NUMPY

NumPy stands for numeric python which is a python package for the computation and processing of the multidimensional and single dimensional array elements.

NumPy provides a convenient and efficient way to handle the vast amount of data. NumPy is also very convenient with Matrix multiplication and data reshaping. NumPy is fast which makes it reasonable to work with a large set of data.

There are the following advantages of using NumPy for data analysis.

- 1. NumPy performs array-oriented computing.
- 2. It efficiently implements the multidimensional arrays.
- 3. It performs scientific computations.
- 4. It is capable of performing Fourier Transform and reshaping the data stored in multidimensional arrays.
- 5. NumPy provides the in-built functions for linear algebra and random number generation.

Nowadays, NumPy in combination with SciPy and Mat-plotlib is used as the replacement to MATLAB as Python is more complete and easier programming language than MATLAB.

```
import numpy as np
mylist = [1,2,3,4,5,6,7]
myarray =np.array(mylist)
print(myarray)
[1 2 3 4 5 6 7]
myarray.shape
(7,)
x1=np.array([[1,2],[4,5]], dtype = 'g')
x1.dtype
dtype('float64')
x1=np.array([[1,2],[4,5]], dtype =np.uint8)
x1.dtype
dtype('uint8')
x1=np.array([[1,2],[4,5]] , dtype =np.longdouble)
x1.dtype
dtype('float64')
x1=np.array([[1,2],[4,5]] , dtype =np.csingle)
x1.dtype
dtype('complex64')
x1=np.array([[1,2],[4,5]] , dtype =np.ubyte)
x1.dtype
dtype('uint8')
x=np.array([[1,2,3],[4,5,6],[7,8,9],[1,2,3]])
x.shape
(4, 3)
x.dtype
dtype('int32')
```

```
x=np.array([1,2,3,4,5,6])
x.shape
(6,)
y=np.array([[1,2,3,4,5,6]])
y.shape
(1, 6)
arr1d = np.array([1,2,3,4,5])
arr2d =np.array([[1,2,3],[4,5,6],[7,8,9],[1,2,3],[4,5,6],[7,8,9]])
arr2d
[1, 2, 3],
       [4, 5, 6],
       [7, 8, 9]])
arr1d[2:]
array([3, 4, 5])
arr2d[1:,1:2]
array([[5],
       [8],
       [2],
       [5],
       [8]])
y=np.array([[1,2,3,4,5,6,7,8,9,10,11,12]])
k=y.reshape(4,3)
k
array([[ 1, 2, 3],
       [ 4, 5, 6],
[ 7, 8, 9],
[10, 11, 12]])
k.flatten()
array([ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12])
np.transpose(k)
unsort arr = np.array([[12,1,13],[15,13,0],[17,1,9]])
unsort arr
```

```
a=np.random.randint(1,10,(5,2))
array([[3, 7],
       [5, 5],
       [3, 8],
       [9, 3],
       [2, 5]])
a
array([[3, 7],
       [5, 5],
       [3, 8],
       [9, 3],
       [2, 5]])
arr = np.array([-2, -1, 0, 1, 2])
result = np.piecewise(arr, [arr < 0, arr >= 0], [lambda x: x^{**2},
lambda x: x^{**3}
print(result)
[4 1 0 1 8]
arr = np.array([1, 2, 3, 4, 5])
condition = arr % 2 == 0
result = np.extract(condition, arr)
print(result)
[2 4]
arr = np.array([[1, 2], [3, 4], [5, 6]])
indices = np.array([[1], [0], [1]])
result = np.take along axis(arr, indices, axis=1)
print(result)
[[2]
 [3]
 [6]]
start date = np.datetime64('2023-08-01')
end date = np.datetime64('2023-08-07')
count = np.busday count(start date, end date)
print(count)
data = np.array([1, 2, 3, 4, 5, 6, 7, 8, 9, 10])
bin_edges = np.histogram_bin_edges(data, bins='auto')
print(bin edges)
[ 1. 2.8 4.6 6.4 8.2 10. ]
```

PANDAS

Pandas is an **open-source library** in **Python** that is made mainly for working with relational or labeled data both easily and intuitively. It provides various data structures and operations for manipulating numerical data and time series. This library is built on top of the NumPy library of Python. Pandas is fast and it has high performance & productivity for users.

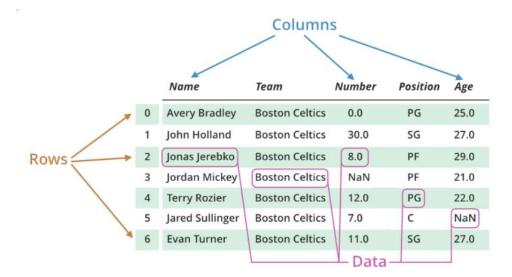
- Fast and efficient for manipulating and analyzing data.
- Data from different file objects can be easily loaded.
- Flexible reshaping and pivoting of data sets
- Provides time-series functionality.

