numpy1

September 12, 2025

0.1 Intro to Numpy

[1]:
```
l = [1, 2, 3, "Nishant", True, 1.3]
```

[3]:
```
type(l)
```

[3]:
```
list
```

[5]:
```
# !pip install numpy
```

[4]:
```
import numpy as np
```

[7]:
```
a = [1, 2, 3, 4, 5]

type(a)
```

[7]:
```
list
```

[13]:
```
[i**2 for i in a]
```

[13]:
```
[1, 4, 9, 16, 25]
```

[ ]:
```

```

[9]:
```
b = np.array([1, 2, 3, 4, 5])
```

[10]:
```
type(b)
```

[10]:
```
numpy.ndarray
```

[16]:
```
b ** 2
```

[16]:
```
array([ 1,  4,  9, 16, 25])
```

[ ]:
```

```

[11]:
```
# Speed comparison
```

[17]:
```
l = range(1000000)
```

[18]:
```
%timeit [i**2 for i in l]
```

```
268 ms ± 73 ms per loop (mean ± std. dev. of 7 runs, 1 loop each)
```

[19]:
```
l_np = np.array(range(1000000))
```

[20]:
```
%timeit l_np ** 2
```

```
322 µs ± 7.68 µs per loop (mean ± std. dev. of 7 runs, 1000 loops each)
```

[ ]:

[ ]:

0.1.1 Dimensions and Shape

[21]:
```
arr = np.array(range(10))
```

[22]:
```
arr
```

[22]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

[23]:
```
arr.ndim
```

[23]:
```
1
```

[28]:
```
arr.shape
```

[28]:
```
(10,)
```

[24]:
```
arr1 = np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]])
```

[26]:
```
arr1.ndim
```

[26]:
```
2
```

[27]:
```
arr1.shape
```

[27]:
```
(3, 3)
```

[29]:
```
arr2 = np.array([[1, 2, 3, 11], [4, 5, 6, 10], [7, 8, 9, 12]])
```

[30]:
```
arr2.ndim
```

[30]:
```
2
```

[32]:
```
arr2.shape
```

[32]:
```
(3, 4)
```

[33]:
```
arr3 = np.array([[1], [2], [3], [4]])
```

[35]:
```
arr3.shape
```

[35]:
```
(4, 1)
```

[37]:
```
arr3.ndim
```

[37]:
```
2
```

[38]:
```
# Quiz
```

[39]:
```
a = np.array([1,2,3,4,5,6,7,8])
print(a.ndim, a.shape)
```

```
1 (8,)
```

[40]:
```
arr4 = np.array([[1, 2, 3, 4]])
```

[41]:
```
arr4.shape
```

[41]:
```
(1, 4)
```

[ ]:
```

```

0.2 Arange

[42]:
```
# 1, 100
```

[45]:
```
print(list(range(1, 100)))
```

```
[1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22,
23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42,
43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62,
63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82,
83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99]
```

[46]:
```
range(10)
```

[46]:
```
range(0, 10)
```

[47]:
```
print(list(range(1, 10, 2)))
```

```
[1, 3, 5, 7, 9]
```

[51]:
```
# print(list(range(1.5, 10, 2)))
```

[52]:
```
ar = np.arange(1, 5, 2)
```

[53]:
```
ar
```

[53]:
```
array([1, 3])
```

[56]:
```
np.arange(1, 10, 1.2)
```

[56]:
```
array([1. , 2.2, 3.4, 4.6, 5.8, 7. , 8.2, 9.4])
```

[61]:
```
np.arange(1.5, 11.2, 1.2)
```

[61]:
```
array([ 1.5,  2.7,  3.9,  5.1,  6.3,  7.5,  8.7,  9.9, 11.1])
```

[ ]:

0.3 Type Conversion

[62]:
```
a = np.array([1, 2, 3, 4.0])
```

[63]:
```
a
```

[63]:
```
array([1., 2., 3., 4.])
```

[65]:
```
s = np.array(["Rahul", 1, 2])
```

[66]:
```
s
```

[66]:
```
array(['Rahul', '1', '2'], dtype='<U21')
```

[67]:
```
s = np.array(["Rahul", 1, 2, 4.5])
```

[68]:
```
s
```

[68]:
```
array(['Rahul', '1', '2', '4.5'], dtype='<U32')
```

[69]:
```
a = np.array([1, 2, 3, 4.5], dtype = float)
```

[70]:
```
a
```

[70]:
```
array([1. , 2. , 3. , 4.5])
```

[71]:
```
a = np.array([1, 2, 3, 4.5], dtype = int)
```

[72]:
```
a
```

[72]:
```
array([1, 2, 3, 4])
```

[74]:
```
s = np.array(["Rahul", 1, 2, 4.5], dtype = float)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
/var/folders/t5/yhjgrjs907zfp250jyxtw54m0000gn/T/ipykernel_42741/219984381.py i
 ↪<module>
----> 1 s = np.array(["Rahul", 1, 2, 4.5], dtype = float)

ValueError: could not convert string to float: 'Rahul'
```

