In [1]:

```
print("Welcome to Numpy-2")
```

```
Welcome to Numpy-2
```

Agenda

- **Installing and Importing Numpy**✅
- **Introduction to use case**✅
- **Motivation: Why to use Numpy? - How is it different from Python Lists?**✅
- **Creating a Basic Numpy Array**✅
  - From a List - `array()` , `shape` , `ndim` ✅
  - From a range and stepsize - `arange()` ✅
  - `type()` ndarray✅
- **How numpy works under the hood?**✅
- **Indexing and Slicing on 1D** ✅
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  - Slicing✅
  - Masking (Fancy Indexing)✅
- **Operation on array**✅
- **Universal Functions (ufunc) on 1D array**✅
  - Aggregate Function/ Reduction functions - `sum()` , `mean()` , ✅ `min()` , `max()`
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  - loading data: `np.loadtxt()` ✅
  - `np.empty()`
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- **2-D arrays (Matrices)**
  - `reshape()`
  - Transpose
  - Converting Matrix back to Vector - `flatten()`

Indexing and Slicing on 1D

```
- Indexing

- Slicing

- Masking (Fancy Indexing)
```

In [ ]:

In [3]:

```
a=np.arange(1,12)
a
```

Out[3]:

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

In [4]:

```
a[2]
```

Out[4]:

```
3
```

In [5]:

```
a[5]
```

Out[5]:

```
6
```

In [6]:

```
a[-6]
```

Out[6]:

```
6
```

In [7]:

```
a
```

Out[7]:

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

In [ ]:

In [ ]:

```
[2,6,7,10]
```

In [8]:

```
a[[2,6,7,10]]
```

Out[8]:

```
array([ 3,  7,  8, 11])
```

In [ ]:

```
[-9,-5,-4,-1]
```

In [9]:

```
a[[-9,-5,-4,-1]]
```

Out[9]:

```
array([ 3,  7,  8, 11])
```

In [10]:

```
a[[2,6,-4,-1]]
```

Out[10]:

```
array([ 3,  7,  8, 11])
```

In [11]:

```
a
```

Out[11]:

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

In [12]:

```
a[2,-9]
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
/var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/2619042337.py in <module>
----> 1 a[2,-9]
```

```
IndexError: too many indices for array: array is 1-dimensional, but 2 were indexed
```

```
In [ ]:   # Slicing

In [13]:  a

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

In [14]:  a[:]

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

In [15]:  a[::]

Out[15]:  array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11])

In [16]:  a

Out[16]:  array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11])

In [17]:  a[0:5]

Out[17]:  array([1, 2, 3, 4, 5])

In [18]:  a[2:7]

Out[18]:  array([3, 4, 5, 6, 7])

In [19]:  a[2:7:2]

Out[19]:  array([3, 5, 7])

In [20]:  a[2:7:-1]

Out[20]:  array([], dtype=int64)

In [21]:  a[7:2:-1]

Out[21]:  array([8, 7, 6, 5, 4])

In [ ]:

In [22]:  a[-2:-7:-1]

Out[22]:  array([10,  9,  8,  7,  6])

In [23]:  a[-7:-2:-1]

Out[23]:  array([], dtype=int64)

In [24]:  a[-2:-7:-2]

Out[24]:  array([10,  8,  6])

In [25]:  a[8:-10:-2]

Out[25]:  array([9, 7, 5, 3])

In [ ]:

In [27]:  # q=[1,2,3,4,5]
          # q[[0,1]]

In [ ]:

In [28]:  a<6

Out[28]:  array([ True,  True,  True,  True,  True, False, False, False, False,
                 False, False])

In [29]:  a[a<6]

Out[29]:  array([1, 2, 3, 4, 5])

In [ ]:

In [31]:  mask=(a%2==0)
          mask

Out[31]:  array([False,  True, False,  True, False,  True, False,  True, False,
                  True, False])

In [32]:  a[mask]

Out[32]:  array([ 2,  4,  6,  8, 10])

In [33]:  a[a%2==0]

Out[33]:  array([ 2,  4,  6,  8, 10])
```

```
In [34]: a[~mask]

Out[34]: array([ 1,  3,  5,  7,  9, 11])
```

```
In [36]: a[~(a%2==0)]

Out[36]: array([ 1,  3,  5,  7,  9, 11])
```

```
In [37]: ~a

Out[37]: array([ -2,  -3,  -4,  -5,  -6,  -7,  -8,  -9, -10, -11, -12])
```

```
In [ ]:
```

```
In [42]: mask1=(a%2==0)
         mask2=(a%5==0)
         print(mask1)
         print(mask2)
         # And or

         [False  True False  True False  True False  True False  True False]
         [False False False False  True False False False False  True False]
```

```
In [40]: a[mask1 and mask2]

         ---------------------------------------------------------------------------
         ValueError                                Traceback (most recent call last)
         /var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/1739789875.py in <module>
         ----> 1 a[mask1 and mask2]

         ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

```
In [41]: a[mask1 & mask2]

Out[41]: array([10])
```

```
In [44]: # a[mask1] and a[mask2]

         ---------------------------------------------------------------------------
         ValueError                                Traceback (most recent call last)
         /var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/287839112.py in <module>
         ----> 1 a[mask1] and a[mask2]

         ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

```
In [45]: False and False

Out[45]: False
```

```
In [46]: False and True

Out[46]: False
```

```
In [47]: True and True

Out[47]: True
```

```
In [ ]:
```

```
In [ ]:
```

```
In [48]: mask1 and mask2

         ---------------------------------------------------------------------------
         ValueError                                Traceback (most recent call last)
         /var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/3243064393.py in <module>
         ----> 1 mask1 and mask2

         ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

```
In [49]: a[mask1 or mask2]

         ---------------------------------------------------------------------------
         ValueError                                Traceback (most recent call last)
         /var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/480664235.py in <module>
         ----> 1 a[mask1 or mask2]

         ValueError: The truth value of an array with more than one element is ambiguous. Use a.any() or a.all()
```

```
In [50]: a[mask1 | mask2]

Out[50]: array([ 2,  4,  5,  6,  8, 10])
```

```
In [ ]:
```

```
In [51]: a==3

Out[51]: array([False, False,  True, False, False, False, False, False, False,
                False, False])
```

```
In [52]: a[a==3]

Out[52]: array([3])
```

```
In [53]: a[(a%2==0)&(a>4)]

Out[53]: array([ 6,  8, 10])
```

```
In [ ]:

In [ ]:

In [ ]:

In [57]: mask=a%2==0
         mask

Out[57]: array([False,  True, False,  True, False,  True, False,  True, False,
                 True, False])

In [58]:  a[mask | ~mask]

Out[58]: array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11])

In [ ]:

In [60]: # - **Operation on array**
         # - **Universal Functions (ufunc) on 1D array**
         # #     - Aggregate Function/ Reduction functions - `sum()`, `mean()`, `min()`, `max()`

In [ ]:

In [71]: a=np.array([1,2,3])
         b=np.array([4,5,6])
         c=np.array([4,5,6,8])
         print(a)
         print(b)
         print(c)

         [1 2 3]
         [4 5 6]
         [4 5 6 8]

In [62]: a+b

Out[62]: array([5, 7, 9])

In [64]: a+c

         ---------------------------------------------------------------------------
         ValueError                                Traceback (most recent call last)
         /var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/3032047929.py in <module>
         ----> 1 a+c

         ValueError: operands could not be broadcast together with shapes (3,) (4,)

In [65]: a-b

Out[65]: array([-3, -3, -3])

In [66]: a*b

Out[66]: array([ 4, 10, 18])

In [67]: a/b

Out[67]: array([0.25, 0.4 , 0.5 ])

In [72]: a%b

Out[72]: array([1, 2, 3])

In [73]: a=np.arange(1,13)

In [74]: a

Out[74]: array([ 1,  2,  3,  4,  5,  6,  7,  8,  9, 10, 11, 12])

In [75]: np.mean(a)

Out[75]: 6.5

In [76]: np.sum(a)

Out[76]: 78

In [77]: np.max(a)

Out[77]: 12

In [78]: np.min(a)

Out[78]: 1

In [79]: a.min()

Out[79]: 1

In [80]: a.max()

Out[80]: 12
```

```
In [81]:  a.mean()

Out[81]:  6.5

In [82]:  a.sum()

Out[82]:  78

In [83]:  a=np.array([5,2,7,8,3,0,1])
          a

Out[83]:  array([5, 2, 7, 8, 3, 0, 1])

In [84]:  np.sort(a)

Out[84]:  array([0, 1, 2, 3, 5, 7, 8])

In [85]:  a

Out[85]:  array([5, 2, 7, 8, 3, 0, 1])

In [86]:  a.sort()

In [87]:  a

Out[87]:  array([0, 1, 2, 3, 5, 7, 8])

In [ ]:   # 1c0ClC8SrPwJq5rrkyMKyPn80nyHcFikK

In [88]:  !gdown 1c0ClC8SrPwJq5rrkyMKyPn80nyHcFikK

          Downloading...
          From: https://drive.google.com/uc?id=1c0ClC8SrPwJq5rrkyMKyPn80nyHcFikK
          To: /Users/nikhilsanghi/Downloads/01_dsml-course-main-live/batches/1_Aug_Beg_Mon/02_Numpy_2/survey.txt
          100%|██████████████████████████████████████| 2.55k/2.55k [00:00<00:00, 2.33MB/s]

In [89]:  score=np.loadtxt("/Users/nikhilsanghi/Downloads/01_dsml-course-main-live/batches/1_Aug_Beg_Mon/02_Numpy_2/survey.txt",dtype='int')

In [90]:  score

Out[90]:  array([ 7, 10,  5, ...,  5,  9, 10])