Pandas Data Structures:

Pandas generally provide two data structures for manipulating data, They are:

Series

DataFrame



Pandas library of python is very useful for the manipulation of mathematical data and is widely used in the field of machine learning. It comprises many methods for its proper functioning. loc() and iloc() are one of those methods. These are used in slicing data from the Pandas DataFrame. They help in the convenient selection of data from the DataFrame in Python. They are used in filtering the data according to some conditions.

Pandas loc vs. iloc

- loc selects rows and columns with specific labels
- iloc selects rows and columns at specific integer positions

```
import pandas as pd
file="sample.csv"
df =pd.read csv(file)
df
    id
                     salary department
              name
0
     1
                       2000
              john
                                   sales
     2
1
            Andrew
                       5000
                                finance
2
     3
              Mark
                       8000
                                      hr
3
     4
                       5000
                              marketing
               Rey
     5
4
                       4000
               Tan
                                      IT
5
     6
             Sarah
                       3500
                                   sales
6
     7
           Michael
                       6000
                                finance
7
     8
             Emily
                       7000
                                      hr
8
     9
             David
                       5500
                              marketing
9
    10
              Lisa
                       4500
                                      IT
10
    11
             Chris
                       3000
                                   sales
11
    12
          Michelle
                       6500
                                finance
12
    13
              Alex
                       7500
                                      hr
13
    14
            Oliver
                       4800
                              marketing
14
    15
           Natalie
                       4200
                                      IT
15
    16
             James
                       3200
                                   sales
16
    17
             Grace
                                finance
                       5800
17
    18
           William
                       8200
                                      hr
18
    19
          Samantha
                       5200
                              marketing
19
    20
          Benjamin
                       3900
                                      IT
20
    21
                       2800
               Ava
                                   sales
21
    22
                                finance
            Daniel
                       6700
22
    23
              Emma
                       7200
                                      hr
23
    24
                       5100
              Liam
                              marketing
    25
24
            Sophia
                       4100
                                      IT
25
    26
           Matthew
                       3100
                                   sales
26
    27
             Chloe
                       5400
                                finance
27
    28
            Joshua
                       7900
                                      hr
28
    29
                       5300
                              marketing
            Ashley
29
    30
             Ethan
                       4700
                                      IT
30
    31
              Anna
                       2600
                                   sales
    32
31
           William
                       6200
                                finance
32
    33
          Isabella
                       7800
                                      hr
33
    34
                       5900
                              marketing
             Lucas
34
    35
               Mia
                       4300
                                      IT
35
    36
             Aiden
                       3400
                                   sales
36
    37
             Grace
                       5600
                                finance
37
    38
                       8400
              Jack
                                      hr
38
    39
            Sophia
                       5700
                              marketing
39
    40
                       4400
                                      IT
             Logan
40
    41
                       2700
                                   sales
            Amelia
41
    42
              0wen
                       6900
                                finance
```

```
42 43
       Charlotte
                    7600
                                 hr
                    5000 marketing
43 44
          Harper
44 45
            Liam
                    4600
                                 IT
45 46
             Mia
                    3300
                              sales
46 47
           James
                    5500
                           finance
47 48
         Abigail
                    8100
                                hr
                    5900 marketing
48 49
           Emily
49 50
            Noah
                    4200
```

df[['name','department']]