[141]:
```
a = np.array([1, 2, 3, 4], dtype = float)
```

[142]:
```
a
```

[142]:
```
array([1., 2., 3., 4.])
```

[143]:
```
# int -> float -> str
```

[144]:
```
a.astype('float')
```

[144]:
```
array([1., 2., 3., 4.])
```

[ ]:
```

```

[ ]:
```

```

0.4 Indexing

[78]:
```
m1 = np.arange(10)
```

[79]:
```
m1
```

[79]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

[80]:
```
m1[0]
```

[80]:
```
0
```

[82]:
```
# Negative indexing starts from last element

m1[-1]
```

[82]:
```
9
```

[83]:
```
m1[[1, 2, 3, 1, 2, 4]]
```

[83]:
```
array([1, 2, 3, 1, 2, 4])
```

[85]:
```
# m1[1, 2, 3, 1, 2, 4] will not work
```

[86]:
```
m = np.array([100, 200, 400, 300, 500])
```

[87]:
```
m
```

[87]:
```
array([100, 200, 400, 300, 500])
```

[88]:
```
m[1]
```

[88]:
```
200
```

[89]:
```
m[2]
```

[89]:
```
400
```

[92]:
```
m[[1, 2, 3, 1, 2, 1]]
```

[92]:
```
array([200, 400, 300, 200, 400, 200])
```

[ ]:
```

```

0.5 Slicing of array

[93]:
```
m1
```

[93]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

[94]:
```
# Get first 5 elements
```

[95]:
```
m1[:5]
```

[95]:
```
array([0, 1, 2, 3, 4])
```

[96]:
```
m1[-5:-1]
```

[96]:
```
array([5, 6, 7, 8])
```

[97]:
```
m1[-5:-1:-1]
```

[97]:
```
array([], dtype=int64)
```

[98]:
```
a = np.array([1, 2, 5, 4, 3, 6, 7])
```

[99]:
```
a[4:]
```

[99]:
```
array([3, 6, 7])
```

[100]:
```
a[4:] = 12
```

[101]:
```
a
```

[101]:
```
array([ 1,  2,  5,  4, 12, 12, 12])
```

[ ]:
```

```

[102]:
```
# Quiz
```

[103]:
```
a = np.array([0,1,2,3,4,5])
a[4:] = 10
print(a)
```

```
[ 0  1  2  3 10 10]
```

[ ]:
```

```

[117]:
```
# Reshaping : It is a creating a new array.
```

[106]:
```
a = np.array(range(16))
```

[107]:
```
a
```

[107]:
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15])
```

[108]:
```
a.shape
```

[108]:
```
(16,)
```

[109]:
```
a.ndim
```

[109]:
```
1
```

[111]:
```
a.reshape(8, 2)
```

[111]:
```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
```

```
       [10, 11],
       [12, 13],
       [14, 15]])
```

[114]:
```
a.reshape(8, 2)
```

[114]:
```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11],
       [12, 13],
       [14, 15]])
```

[113]:
```
a.reshape(8, 2).ndim
```

[113]:
```
2
```

[112]:
```
a.reshape(2, 8)
```

[112]:
```
array([[ 0,  1,  2,  3,  4,  5,  6,  7],
       [ 8,  9, 10, 11, 12, 13, 14, 15]])
```

[115]:
```
a.reshape(2, 8).ndim
```

[115]:
```
2
```

[116]:
```
a
```

[116]:
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14, 15])
```

[118]:
```
a.reshape(8, -1)
```

[118]:
```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11],
       [12, 13],
       [14, 15]])
```

[119]:
```
a.reshape(4, -1)
```

[119]:
```
array([[ 0,  1,  2,  3],
       [ 4,  5,  6,  7],
```

```
       [ 8,  9, 10, 11],
       [12, 13, 14, 15]])
```

[120]:
```
a.reshape(-1, -1)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
/var/folders/t5/yhjgrjs907zfp250jyxtw54m0000gn/T/ipykernel_42741/3186977563.py␣
 ↪in <module>
----> 1 a.reshape(-1, -1)

ValueError: can only specify one unknown dimension
```

[121]:
```
a.reshape(5, -1)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
/var/folders/t5/yhjgrjs907zfp250jyxtw54m0000gn/T/ipykernel_42741/530333492.py i␣
 ↪<module>
----> 1 a.reshape(5, -1)

ValueError: cannot reshape array of size 16 into shape (5,newaxis)
```

[122]:
```
a1 = a.reshape(8, 2)
```

[123]:
```
a1.shape
```

[123]:
```
(8, 2)
```

[125]:
```
a1.T.shape
```

[125]:
```
(2, 8)
```

[127]:
```
a1
```

[127]:
```
array([[ 0,  1],
       [ 2,  3],
       [ 4,  5],
       [ 6,  7],
       [ 8,  9],
       [10, 11],
       [12, 13],
       [14, 15]])
```

[128]:
```
a1[0]
```

[128]:
```
array([0, 1])
```

[131]:
```
a1[2][1]
```

[131]:
```
5
```

[138]:
```
a1.shape
```

[138]:
```
(8, 2)
```

[ ]:

[ ]:

[ ]:

[ ]:

[132]:
```
# Quiz
```

[133]:
```
a = [1,2,3,4,5]
b = [8,7,6]
a[3:] = b[::-2]
print(a)
```

```
[1, 2, 3, 6, 8]
```

[136]:
```
b[::-2]
```

[136]:
```
[6, 8]
```

[ ]:

[ ]:

[ ]:

[ ]: