NumPy Array Indexing

Get the first element from the following array:

```
In [109]: arr = np.array([1, 2, 3, 4, 5])

print(arr[0])
```

```
Out[109]: 1
```

Get the second element from the following array.

```
In [110]: arr = np.array([1, 2, 3, 4, 5])

print(arr[1])
```

```
Out[110]: 2
```

Get third and fourth elements from the following array and add them.

```
In [111]: arr = np.array([1, 2, 3, 4, 5])

print(arr[2] + arr[3])
```

```
Out[111]: 7
```

Access the 2nd element on 1st dim:

```
In [112]: arr = np.array([[1, 2, 3, 4, 5], [1, 2, 3, 4, 5]])

print('2nd element on 1st dim: ', arr[0, 2])
```

```
Out[112]: 3
```

Access the 5th element on 2nd dim:

```
In [113]: arr = np.array([[1, 2, 3, 4, 5], [1, 2, 3, 4, 5]])

print('5th element on 2nd dim: ', arr[1, 4])
```

```
Out[113]: 5
```

Access the third element of the second array of the first array:

```
In [114]: arr = np.array([[[1, 2, 3], [4, 5, 6]], [[1, 2, 3], [4, 5, 6]]])

print(arr[0, 1, 2])
```

```
Out[114]: 3
```

Print the last element from the 2nd dim:

```
In [115]: arr = np.array([[1, 2, 3, 4, 5], [5, 6, 7, 8, 9]])

print('Last element from 2nd dim: ', arr[1, -1])
```

```
Out[115]: 9
```

NumPy Array Slicing

Slice elements from index 1 to index 5 from the following array:

```
In [116]: arr = np.array([1, 2, 3, 4, 5, 6, 7])

print(arr[1:5])
```

```
Out[116]: array([2, 3, 4, 5, 6])
```

Slice elements from index 4 to the end of the array:

```
In [117]: arr = np.array([1, 2, 3, 4, 5, 6, 7])

print(arr[4:])
```

```
Out[117]: array([5, 6, 7])
```

Slice elements from the beginning to index 4 (not included):

```
In [118]: arr = np.array([1, 2, 3, 4, 5, 6, 7])

print(arr[:4])
```

```
Out[118]: array([1, 2, 3, 4])
```

Slice from the index 3 from the end to index 1 from the end:

```
In [119]: arr = np.array([1, 2, 3, 4, 5, 6, 7])

print(arr[-3:-1])
```

```
Out[119]: array([4, 5])
```

Return every other element from index 1 to index 5:

```
In [120]: arr = np.array([1, 2, 3, 4, 5, 6, 7])

print(arr[1:5:2])
```

```
Out[120]: array([2, 4, 6])
```

Return every other element from the entire array:

```
In [121]: arr = np.array([1, 2, 3, 4, 5, 6, 7])

print(arr[::2])
```

```
Out[121]: array([1, 3, 5, 7])
```

NumPy Data Types

Get the data type of an array object:

```
In [122]: arr = np.array([1, 2, 3, 4])

print(arr.dtype)
```

```
Out[122]: dtype('int64')
```

Make a copy, change the original array, and display both arrays:

```
In [123]: arr = np.array([1, 2, 3, 4])
x = arr.copy()
arr[0] = 42

print(arr)
print(x)
```

```
Out[123]: array([42, 2, 3, 4])
array([1, 2, 3, 4])
```

NumPy Array Shape

Print the shape of a 2-D array:

```
In [124]: arr = np.array([[1, 2, 3, 4], [5, 6, 7, 8]])

print(arr.shape)
```

```
Out[124]: (2, 4)
```

NumPy Array Reshaping

Convert the following 1-D array with 12 elements into a 2-D array. The outermost dimension will have 4 arrays, each with 3 elements:

```
In [125]: arr = np.array([1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12])

newarr = arr.reshape(4, 3)

print(newarr)
```

```
Out[125]: array([[1, 2, 3],
                  [4, 5, 6],
                  [7, 8, 9],
                  [10, 11, 12]])
```

NumPy Sorting Arrays

Sort the array:

```
In [126]: arr = np.array([5, 2, 6, 1])

print(np.sort(arr))
```

```
Out[126]: array([1, 2, 5, 6])
```

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EXPERIMENT COMPLETED

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