	name	department
0	john	sales
1 2 3 4 5 6 7 8	Andrew	finance
2	Mark	hr
3	Rey	marketing
4	Tan	IT
5	Sarah	sales
6	Michael	finance
/	Emily	hr
8	David	marketing
9	Lisa	IT
10	Chris	sales
11	Michelle	finance
12	Alex	hr
13	Oliver	marketing
14	Natalie	IT
15	James	sales
16	Grace	finance
17	William	hr
18	Samantha	marketing
19 20	Benjamin	IT sales
21	Ava Daniel	finance
22	Emma	
23	Liam	hr marketing
24	Sophia	IIIai keting
25	Matthew	sales
26	Chloe	finance
27	Joshua	hr
28	Ashley	marketing
29	Ethan	IT
30	Anna	sales
31	William	finance
32	Isabella	hr
33	Lucas	marketing
34	Mia	IT
35	Aiden	sales
36	Grace	finance
37	Jack	hr
38	Sophia	marketing
	550	

```
39
        Logan
                        IT
40
       Amelia
                    sales
41
         0wen
                  finance
42
    Charlotte
                        hr
43
       Harper
               marketing
44
         Liam
                        IT
45
           Mia
                     sales
46
        James
                  finance
47
      Abigail
                        hr
48
        Emily
                marketing
49
         Noah
                        IT
df.iloc[44]
                 45
id
name
               Liam
               4600
salary
department
                 IT
Name: 44, dtype: object
df.iloc[44][3]
'IT'
df.iloc[::-1]
    id
              name
                    salary department
49
                       4200
    50
              Noah
                                     IT
48
    49
                       5900
             Emily
                             marketing
47
    48
           Abigail
                       8100
                                     hr
46
   47
             James
                       5500
                                finance
    46
45
                       3300
               Mia
                                  sales
44
    45
              Liam
                       4600
                                     IT
43
    44
            Harper
                       5000
                             marketing
42
    43
        Charlotte
                       7600
                                     hr
41
    42
                       6900
                                finance
              0wen
40
    41
                       2700
                                  sales
            Amelia
39
    40
                       4400
             Logan
                                     IT
38
    39
            Sophia
                       5700
                             marketing
37
    38
              Jack
                       8400
                                     hr
                                finance
36
    37
             Grace
                       5600
35
    36
             Aiden
                       3400
                                  sales
34
    35
               Mia
                       4300
                                     IT
             Lucas
33
    34
                       5900
                             marketing
    33
32
         Isabella
                       7800
                                     hr
    32
31
          William
                       6200
                                finance
30
    31
              Anna
                       2600
                                  sales
29
    30
             Ethan
                       4700
                                     IT
28
    29
                       5300
            Ashley
                             marketing
27
    28
            Joshua
                       7900
                                     hr
26
    27
                       5400
                                finance
             Chloe
```

```
25
    26
           Matthew
                       3100
                                  sales
24
    25
            Sophia
                       4100
                                     IT
23
    24
              Liam
                       5100
                             marketing
22
    23
              Emma
                       7200
                                     hr
21
    22
            Daniel
                       6700
                                finance
    21
20
                       2800
                                  sales
               Ava
19
    20
          Benjamin
                       3900
                                     IT
18
    19
          Samantha
                       5200
                              marketing
           William
17
    18
                       8200
                                     hr
                                finance
16
    17
             Grace
                       5800
15
    16
             James
                       3200
                                  sales
14
    15
           Natalie
                       4200
                                      IT
13
    14
            Oliver
                       4800
                             marketing
12
    13
                       7500
              Alex
                                     hr
11
    12
          Michelle
                       6500
                                finance
10
    11
             Chris
                       3000
                                  sales
9
    10
              Lisa
                       4500
                                     IT
8
     9
             David
                       5500
                             marketing
7
     8
             Emily
                       7000
6
     7
           Michael
                       6000
                                finance
             Sarah
5
     6
                       3500
                                  sales
4
     5
                       4000
               Tan
                                     IT
3
     4
                       5000
               Rey
                             marketing
2
     3
              Mark
                       8000
     2
                                finance
1
            Andrew
                       5000
     1
                                  sales
0
              john
                       2000
df.iloc[44,[2,3]]
salary
               4600
department
                 IT
Name: 44, dtype: object
df.iloc[[44,45,46],[0,2,3]]
        salary department
    id
44
    45
           4600
                         IT
45
   46
           3300
                      sales
   47
           5500
                    finance
df.iloc[44:,1:]
       name
              salary department
44
       Liam
                4600
                               IT
45
        Mia
                3300
                            sales
46
      James
                5500
                         finance
47
    Abigail
                8100
                               hr
48
      Emily
                5900
                       marketing
49
       Noah
                4200
                               IT
df.loc[44:,'salary']
```

```
44
      4600
45
      3300
46
      5500
47
      8100
48
      5900
49
      4200
Name: salary, dtype: int64
df.loc[44:48,'salary']
44
      4600
45
      3300
46
      5500
47
      8100
48
      5900
Name: salary, dtype: int64
df.iloc[44:48,0:2]
    id
           name
44
   45
           Liam
45
            Mia
   46
          James
46 47
47 48 Abigail
df[df.name =='Liam']
    id name salary department
23
   24 Liam
                5100 marketing
44 45 Liam
                4600
df.name =='Liam'
0
      False
1
      False
2
      False
3
      False
4
      False
5
      False
6
      False
7
      False
8
      False
9
      False
10
      False
11
      False
12
      False
13
      False
14
      False
15
      False
16
      False
17
      False
18
      False
```

```
19
      False
20
      False
21
      False
22
      False
23
       True
24
      False
25
      False
26
      False
27
      False
28
      False
29
      False
30
      False
31
      False
32
      False
33
      False
34
      False
35
      False
36
      False
37
      False
38
      False
39
      False
40
      False
41
      False
42
      False
43
      False
44
       True
45
      False
46
      False
47
      False
48
      False
49
      False
Name: name, dtype: bool
df[df['salary']==7500]
    id name salary department
12 13 Alex
                7500
                              hr
df[(df['salary']>4000)&(df['department']=='IT')]
    id
           name salary department
9
    10
           Lisa
                   4500
14
    15
        Natalie
                                 IT
                    4200
24 25
         Sophia
                   4100
                                 IT
29 30
          Ethan
                   4700
                                 IT
34 35
            Mia
                    4300
                                 IT
39 40
                                 IT
          Logan
                    4400
44
   45
           Liam
                    4600
                                 IT
49
    50
           Noah
                    4200
                                 IT
df.rename(columns = {'salary':'bonus'},inplace=True)
```

