FINAL PRACTICAL FILE

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Que1 Perform elementary mathematical operations in R like addition, multiplication, division and exponentiation.

Ans

```
sum <-1+2
diff <-1-2
prod <-1*2
quot <-1/2
exp <-2^6
print(sum)
print(diff)
print(prod)
print(quot)
print(exp)
```

```
[1] 3
[1] -1
[1] 2
[1] 0.5
[1] 64
```

Que2 Perform elementary logical operations in R like OR, AND, checking for equality, NOT and XOR.

Ans

```
and <-TRUE&&FALSE
or <-TRUE||FALSE
not <-!TRUE
ne <-1!=2
xor <-xor(FALSE,TRUE)
print(and)
print(or)
print(not)
print(ne)
print(xor)
```

```
[1] FALSE
[1] TRUE
[1] FALSE
[1] TRUE
[1] TRUE
```

Que3 Create, initialize and display simple variables and simple strings and use simple formatting for variables.

Ans

```
integer_var = 42
float_var = 3.14
boolean_var = True

string_var = "Hello, world!"
formatted_string = "The value of integer_var is: {}, and the value of
float_var is: {:.2f}".format(integer_var, float_var)

print("Simple Variables:")
print("Integer Variable:", integer_var)
print("Float Variable:", float_var)
print("Boolean Variable:", boolean_var)
print()

print("Simple Strings:")
print("String Variable:", string_var)
print("Formatted String:", formatted_string)
```

```
Simple Variables:
Integer Variable: 42
Float Variable: 3.14
Boolean Variable: True

Simple Strings:
String Variable: Hello, world!
Formatted String: The value of integer_var is:
42, and the value of float_var is: 3.14
PS C:\Users\Cyberdex 42\Desktop\Academic\Sem 6\
ML Prac>
```

Que4 Create single dimension/ multidimensional arrays, and arrays with specific values like array of all ones, all zeros, array with random values within a range, or a diagonal matrix.

Ans

```
import numpy as np

single_dim_array = np.array([1, 2, 3, 4, 5])

multi_dim_array = np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]])

ones_array = np.ones((3, 3))

zeros_array = np.zeros((2, 4))

random_array = np.random.randint(0, 10, size=(3, 3))

diagonal_matrix = np.diag([1, 2, 3, 4, 5])

print("Single-dimensional Array:")
print(single_dim_array)
print()

print("Multi-dimensional Array:")
print(multi_dim_array)
print()

print("Array of All Ones:")
print(ones_array)
print()

print("Array of All Zeros:")
print(zeros_array)
print()

print("Array with Random Values:")
print(random_array)
print()

print("Diagonal Matrix:")
print(diagonal_matrix)
```

```
Single-dimensional Array:
[1 2 3 4 5]

Multi-dimensional Array:
[[1 2 3]
 [4 5 6]
 [7 8 9]]

Array of All Ones:
[[1. 1. 1.]
 [1. 1. 1.]
 [1. 1. 1.]]

Array of All Zeros:
[[0. 0. 0. 0.]
 [0. 0. 0. 0.]]

Array with Random Values:
[[6 8 6]
 [3 9 3]
 [5 4 6]]

Diagonal Matrix:
[[1 0 0 0 0]
 [0 2 0 0 0]
 [0 0 3 0 0]
 [0 0 0 4 0]
 [0 0 0 0 5]]
```

Que5 Use commands to compute the size of a matrix, size of a particular row/column, load data from a text file, store matrix data to a text file, finding out variables and their features in the current scope.

Ans

```
import numpy as np

def compute_matrix_size(matrix):
    return matrix.shape

def row_size(matrix):
    return matrix.shape[1]
```

```
def load_matrix_from_file(filename):
    matrix = np.loadtxt(filename)
    return matrix

def store_matrix_to_file(matrix, filename):
    np.savetxt(filename, matrix)

def variables_in_scope():
    variables = globals().copy()
    return variables.keys()

matrix = np.array([[1, 2, 3], [4, 5, 6], [7, 8, 9]])

matrix_size = compute_matrix_size(matrix)
print("Size of matrix:", matrix_size)

row_index = 1
row_size = row_size(matrix)
print("Size of row", row_index, ":", row_size)

filename = "matrix_data.txt"
loaded_matrix = load_matrix_from_file(filename)
print("Loaded matrix from file:")
print(loaded_matrix)

store_matrix_to_file(matrix, filename)
print("Stored matrix data to file:", filename)

print("Variables in current scope:")
variables = variables_in_scope()
for variable in variables:
    print(variable)
```

```
Size of matrix: (3, 3)
Size of row 1 : 3
Loaded matrix from file:
[[1. 2. 3.]
 [4. 5. 6.]
 [7. 8. 9.]]
Stored matrix data to file: matrix_data.txt
Variables in current scope:
__name__
__doc__
__package__
__loader__
__spec__
__annotations__
__builtins__
__file__
__cached__
np
compute_matrix_size
row_size
load_matrix_from_file
store_matrix_to_file
variables_in_scope
matrix
matrix_size
row_index
filename
```

Que6 Perform basic operations on matrices(like addition, subtraction, multiplication) and display specific rows or columns of the matrix.

Ans

```
def matadd(X,Y):
    m,o = len(X),len(Y[0])
    n1,n2 = len(X[0]),len(Y)
    if(m!=n2 or n1!=o):
        raise Exception('Incompatible matrices')
    else:
        prod = [[0]*n1 for i in range(m)]
        for i in range(m):
            for j in range(n1):
                prod[i][j] = X[i][j]+Y[i][j]
        return prod
```

```
def matsub(X,Y):
    m,o = len(X),len(Y[0])
    n1,n2 = len(X[0]),len(Y)
    if(m!=n2 or n1!=o):
        raise Exception('Incompatible matrices')
    else:
        prod = [[0]*n1 for i in range(m)]
        for i in range(m):
            for j in range(n1):
                prod[i][j] = X[i][j]-Y[i][j]
        return prod

def matmul(X,Y):
    m,o = len(X),len(Y[0])
    n1,n2 = len(X[0]),len(Y)
    if(n1!=n2):
        raise Exception('Incompatible matrices')
    else:
        prod = [[0]*o for i in range(m)]
        for i in range(m):
            for k in range(o):
                for j1 in range(n1):
                    prod[i][k]+=(X[i][j1]*Y[j1][k])
        return prod

def printMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        for i in range(m):
            for k in range(n):
                print(f'{X[i][k]}',end="\t")
            print('\n')
def printCol(X,j):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        for i in range(m):
            print(f'{X[i][j]}')
def printRow(X,i):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        for j in range(n):
            print(f'{X[i][j]}',end=" ")
        print("\n")
```

```
ex = [[1,2],[3,4]]
print(f'Our given matrix(M) is: ')
printMat(ex)
print(f'M + M is: ')
printMat(matadd(ex,ex))
print(f'M - M is: ')
printMat(matsub(ex,ex))
print(f'M * M is: ')
printMat(matmul(ex,ex))
print(f'1st row is: ')
printRow(ex,0)
print(f'1st column is: ')
printCol(ex,1)
```

```
Our given matrix(M) is:
1       2

3       4

M + M is:
2       4

6       8

M - M is:
0       0

0       0

M * M is:
7       10

15      22

1st row is:
1 2

1st column is:
2
4
```

Que7 Perform other matrix operations like converting matrix data to absolute values, taking negative of matrix values, adding/removing

rows/columns from a matrix, finding the maximum or minimum values in a a matrix or in a row/ column, and finding the sum of some/all elements in a matrix.

Ans

```
from copy import deepcopy

def printMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        for i in range(m):
            for k in range(n):
                print(f'{X[i][k]}',end="\t")
            print('\n')
def absMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        prod = deepcopy(X)
        for i in range(m):
            for k in range(n):
                prod[i][k] = abs(X[i][k])
        return prod
def negMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        prod = deepcopy(X)
        for i in range(m):
            for k in range(n):
                prod[i][k] = -(X[i][k])
        return prod
def sumMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        sum = 0
        for i in range(m):
            for k in range(n):
                sum+=(X[i][k])
        return sum
ex = [[-1,2],[3,-4]]
print("The original matrix is: ")
```

```
printMat(ex)
print("The absolute matrix is: ")
printMat(absMat(ex))
print("The negative matrix is: ")
printMat(negMat(ex))
print(f"The sum of matrix is: {sumMat(ex)}")
```

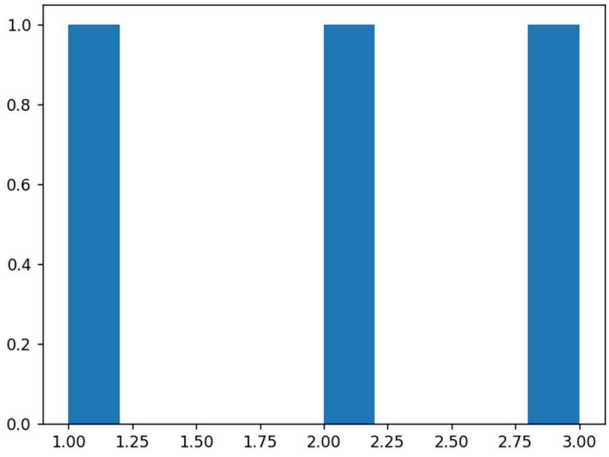
```
The original matrix is:
-1      2

3       -4

The absolute matrix is:
1       2

3       4

The negative matrix is:
1       -2

-3      4

The sum of matrix is: 0
```

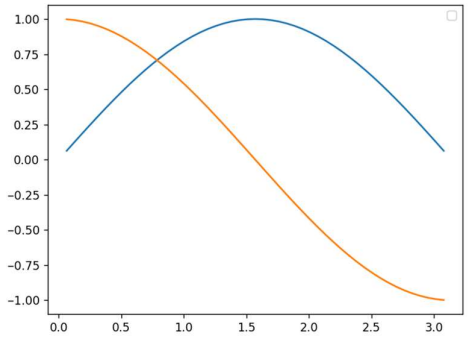
Que8 Create various types of plots/charts like histograms, plot based on sine/cosine function based on data from a matrix. Further label different axes in a plot and data in a plot.

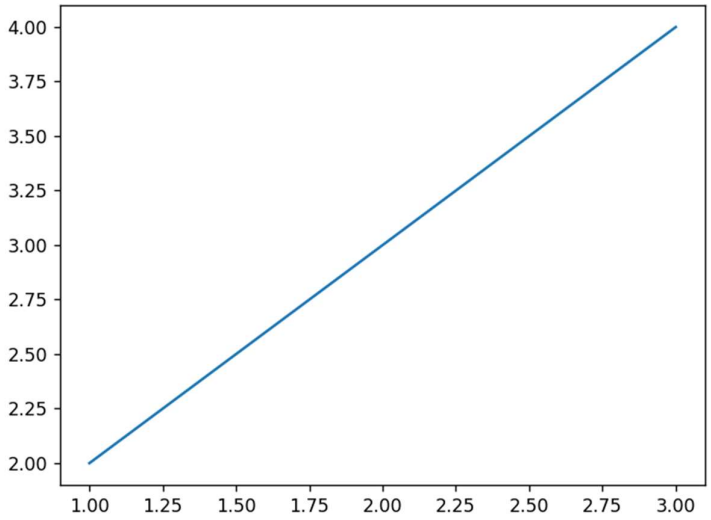
Ans

```
from copy import deepcopy
from matplotlib.pyplot import hist,plot,show,legend
from math import sin,cos,pi
def printMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        for i in range(m):
            for k in range(n):
                print(f'{X[i][k]}',end="\t")
            print('\n')

ex = [[1,2,3],[2,3,4]]
print("The original matrix is: ")
```

```
printMat(ex)
hist(ex[0])
show()
plot([pi*i/50 for i in range(1,50,1)],[sin(pi*i/50) for i in range(1,50,1)])
plot([pi*i/50 for i in range(1,50,1)],[cos(pi*i/50) for i in range(1,50,1)])
legend()
show()
plot(ex[0],ex[1])
show()
ex = [[-1,2],[3,-4]]
```





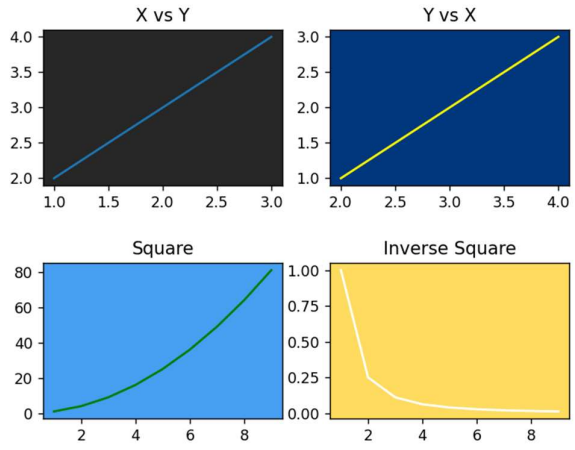


Que9 Generate different subplots from a given plot and color plot data.

Ans

```
from matplotlib.pyplot import hist,plot,show,legend,subplots
```

```
fig,ax = subplots(2,2)
def printMat(X):
    m,n = len(X),len(X[0])
    if(m<=0 or n<=0):
        raise Exception('Misshapen matrix')
    else:
        for i in range(m):
            for k in range(n):
                print(f'{X[i][k]}',end="\t")
            print('\n')

ex = [[1,2,3],[2,3,4]]
print("The original matrix is: ")
printMat(ex)
fig.subplots_adjust(hspace=0.5)
ax[0,0].set_facecolor('#272727')
ax[0,0].set_title('X vs Y')
ax[0,0].plot(ex[0],ex[1])
ax[0,1].set_facecolor('#01377D')
ax[0,1].set_title('Y vs X')
ax[0,1].plot(ex[1],ex[0],c='yellow')
ax[1,0].set_facecolor('#489EF1')
ax[1,0].set_title('Square')
ax[1,0].plot(range(1,10),[i*i for i in range(1,10)],c='green')
ax[1,1].set_facecolor('#ffdc5f')
ax[1,1].set_title('Inverse Square')
ax[1,1].plot(range(1,10),[1/(i*i) for i in range(1,10)],c='white')
show()
ex = [[-1,2],[3,-4]]
```



Que10 Use conditional statements and different types of loops based on simple examples.

Ans

```
print("For loop with array:")
array = [1, 2, 3, 4, 5]
for element in array:
    print(element)
print()

print("While loop with array:")
array = [1, 2, 3, 4, 5]
i = 0
while i < len(array):
    print(array[i])
    i += 1
print()

print("Do-while loop equivalent with array:")
array = [1, 2, 3, 4, 5]
i = 0
while True:
    print(array[i])
    i += 1
    if i >= len(array):
        break
print()
```

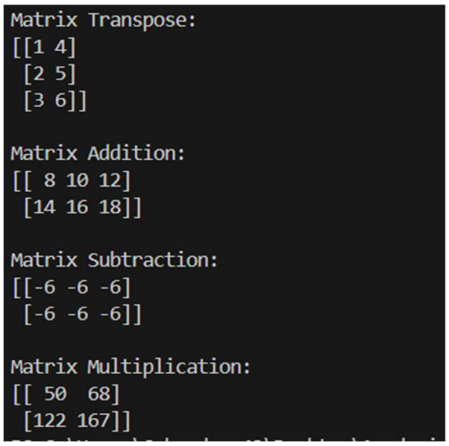
```
For loop with array:
1
2
3
4
5

While loop with array:
1
2
3
4
5

Do-while loop equivalent with array:
1
2
3
4
5
```

Que11 Perform vectorized implementation of simple matrix operations like finding the transpose of a matrix, adding, subtracting or multiplying two matrices.

Ans

```
import numpy as np
```

```
def matrix_transpose(matrix):
    return np.transpose(matrix)

def matrix_addition(matrix1, matrix2):
    return np.add(matrix1, matrix2)

def matrix_subtraction(matrix1, matrix2):
    return np.subtract(matrix1, matrix2)

def matrix_multiplication(matrix1, matrix2):
    return np.dot(matrix1, matrix2)

matrix_a = np.array([[1, 2, 3],
                     [4, 5, 6]])

matrix_b = np.array([[7, 8, 9],
                     [10, 11, 12]])

print("Matrix Transpose:")
print(matrix_transpose(matrix_a))
print()

print("Matrix Addition:")
print(matrix_addition(matrix_a, matrix_b))
print()

print("Matrix Subtraction:")
print(matrix_subtraction(matrix_a, matrix_b))
print()

print("Matrix Multiplication:")
print(matrix_multiplication(matrix_a, matrix_b.T))
```



Que12 Implement Linear Regression problem. For example, based on a dataset of prices and area/size of the houses predict the estimated price of a given house.