In [93]:  total=score.shape[0]
          total

Out[93]:  1167

In [94]:  np.max(score)

Out[94]:  10

In [95]:  np.min(score)

Out[95]:  1

In [96]:  score.shape

Out[96]:  (1167,)

In [97]:  a=(1,2,3,4)
          a

Out[97]:  (1, 2, 3, 4)

In [98]:  type(a)

Out[98]:  tuple

In [99]:  a[0]

Out[99]:  1

In [100…  a[1]

Out[100…  2

In [101…  a[3]

Out[101…  4

In [102…  total=score.shape[0]
          total

Out[102…  1167

In [108…  detractors=score[score<7].shape[0]
          detractors

Out[108…  332

In [113…  promotors=score[score>8].shape[0]
          promotors
```

Out[113…

```
609
```

In [ ]:

In [114…

```
perc_promotors = (promotors/total)*100
perc_detractors = (detractors/total)*100
print(perc_promotors)
print(perc_detractors)
```

```
52.185089974293064
28.449014567266495
```

In [115…

```
nps=perc_promotors-perc_detractors
```

In [116…

```
nps
```

Out[116…

```
23.73607540702657
```

In [ ]:

In [117…

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

```
1 (8,)
```

In [ ]:

In [130…

```
a=np.arange(1,13)
a
```

Out[130…

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

In [132…

```
a[2:7]=10
```

In [133…

```
a
```

Out[133…

```
array([ 1,  2, 10, 10, 10, 10, 10,  8,  9, 10, 11, 12])
```

In [ ]:

In [128…

```
a[[1,2,3]] =10
```

In [129…

```
a
```

Out[129…

```
array([ 1, 10, 10, 10,  5,  6,  7,  8,  9, 10, 11, 12])
```

In [123…

```
a[a%2==0] =-1
```

In [124…

```
a
```

Out[124…

```
array([ 1, -1,  3, -1,  5, -1,  7, -1,  9, -1, 11, -1])
```

In [ ]:

In [136…

```
# a = [0,1,2,3,4,5]
# a[4:] = 10

# [0,1,2,3,4,5]

# [0,1,2,3,10,10]
# [0,1,2,3,10,5]

# Error
```

In [139…

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

In [140…

```
a
```

Out[140…

```
array([ 0,  1,  2,  3, 10, 10])
```

In [ ]:

In [ ]:

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

In [ ]:

```
Error
```

In [ ]:

```
[1,2,6,7,8]
```

In [ ]:

```
[1,2,8,7,6]
```

In [ ]:

```
[1,2,3,4,5,8,7,6]
```

In [141…

```
a = np.array([1,2,3,4,5])
b = np.array([8,7,6])
```

```
In [142…  a

Out[142…  array([1, 2, 3, 4, 5])

In [143…  b

Out[143…  array([8, 7, 6])

In [144…  a[2:]

Out[144…  array([3, 4, 5])

In [145…  b[::-1]

Out[145…  array([6, 7, 8])

In [146…  a[2:]=b[::-1]

In [147…  a

Out[147…  array([1, 2, 6, 7, 8])

In [ ]:

In [156…  a = np.array([1,2,3,4,5])
          b = np.array([8,7,6,5])
          # a[2:]=b[::-1]

In [157…  a

Out[157…  array([1, 2, 3, 4, 5])

In [158…  b

Out[158…  array([8, 7, 6, 5])

In [159…  a[2:]

Out[159…  array([3, 4, 5])

In [160…  a

Out[160…  array([1, 2, 3, 4, 5])

In [161…  b[::-1]

Out[161…  array([5, 6, 7, 8])

In [162…  a[2:]=b[::-1]

          ---------------------------------------------------------------------------
          ValueError                                Traceback (most recent call last)
          /var/folders/hd/9z4dczb56dj54lb7q8w7s4zw0000gn/T/ipykernel_64852/829919375.py in <module>
          ----> 1 a[2:]=b[::-1]

          ValueError: could not broadcast input array from shape (4,) into shape (3,)

In [ ]:

In [ ]:   a = np.array([0,1,2,3,4,5])
          mask = (a%2 == 0)
          a[mask] = -1

In [ ]:   [0,1,2,3,4,5]

          [-1,1,-1,1,-1,1]

          Error

          [-1,1,-1,3,-1,5]

In [163…  a = np.array([0,1,2,3,4,5])
          a

Out[163…  array([0, 1, 2, 3, 4, 5])

In [164…  mask = (a%2 == 0)
          mask

Out[164…  array([ True, False,  True, False,  True, False])

In [166…  a[mask] = -1

In [167…  a

Out[167…  array([-1,  1, -1,  3, -1,  5])

In [ ]:

In [172…  passives=score[(score==7) | (score==8)].shape[0]

In [173…  passives

Out[173…  226

In [ ]:

In [ ]:

In [ ]:

In [ ]:
```