	id	name	bonus	department
0	1	john	2000	sales
1	2	Andrew	5000	finance
	3	Mark	8000	hr
2	4	Rey	5000	marketing
4	5	Tan	4000	IIIai Keting
5	6	Sarah	3500	sales
6	7			
		Michael	6000	finance
7	8	Emily	7000	hr
8	9	David	5500	marketing
9	10	Lisa	4500	IT
10	11	Chris	3000	sales
11	12	Michelle	6500	finance
12	13	Alex	7500	hr
13	14	0liver	4800	marketing
14	15	Natalie	4200	IT
15	16	James	3200	sales
16	17	Grace	5800	finance
17	18	William	8200	hr
18	19	Samantha	5200	marketing
19	20	Benjamin	3900	IT
20	21	Āva	2800	sales
21	22	Daniel	6700	finance
22	23	Emma	7200	hr
23	24	Liam	5100	marketing
24	25	Sophia	4100	IT
25	26	Matthew	3100	sales
26	27	Chloe	5400	finance
27	28	Joshua	7900	hr
28	29	Ashley	5300	marketing
29	30	Ethan	4700	IT
30	31	Anna	2600	sales
31	32	William	6200	finance
32	33	Isabella	7800	hr
33	34	Lucas	5900	marketing
34				
	35	Mia	4300	IT
35	36	Aiden	3400	sales
36	37	Grace	5600	finance
37	38	Jack	8400	hr
38	39	Sophia	5700	marketing
39	40	Logan	4400	IT
40	41	Amelia	2700	sales
41	42	0wen	6900	finance
42	43	Charlotte	7600	hr
43	44	Harper	5000	marketing
44	45	Liam	4600	IT
45	46	Mia	3300	sales
46	47	James	5500	finance

```
47
    48
           Abigail
                      8100
                                      hr
                       5900
48
    49
             Emily
                             marketing
    50
49
              Noah
                       4200
                                      IT
df['salary']=df['bonus']*12
df
    id
                     bonus department
              name
                                          salary
0
     1
                       2000
                                           24000
              john
                                  sales
1
     2
            Andrew
                       5000
                                finance
                                           60000
2
     3
              Mark
                       8000
                                      hr
                                           96000
3
     4
                       5000
                                           60000
                Rey
                              marketing
4
     5
                       4000
                Tan
                                      IT
                                           48000
5
     6
             Sarah
                       3500
                                  sales
                                           42000
6
     7
                       6000
                                           72000
           Michael
                                finance
7
     8
                       7000
                                           84000
             Emily
                                      hr
8
     9
             David
                       5500
                              marketing
                                           66000
9
    10
                       4500
                                           54000
              Lisa
                                      IT
                                  sales
10
    11
             Chris
                       3000
                                           36000
11
    12
          Michelle
                       6500
                                finance
                                           78000
    13
12
                       7500
                                           90000
              Alex
                                      hr
13
    14
            Oliver
                       4800
                             marketing
                                           57600
14
    15
           Natalie
                       4200
                                           50400
                                      IT
15
    16
             James
                       3200
                                  sales
                                           38400
16
    17
             Grace
                       5800
                                finance
                                           69600
17
    18
                       8200
           William
                                      hr
                                           98400
                             marketing
18
    19
          Samantha
                       5200
                                           62400
19
    20
          Benjamin
                       3900
                                           46800
                                      IT
20
    21
                Ava
                       2800
                                  sales
                                           33600
21
    22
                                           80400
            Daniel
                       6700
                                finance
22
    23
              Emma
                       7200
                                      hr
                                           86400
23
    24
               Liam
                       5100
                             marketing
                                           61200
24
    25
            Sophia
                       4100
                                      IT
                                           49200
25
    26
                       3100
           Matthew
                                  sales
                                           37200
26
    27
             Chloe
                       5400
                                           64800
                                finance
27
    28
            Joshua
                       7900
                                           94800
                                      hr
28
    29
            Ashley
                       5300
                              marketing
                                           63600
29
    30
                       4700
             Ethan
                                      IT
                                           56400
    31
30
               Anna
                       2600
                                  sales
                                           31200
31
    32
           William
                       6200
                                finance
                                           74400
32
    33
                       7800
          Isabella
                                           93600
                                      hr
    34
33
                       5900
                              marketing
                                           70800
             Lucas
34
    35
                Mia
                       4300
                                      IT
                                           51600
                       3400
35
    36
             Aiden
                                  sales
                                           40800
36
    37
                       5600
                                           67200
             Grace
                                finance
37
    38
                       8400
                                          100800
               Jack
                                      hr
38
    39
            Sophia
                       5700
                                           68400
                             marketing
39
    40
                       4400
                                      IT
                                           52800
             Logan
40
    41
                       2700
                                           32400
            Amelia
                                  sales
41
    42
              0wen
                       6900
                                finance
                                           82800
```

```
42
    43
         Charlotte
                       7600
                                      hr
                                            91200
                       5000
43
    44
            Harper
                              marketing
                                            60000
44
    45
               Liam
                       4600
                                      IT
                                            55200
45
    46
                       3300
                                            39600
                Mia
                                  sales
46
    47
             James
                       5500
                                finance
                                            66000
47
    48
           Abigail
                       8100
                                      hr
                                            97200
                              marketing
48
    49
              Emily
                       5900
                                            70800
49
    50
               Noah
                       4200
                                            50400
                                      IT
df['CTC']=df['bonus']+df['salary']
df
                                                       CTC
    id
               name
                      bonus department
                                          salary
0
     1
               john
                       2000
                                  sales
                                            24000
                                                     26000
1
                       5000
                                            60000
                                                     65000
     2
            Andrew
                                finance
2
     3
               Mark
                       8000
                                            96000
                                                    104000
                                      hr
3
                       5000
                                                     65000
     4
                Rey
                              marketing
                                            60000
4
     5
                       4000
                Tan
                                      IT
                                            48000
                                                     52000
5
             Sarah
                       3500
                                  sales
                                            42000
                                                     45500
     6
6
                       6000
     7
           Michael
                                finance
                                            72000
                                                     78000
7
                       7000
     8
                                            84000
                                                     91000
             Emily
                                      hr
8
     9
                       5500
                              marketing
             David
                                            66000
                                                     71500
9
    10
               Lisa
                       4500
                                            54000
                                                     58500
                                      IT
                       3000
10
    11
              Chris
                                  sales
                                            36000
                                                     39000
                       6500
11
    12
          Michelle
                                            78000
                                                     84500
                                finance
12
    13
                       7500
                                            90000
               Alex
                                      hr
                                                     97500
                       4800
13
    14
            Oliver
                              marketing
                                            57600
                                                     62400
    15
                       4200
                                            50400
14
           Natalie
                                      IT
                                                     54600
15
             James
                                            38400
    16
                       3200
                                                     41600
                                  sales
16
    17
             Grace
                       5800
                                finance
                                            69600
                                                     75400
17
    18
           William
                       8200
                                            98400
                                                    106600
                                      hr
18
    19
          Samantha
                       5200
                              marketing
                                            62400
                                                     67600
                                                     50700
19
    20
          Benjamin
                       3900
                                            46800
                                      IT
20
    21
                                  sales
                       2800
                                            33600
                                                     36400
                Ava
21
    22
            Daniel
                       6700
                                finance
                                            80400
                                                     87100
22
    23
               Emma
                       7200
                                            86400
                                                     93600
                                      hr
                       5100
23
    24
               Liam
                                            61200
                                                     66300
                              marketing
