Python - Matrix

Matrix is a special case of two dimensional array where each data element is of strictly same size. So every matrix is also a two dimensional array but not vice versa. Matrices are very important data structures for many mathematical and scientific calculations. As we have already discussed two dimnsional array data structure in the previous chapter we will be focusing on data structure operations specific to matrices in this chapter.

We also be using the numpy package for matrix data manipulation.

Matrix Example

Consider the case of recording temprature for 1 week measured in the morning, mid-day, evening and mid-night. It can be presented as a 7X5 matrix using an array and the reshape method available in numpy.

```
from numpy import *
a = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

m = reshape(a,(7,5))
print(m)
```

The above data can be represented as a two dimensional array as below.

```
[['Mon' '18' '20' '22' '17']
 ['Tue' '11' '18' '21' '18']
 ['Wed' '15' '21' '20' '19']
 ['Thu' '11' '20' '22' '21']
 ['Fri' '18' '17' '23' '22']
 ['Sat' '12' '22' '20' '18']
 ['Sun' '13' '15' '19' '16']]
```

Accessing Values in a Matrix

The data elements in a matrix can be accessed by using the indexes. The access methos is same as the way data is accessed in Two dimensional array.

```
from numpy import *
m = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

# Print data for Wednesday
print(m[2])
```

```
# Print data for friday evening
print(m[4][3])
```

When the above code is executed, it produces the following result −

```
['Wed', 15, 21, 20, 19]
23
```

Adding a row

```
from numpy import *
m = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

m_r = append(m,[['Avg',12,15,13,11]],0)

print(m_r)
```

When the above code is executed, it produces the following result −

```
[['Mon' '18' '20' '22' '17']
 ['Tue' '11' '18' '21' '18']
 ['Wed' '15' '21' '20' '19']
 ['Thu' '11' '20' '22' '21']
 ['Fri' '18' '17' '23' '22']
 ['Sat' '12' '22' '20' '18']
 ['Sun' '13' '15' '19' '16']
 ['Avg' '12' '15' '13' '11']]
```

Adding a column

We can add column to a matrix using the insert() method. here we have to mention the index where we want to add the column and a array containing the new values of the columns added. In the below example we add t a new column at the fifth position from the begining.

```
from numpy import *
m = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

m_c = insert(m,[5],[[1],[2],[3],[4],[5],[6],[7]],1)

print(m_c)
```

When the above code is executed, it produces the following result −

```
[['Mon' '18' '20' '22' '17' '1']
 ['Tue' '11' '18' '21' '18' '2']
 ['Wed' '15' '21' '20' '19' '3']
 ['Thu' '11' '20' '22' '21' '4']
 ['Fri' '18' '17' '23' '22' '5']
 ['Sat' '12' '22' '20' '18' '6']
 ['Sun' '13' '15' '19' '16' '7']]
```

Delete a row form a Matrix

We can delete a row from a matrix using the delete() method. We have to specify the index of the row and also the axis value which is 0 for a row and 1 for a column.

```
 from numpy import *
m = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

m = delete(m,[2],0)

print(m)
```

When the above code is executed, it produces the following result −

```
[['Mon' '18' '20' '22' '17']
 ['Tue' '11' '18' '21' '18']
 ['Thu' '11' '20' '22' '21']
 ['Fri' '18' '17' '23' '22']
 ['Sat' '12' '22' '20' '18']
 ['Sun' '13' '15' '19' '16']]
```

Delete a column from a Matrix

We can delete a column from a matrix using the delete() method. We have to specify the index of the column and also the axis value which is 0 for a row and 1 for a column.

```
from numpy import *
m = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

m = delete(m,s_[2],1)

print(m)
```

When the above code is executed, it produces the following result −

```
[['Mon' '18' '22' '17']
 ['Tue' '11' '21' '18']
 ['Wed' '15' '20' '19']
 ['Thu' '11' '22' '21']
 ['Fri' '18' '23' '22']
 ['Sat' '12' '20' '18']
 ['Sun' '13' '19' '16']]
```

Update a row in in a Matrix

To update the values in the row of a matrix we simply re-assign the values at the index of the row. In the below example all the values for thrursday's data is marked as zero. The index for this row is 3.

```
from numpy import *
m = array([['Mon',18,20,22,17],['Tue',11,18,21,18],
                   ['Wed',15,21,20,19],['Thu',11,20,22,21],
                   ['Fri',18,17,23,22],['Sat',12,22,20,18],
                   ['Sun',13,15,19,16]])

m[3] = ['Thu',0,0,0,0]

print(m)
```

When the above code is executed, it produces the following result −

```
[['Mon' '18' '20' '22' '17']
 ['Tue' '11' '18' '21' '18']
 ['Wed' '15' '21' '20' '19']
 ['Thu' '0' '0' '0' '0']
 ['Fri' '18' '17' '23' '22']
 ['Sat' '12' '22' '20' '18']
 ['Sun' '13' '15' '19' '16']]
```