In [10]:
```
import numpy as np
```

In [11]:
```
np.__version__
```

Out[11]:
```
'2.2.3'
```

In [12]:
```
import sys
sys.version
```

Out[12]:
```
'3.13.2 (v3.13.2:4f8bb3947cf, Feb  4 2025, 11:51:10) [Clang 15.0.0 (clang-1
500.3.9.4)]'
```

Creating Arrays

In [13]:
```
my_list = [0,1,2,3,4,5]
my_list
```

Out[13]:
```
[0, 1, 2, 3, 4, 5]
```

In [14]:
```
type(my_list)
```

Out[14]:
```
list
```

In [15]:
```
arr = np.array(my_list)
```

In [16]:
```
arr
```

Out[16]:
```
array([0, 1, 2, 3, 4, 5])
```

In [17]:
```
type(my_list)
```

Out[17]:
```
list
```

In [18]:
```
type(arr)
```

Out[18]:
```
numpy.ndarray
```

In [19]:
```
type(my_list)
```

Out[19]:
```
list
```

Numpy Functions

In [21]:
```
np.arange(15)
```

Out[21]:
```
array([ 0,  1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12, 13, 14])
```

In [22]:
```
np.arange(3.0)
```

Out[22]:
```
array([0., 1., 2.])
```

In [23]:
```
np.arange(10)
```

Out[23]:
```
array([0, 1, 2, 3, 4, 5, 6, 7, 8, 9])
```

In [24]:
```
np.arange(0,5)
```

Out[24]:
```
array([0, 1, 2, 3, 4])
```

In [25]:
```
np.arange(10,20)
```

Out[25]:
```
array([10, 11, 12, 13, 14, 15, 16, 17, 18, 19])
```

In [26]:
```
np.arange(20,10)
```

Out[26]:
```
array([], dtype=int64)
```

In [27]:
```
np.arange(-20,10)
```

Out[27]:
```
array([-20, -19, -18, -17, -16, -15, -14, -13, -12, -11, -10,  -9,  -8,
        -7,  -6,  -5,  -4,  -3,  -2,  -1,   0,   1,   2,   3,   4,   5,
         6,   7,   8,   9])
```

In [28]:
```
np.arange(-16,10)
```

Out[28]:
```
array([-16, -15, -14, -13, -12, -11, -10,  -9,  -8,  -7,  -6,  -5,  -4,
        -3,  -2,  -1,   0,   1,   2,   3,   4,   5,   6,   7,   8,   9])
```

In [29]:
```
np.arange()
```

```
---------------------------------------------------------------------------
TypeError                                 Traceback (most recent call last)
Cell In[29], line 1
----> 1 np.arange()

TypeError: arange() requires stop to be specified.
```

In [30]:
```
np.arange(10,30,5)
```

Out[30]:
```
array([10, 15, 20, 25])
```

In [31]:
```
np.arange(0,10,3)
```

Out[31]:
```
array([0, 3, 6, 9])
```

In [32]:
```
np.zeros(5, dtype=int)
```

Out[32]:
```
array([0, 0, 0, 0, 0])
```

In [34]:
```
np.zeros((2,2), dtype= float)
```

Out[34]:
```
array([[0., 0.],
       [0., 0.]])
```

In [35]:
```
np.zeros((3,3))
```

Out[35]:
```
array([[0., 0., 0.],
       [0., 0., 0.],
       [0., 0., 0.]])
```

In [36]:
```
np.zeros((10,30))
```

Out[36]:
```
array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.,
        0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

In [37]:
```
np.zeros((5,10))
```

Out[37]:
```
array([[0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.],
       [0., 0., 0., 0., 0., 0., 0., 0., 0., 0.]])
```

In [40]:
```
n = (6,7)
n1 = (6,8)
print(np.zeros(n1))
```

```
[[0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]
 [0. 0. 0. 0. 0. 0. 0. 0.]]
```

In [41]:
```
print(np.zeros(n,dtype=int))
```

```
[[0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0]
 [0 0 0 0 0 0 0]]
```

In [42]:
```
np.ones(3)
```

Out[42]:
```
array([1., 1., 1.])
```

In [43]:
```
np.ones(4, dtype=int)
```

Out[43]:
```
array([1, 1, 1, 1])
```

In [44]:
```
n
```

Out[44]:
```
(6, 7)
```

In [46]:
```
np.ones(n)
```

Out[46]:
```
array([[1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.],
       [1., 1., 1., 1., 1., 1., 1.]])
```

In [47]:
```
np.twos((2,3))
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
Cell In[47], line 1
----> 1 np.twos((2,3))

File /Library/Frameworks/Python.framework/Versions/3.13/lib/python3.13/site-
packages/numpy/__init__.py:414, in __getattr__(attr)
    411     import numpy.char as char
    412     return char.chararray
--> 414 raise AttributeError("module {!r} has no attribute "
    415                       "{!r}".format(__name__, attr))

AttributeError: module 'numpy' has no attribute 'twos'
```

In [48]:
```
np.ones(2)
```

Out[48]:
```
array([1., 1.])
```

In [49]:
```
np.ones((2,4))
```

Out[49]:
```
array([[1., 1., 1., 1.],
       [1., 1., 1., 1.]])
```

In [50]:
```
r = range(5)
r
```

Out[50]: range(0, 5)

In [51]:
```
for i in r:print(i)
```