            Sophia
24
    25
                       4100
                                            49200
                                      IT
                                                     53300
25
    26
           Matthew
                       3100
                                  sales
                                            37200
                                                     40300
26
    27
             Chloe
                       5400
                                finance
                                            64800
                                                     70200
                                                    102700
27
    28
            Joshua
                       7900
                                      hr
                                            94800
28
    29
                       5300
            Ashley
                              marketing
                                            63600
                                                     68900
29
    30
              Ethan
                       4700
                                      IT
                                            56400
                                                     61100
30
    31
                       2600
                                            31200
                                                     33800
               Anna
                                  sales
31
    32
           William
                       6200
                                            74400
                                                     80600
                                finance
32
    33
          Isabella
                                                    101400
                       7800
                                            93600
                                      hr
33
    34
              Lucas
                       5900
                              marketing
                                            70800
                                                     76700
34
    35
                Mia
                       4300
                                      IT
                                            51600
                                                     55900
35
    36
                       3400
             Aiden
                                  sales
                                            40800
                                                     44200
36
    37
             Grace
                       5600
                                finance
                                            67200
                                                     72800
```

```
8400
                                          100800
                                                   109200
37
    38
              Jack
                                     hr
38
    39
                      5700
                                                    74100
            Sophia
                             marketing
                                           68400
39
    40
             Logan
                      4400
                                     IT
                                           52800
                                                    57200
40
                      2700
                                  sales
                                           32400
    41
            Amelia
                                                    35100
41
    42
                      6900
                                           82800
                                                    89700
              0wen
                               finance
42
    43
         Charlotte
                      7600
                                     hr
                                           91200
                                                    98800
43
    44
            Harper
                      5000
                             marketing
                                           60000
                                                    65000
44
    45
                      4600
                                           55200
                                                    59800
              Liam
                                     IT
45
    46
               Mia
                      3300
                                  sales
                                           39600
                                                    42900
46
    47
             James
                      5500
                                finance
                                           66000
                                                    71500
47
    48
           Abigail
                      8100
                                     hr
                                           97200
                                                   105300
48
    49
                      5900
                                           70800
                                                    76700
             Emily
                             marketing
49
    50
                      4200
                                           50400
                                                    54600
              Noah
                                     IT
df['increment']=df['bonus']+df['salary']*10/100
df
    id
              name
                     bonus department
                                          salary
                                                      CTC
                                                            increment
                                                    26000
0
     1
               john
                      2000
                                  sales
                                           24000
                                                               4400.0
1
                                                    65000
     2
            Andrew
                      5000
                                finance
                                           60000
                                                              11000.0
2
                      8000
                                                   104000
     3
                                           96000
                                                              17600.0
              Mark
                                     hr
3
     4
               Rev
                      5000
                             marketing
                                           60000
                                                    65000
                                                              11000.0
4
     5
                      4000
               Tan
                                     IT
                                           48000
                                                    52000
                                                               8800.0
5
                      3500
                                           42000
                                                               7700.0
     6
             Sarah
                                  sales
                                                    45500
6
     7
           Michael
                      6000
                               finance
                                           72000
                                                    78000
                                                              13200.0
7
     8
             Emilv
                      7000
                                     hr
                                           84000
                                                    91000
                                                              15400.0
8
                      5500
                                                    71500
     9
             David
                             marketing
                                           66000
                                                              12100.0
9
    10
                      4500
                                                    58500
              Lisa
                                     IT
                                           54000
                                                               9900.0
                                                               6600.0
10
    11
             Chris
                      3000
                                  sales
                                           36000
                                                    39000
    12
11
          Michelle
                      6500
                               finance
                                           78000
                                                    84500
                                                              14300.0
12
    13
              Alex
                      7500
                                     hr
                                           90000
                                                    97500
                                                              16500.0
            Oliver
                                                    62400
13
    14
                      4800
                             marketing
                                           57600
                                                              10560.0
14
    15
           Natalie
                      4200
                                           50400
                                                    54600
                                                               9240.0
                                     IT
15
    16
             James
                      3200
                                  sales
                                           38400
                                                    41600
                                                               7040.0
    17
                      5800
                                                    75400
16
             Grace
                               finance
                                           69600
                                                              12760.0
17
    18
           William
                      8200
                                           98400
                                                   106600
                                                              18040.0
                                     hr
    19
18
          Samantha
                                           62400
                                                    67600
                      5200
                             marketing
                                                              11440.0
    20
19
          Benjamin
                      3900
                                     IT
                                           46800
                                                    50700
                                                               8580.0
                                                               6160.0
20
    21
                      2800
                                  sales
                                           33600
                                                    36400
               Ava
21
    22
            Daniel
                      6700
                               finance
                                           80400
                                                    87100
                                                              14740.0
22
    23
                      7200
              Emma
                                           86400
                                                    93600
                                                              15840.0
                                     hr
23
    24
                      5100
              Liam
                             marketing
                                           61200
                                                    66300
                                                              11220.0
24
    25
                      4100
                                           49200
                                                    53300
            Sophia
                                     IT
                                                               9020.0
25
    26
           Matthew
                      3100
                                  sales
                                           37200
                                                    40300
                                                               6820.0
26
    27
             Chloe
                      5400
                                                    70200
                               finance
                                           64800
                                                              11880.0
27
    28
            Joshua
                      7900
                                     hr
                                           94800
                                                   102700
                                                              17380.0
28
    29
                      5300
                                           63600
                                                    68900
            Ashlev
                             marketing
                                                              11660.0
29
    30
                      4700
                                           56400
                                                    61100
                                                              10340.0
             Ethan
                                     IT
    31
30
              Anna
                      2600
                                  sales
                                           31200
                                                    33800
                                                               5720.0
```

William

finance

13640.0

	Lucas Mia Aiden Grace Jack Sophia Logan Amelia Owen Charlotte Harper Liam Mia James Abigail Emily	7800 5900 4300 3400 5600 8400 5700 4400 2700 6900 7600 5000 4600 3300 5500 8100 5900 4200	hr marketing IT sales finance	93600 70800 51600 40800 67200 100800 68400 52800 32400 82800 91200 60000 55200 39600 66000 97200 70800 50400	101400 76700 55900 44200 72800 109200 74100 57200 35100 89700 98800 65000 59800 42900 71500 105300 76700 54600	17160.0 12980.0 9460.0 7480.0 12320.0 18480.0 12540.0 9680.0 5940.0 15180.0 16720.0 11000.0 7260.0 12100.0 17820.0 12980.0 9240.0	
df				2	company	122 0	3/20
CTC ic	l name	bonus	department	salary	CTC	increment	New
0 1	The state of the s	2000	sales	24000	26000	4400.0	
30400. 1 2	Andrew	5000	finance	60000	65000	11000.0	
76000. 2		8000	hr	96000	104000	17600.0	
121600 3 4		5000	marketing	60000	65000	11000.0	
76000.	0		-				
4 5 60800.		4000	IT	48000	52000	8800.0	
5 6 53200.	Sarah	3500	sales	42000	45500	7700.0	
6 7	Michael	6000	finance	72000	78000	13200.0	
91200. 7 8	B Emily	7000	hr	84000	91000	15400.0	
106400		5500	marketing	66000	71500	12100.0	
83600.	0		3				
9 16 68400.		4500	IT	54000	58500	9900.0	
10 11	. Chris	3000	sales	36000	39000	6600.0	
45600. 11 12	Michelle	6500	finance	78000	84500	14300.0	
98800. 12 13 114000	Alex	7500	hr	90000	97500	16500.0	