```
0
1
2
3
4
```

In [52]:
```
list(range(5))
```

Out[52]: [0, 1, 2, 3, 4]

In [53]:
```
range(1,10)
```

Out[53]: range(1, 10)

In [54]:
```
list(range(1,10))
```

Out[54]: [1, 2, 3, 4, 5, 6, 7, 8, 9]

In [55]:
```
list(range(1,10,3))
```

Out[55]: [1, 4, 7]

In [59]:
```
y =list(range(12))
y
```

Out[59]: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]

In [60]:
```
np.random.rand(5)
```

Out[60]: array([0.25902923, 0.29735576, 0.07783103, 0.66271298, 0.48724438])

In [61]:
```
np.random.rand(2, 10)
```

Out[61]:
```
array([[0.16142467, 0.244209  , 0.60378961, 0.06388952, 0.5768265 ,
        0.12807029, 0.41890737, 0.96260255, 0.96425334, 0.94068555],
       [0.61771315, 0.24525822, 0.52729366, 0.96467307, 0.97502645,
        0.50300215, 0.56522432, 0.38599789, 0.30835634, 0.97458511]])
```

In [76]:
```
np.random.randint(22, 45)
```

Out[76]: 23

In [77]:
```
np.random.randint(30,20,10)
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
Cell In[77], line 1
----> 1 np.random.randint(30,20,10)

File numpy/random/mtrand.pyx:796, in numpy.random.mtrand.RandomState.randint
()

File numpy/random/_bounded_integers.pyx:1334, in numpy.random._bounded_integ
ers._rand_int64()

ValueError: low >= high
```

In [78]:
```
np.random.randint(10,20,4)
```

Out[78]:
```
array([10, 11, 19, 14])
```

In [80]:
```
np.random.randint(10,40,(10,10))
```

Out[80]:
```
array([[23, 25, 38, 19, 35, 33, 13, 20, 22, 18],
       [17, 25, 23, 29, 37, 12, 29, 39, 23, 24],
       [29, 17, 31, 30, 13, 17, 23, 31, 31, 17],
       [19, 28, 17, 26, 26, 10, 32, 19, 35, 19],
       [30, 25, 32, 22, 31, 38, 35, 37, 28, 28],
       [39, 30, 23, 37, 38, 20, 12, 13, 24, 15],
       [33, 16, 15, 16, 20, 39, 38, 14, 19, 22],
       [22, 13, 14, 38, 25, 14, 19, 26, 11, 36],
       [13, 19, 19, 26, 22, 31, 15, 34, 26, 24],
       [20, 26, 29, 21, 11, 13, 38, 31, 25, 18]])
```

In [82]:
```
np.random.randint(1,100, (12,12))
```

Out[82]:
```
array([[59, 13, 66, 93, 13, 98,  8, 53, 44, 55, 57, 70],
       [60,  8, 20,  3, 98, 83, 71, 24,  2, 35, 78,  7],
       [42, 55, 34, 50, 27, 90, 78, 70, 56, 50,  3, 99],
       [94, 81, 26,  4, 54, 27, 61, 15, 82, 42, 14, 12],
       [57, 43, 88, 51, 39, 65, 95, 92, 71, 84, 93, 47],
       [12,  2, 27, 14, 13, 93, 20, 96, 26, 72, 30, 83],
       [ 8, 25, 43, 20, 94, 53, 54, 20, 53, 64, 20, 69],
       [96, 37, 66, 27, 30, 21, 98, 91, 20, 66,  2, 29],
       [77,  2, 20, 18, 56, 26, 64, 68, 25, 32, 24, 61],
       [31, 18, 63, 53, 78, 65, 22, 11, 97, 14, 29,  8],
       [92, 33, 93, 63, 10, 47, 77, 94, 37, 34, 42, 90],
       [73, 93, 71, 82, 97, 20, 63, 85, 61, 99, 60, 94]])
```

In [83]:
```
np.arange(1,13).reshape(3,4)
```

Out[83]:
```
array([[ 1,  2,  3,  4],
       [ 5,  6,  7,  8],
       [ 9, 10, 11, 12]])
```

In [84]:
```
np.arange(1,13).reshape(12,1)
```

Out[84]:
```
array([[ 1],
       [ 2],
       [ 3],
       [ 4],
       [ 5],
       [ 6],
       [ 7],
       [ 8],
       [ 9],
       [10],
       [11],
       [12]])
```

In [91]:
```
b = np.random.randint(10,20, (5,4))
b
```

Out[91]:
```
array([[15, 14, 11, 15],
       [15, 10, 11, 17],
       [12, 16, 15, 11],
       [14, 15, 14, 16],
       [16, 15, 10, 12]])
```

In [92]:
```
type(b)
```

Out[92]:
```
numpy.ndarray
```

In [93]:
```
b
```

Out[93]:
```
array([[15, 14, 11, 15],
       [15, 10, 11, 17],
       [12, 16, 15, 11],
       [14, 15, 14, 16],
       [16, 15, 10, 12]])
```

In [94]:
```
b[:]
```

Out[94]:
```
array([[15, 14, 11, 15],
       [15, 10, 11, 17],
       [12, 16, 15, 11],
       [14, 15, 14, 16],
       [16, 15, 10, 12]])
```

In [96]:
```
b[1:3]
```

Out[96]:
```
array([[15, 10, 11, 17],
       [12, 16, 15, 11]])
```