13 14 72960.0	Oliver	4800	marketing	57600	62400	10560.0
14 15 63840.0	Natalie	4200	IT	50400	54600	9240.0
15 16 48640.0	James	3200	sales	38400	41600	7040.0
16 17 88160.0	Grace	5800	finance	69600	75400	12760.0
17 18 124640.0	William	8200	hr	98400	106600	18040.0
18 19 79040.0	Samantha	5200	marketing	62400	67600	11440.0
19 20 59280.0	Benjamin	3900	IT	46800	50700	8580.0
20 21 42560.0	Ava	2800	sales	33600	36400	6160.0
21 22 101840.0	Daniel	6700	finance	80400	87100	14740.0
22 23 109440.0	Emma	7200	hr	86400	93600	15840.0
23 24 77520.0	Liam	5100	marketing		66300	11220.0
24 25 62320.0	Sophia	4100	IT		53300	9020.0
25 26 47120.0	Matthew	3100	sales	37200	40300	6820.0
26 27 82080.0	Chloe	5400	finance	64800	70200	11880.0
27 28 120080.0 28 29	Joshua	7900	hr	94800	102700 68900	17380.0 11660.0
80560.0 29 30	Ashley Ethan	5300 4700	marketing IT	63600 56400	61100	10340.0
71440.0 30 31	Anna	2600	sales	31200	33800	5720.0
39520.0 31 32	William	6200	finance	74400	80600	13640.0
94240.0 32 33	Isabella	7800	hr	93600	101400	17160.0
118560.0 33 34	Lucas	5900	marketing	70800	76700	12980.0
89680.0 34 35	Mia	4300	IT	51600	55900	9460.0
65360.0 35 36	Aiden	3400	sales	40800	44200	7480.0
51680.0 36 37	Grace	5600	finance	67200	72800	12320.0
85120.0 37 38	Jack	8400	hr	100800	109200	18480.0
127680.0						

38 39	Sophia	5700	marketing	68400	74100	12540.0	
86640.0 39 40	Logan	4400	IT	52800	57200	9680.0	
66880.0 40 41	Amelia	2700	sales	32400	35100	5940.0	
41040.0 41 42	0wen	6900	finance	82800	89700	15180.0	
	Charlotte	7600	hr	91200	98800	16720.0	
115520.0 43 44	Harper	5000	marketing	60000	65000	11000.0	
76000.0 44 45	Liam	4600	IT	55200	59800	10120.0	
69920.0 45 46	Mia	3300	sales	39600	42900	7260.0	
50160.0 46 47	James	5500	finance	66000	71500	12100.0	
83600.0 47 48	Abigail	8100	hr	97200	105300	17820.0	
123120.0 48 49	Emily	5900	marketing	70800	76700	12980.0	
89680.0 49 50 63840.0	Noah	4200	IT	50400	54600	9240.0	
					2 22 2		
df['New C	CTC in flo	at 'l=0	ff'New CTC'	l.astvpe	(float)		
df['New (CTC in flo	oat ']=0	df['New CTC'].astype	(float)		
df id	cTC in flo name		df['New CTC' department			increment	New
df id CTC \ 0 1						increment	New
id CTC \ 0 1 30400.0 1 2	name	bonus	department	salary	СТС		New
id CTC \ 0 1 30400.0 1 2 76000.0 2 3	name john	bonus 2000	department sales	salary 24000	CTC 26000	4400.0	New
df id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4	name john Andrew	bonus 2000 5000	department sales finance	salary 24000 60000	CTC 26000 65000	4400.0 11000.0	New
df id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4 76000.0 4 5	name john Andrew Mark	bonus 2000 5000 8000	department sales finance hr	salary 24000 60000 96000	CTC 26000 65000 104000	4400.0 11000.0 17600.0	New
df id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4 76000.0 4 5 60800.0 5 6	name john Andrew Mark Rey	bonus 2000 5000 8000 5000	department sales finance hr marketing	salary 24000 60000 96000 60000	CTC 26000 65000 104000 65000	4400.0 11000.0 17600.0 11000.0	New
id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4 76000.0 4 5 60800.0 5 6 53200.0 6 7	name john Andrew Mark Rey Tan	bonus 2000 5000 8000 5000 4000	department sales finance hr marketing	salary 24000 60000 96000 60000 48000	CTC 26000 65000 104000 65000 52000	4400.0 11000.0 17600.0 11000.0 8800.0	New
df id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4 76000.0 4 5 60800.0 5 6 53200.0 6 7 91200.0 7 8	name john Andrew Mark Rey Tan Sarah	bonus 2000 5000 8000 5000 4000 3500	department sales finance hr marketing IT sales	salary 24000 60000 96000 60000 48000 42000	CTC 26000 65000 104000 65000 52000 45500	4400.0 11000.0 17600.0 11000.0 8800.0 7700.0	New
df id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4 76000.0 4 5 60800.0 5 6 53200.0 6 7 91200.0 7 8 106400.0 8 9	name john Andrew Mark Rey Tan Sarah Michael	bonus 2000 5000 8000 5000 4000 3500 6000	department sales finance hr marketing IT sales finance	salary 24000 60000 96000 60000 48000 42000 72000	CTC 26000 65000 104000 65000 52000 45500 78000	4400.0 11000.0 17600.0 11000.0 8800.0 7700.0 13200.0	New
df id CTC \ 0 1 30400.0 1 2 76000.0 2 3 121600.0 3 4 76000.0 4 5 60800.0 5 6 53200.0 6 7 91200.0 7 8 106400.0	name john Andrew Mark Rey Tan Sarah Michael Emily	bonus 2000 5000 8000 5000 4000 3500 6000 7000	department sales finance hr marketing IT sales finance hr	salary 24000 60000 96000 60000 48000 42000 72000 84000	CTC 26000 65000 104000 65000 52000 45500 78000 91000	4400.0 11000.0 17600.0 11000.0 8800.0 7700.0 13200.0 15400.0	New

10 11 45600.0	Chris	3000	sales	36000	39000	6600.0
11 12 98800.0	Michelle	6500	finance	78000	84500	14300.0
12 13 114000.0	Alex	7500	hr	90000	97500	16500.0
13 14 72960.0	0liver	4800	marketing	57600	62400	10560.0
14 15 63840.0	Natalie	4200	IT	50400	54600	9240.0
15 16 48640.0	James	3200	sales	38400	41600	7040.0
16 17 88160.0	Grace	5800	finance	69600	75400	12760.0
17 18 124640.0	William	8200	hr	98400	106600	18040.0
18 19 79040.0	Samantha	5200	marketing	62400	67600	11440.0
19 20 59280.0	Benjamin	3900	IT .	46800	50700	8580.0
20 21 42560.0	Ava	2800	sales	33600	36400	6160.0
21 22 101840.0	Daniel	6700	finance	80400	87100	14740.0
22 23 109440.0	Emma	7200	hr	86400	93600	15840.0
23 24 77520.0	Liam	5100	marketing		66300	11220.0
24 25 62320.0 25 26	Sophia Matthew	4100 3100	IT sales	49200 37200	53300 40300	9020.0
47120.0 26 27	Chloe	5400	finance	64800	70200	11880.0
82080.0 27 28	Joshua	7900	hr	94800	102700	17380.0
120080.0 28 29	Ashley		marketing	63600	68900	11660.0
80560.0 29 30	Ethan	4700	IT	56400	61100	10340.0
71440.0 30 31	Anna	2600	sales	31200	33800	5720.0
39520.0 31 32	William	6200	finance	74400	80600	13640.0
94240.0 32 33	Isabella	7800	hr	93600	101400	17160.0
118560.0 33 34	Lucas	5900	marketing	70800	76700	12980.0
89680.0 34 35	Mia	4300	IT	51600	55900	9460.0
65360.0						

35 36 51680.0	Aiden	3400	sales	40800	44200	7480.0	
36 37 85120.0	Grace	5600	finance	67200	72800	12320.0	
37 38 127680.0	Jack	8400	hr	100800	109200	18480.0	
38 39 86640.0	Sophia	5700	marketing	68400	74100	12540.0	
39 40 66880.0	Logan	4400	IT	52800	57200	9680.0	
40 41 41040.0	Amelia	2700	sales	32400	35100	5940.0	
41 42 104880.0	0wen	6900	finance	82800	89700	15180.0	
	harlotte	7600	hr	91200	98800	16720.0	
43 44 76000.0	Harper	5000	marketing	60000	65000	11000.0	
44 45 69920.0	Liam	4600	IT	55200	59800	10120.0	
45 46 50160.0	Mia	3300	sales	39600	42900	7260.0	
46 47 83600.0	James	5500	finance	66000	71500	12100.0	
47 48 123120.0	Abigail	8100	hr	97200	105300	17820.0	
48 49	Emily	5900	marketing	70800	76700	12980.0	
89680.0 49 50 63840.0	Noah	4200	IT	50400	54600	9240.0	

	New	CTC	in float	
0			30400.0	
1			76000.0	
2			121600.0	
3			76000.0	
4			60800.0	
5			53200.0	
6			91200.0	
7			106400.0	
8			83600.0	
9			68400.0	
10			45600.0	
11			98800.0	
12			114000.0	
13			72960.0	
14			63840.0	
15			48640.0	
16			88160.0	
17			124640.0	

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	42560.0 101840.0 109440.0 77520.0 62320.0 47120.0 82080.0 120080.0 80560.0 71440.0 39520.0 94240.0 118560.0 89680.0 65360.0 51680.0 85120.0 127680.0 86640.0 66880.0 41040.0 104880.0 115520.0 76000.0 69920.0 50160.0
43	76000.0
45 46 47 48 49	50160.0 83600.0 123120.0 89680.0 63840.0