Ans

```
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score

import pandas as pd

from warnings import filterwarnings
data = pd.read_csv('housing.csv')
x,y = data['area'],data['price']

lr = LinearRegression()
lr.fit(x.to_frame(),y.to_frame())

area = int(input("Enter the area of the plot: "))
ypred = lr.predict(pd.DataFrame([area]))
print(f'The predicted house price is Rs.{ypred[0][0]}')
```

```
The predicted house price is Rs.2849745.3515634863
```

Que13 Based on multiple features perform Linear Regression. For example, based on a number of additional features like number of bedrooms, servant room, number of balconies, number of houses of years a house has been built- predict the price of a house.

```
from sklearn.preprocessing import LabelEncoder
from sklearn.linear_model import LinearRegression
from sklearn.metrics import r2_score

import pandas as pd

from warnings import filterwarnings
data = pd.read_csv('housing.csv')
x,y = data.iloc[:,1:],data.iloc[:,0]

le = LabelEncoder()
for col in x.columns:
    if (x[col].dtype=='object'):
        x[col] = le.fit_transform(x[col])

lr = LinearRegression()
```

```
lr.fit(x,y)
pred = lr.predict(pd.DataFrame([[5000,4,    2,    3,    1,    0,    0,    0,
      1,    2,    1,    0]]))
print(f"Predicted price of house is Rs.{pred[0]}")
```

```
Predicted price of house is Rs.7611610.832214361
```

Que14 Implement a classification problem. For example, based on different features of students data, classify whether a student is suitable for a particular activity. Based on the available dataset, a student can also implement another classification problem like checking whether an email is spam or not.

Ans

```
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.linear_model import LogisticRegression

from warnings import filterwarnings
filterwarnings('ignore')

data = pd.read_csv("iris.csv")

le = LabelEncoder()
le.fit(data['variety'])
map = dict([(i,le.inverse_transform([i])[0]) for i in
range(len(data['variety'].unique()))])
data['variety'] = le.transform(data['variety'])

x,y = data.iloc[:,:-1],data.iloc[:,-1]

logreg = LogisticRegression()
logreg.fit(x,y)
features = []
for i in x.columns:
    feat = float(input(f"Enter the {i}:"))
    features.append(feat)
print(f'Given flower was a
{map[logreg.predict(pd.DataFrame([features]))[0]]}')
```

```
Given flower was a Virginica
```

Que15 Use some function for regularization of the dataset based on problem 14.

Ans

```
 from sklearn.datasets import load_iris
from sklearn.preprocessing import StandardScaler
import pandas as pd

from warnings import filterwarnings
filterwarnings('ignore')

data = pd.read_csv("iris.csv")
x,y = data.iloc[:,:-1],data.iloc[:,-1]

scaler = StandardScaler()
xstan = scaler.fit_transform(x)

xstan = pd.DataFrame(xstan)
xstan.columns = x.columns
```

	sepal.length	sepal.width	petal.length	petal.width
0	-0.900681	1.019004	-1.340227	-1.315444
1	-1.143017	-0.131979	-1.340227	-1.315444
2	-1.385353	0.328414	-1.397064	-1.315444
3	-1.506521	0.098217	-1.283389	-1.315444
4	-1.021849	1.249201	-1.340227	-1.315444
...	...	...	...	...
145	1.038005	-0.131979	0.819596	1.448832
146	0.553333	-1.282963	0.705921	0.922303
147	0.795669	-0.131979	0.819596	1.053935
148	0.432165	0.788808	0.933271	1.448832
149	0.068662	-0.131979	0.762758	0.790671

Que16 Use some function for neural networks(like Stochastic Gradient Descent or backpropagation) algorithm to predict the value of a variable based on the dataset of problem14.

Ans

```
sum <-1+2
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.neural_network import MLPClassifier
```

```
from warnings import filterwarnings
filterwarnings('ignore')

data = pd.read_csv("iris.csv")
le = LabelEncoder()
le.fit(data['variety'])
map = dict([(i,le.inverse_transform([i])[0]) for i in
range(len(data['variety'].unique()))])
data['variety'] = le.transform(data['variety'])

x,y = data.iloc[:,:-1],data.iloc[:,-1]

mlp = MLPClassifier(alpha=0.05,activation='logistic')
mlp.fit(x,y)

features = []
for i in x.columns:
    feat = float(input(f"Enter the {i}:"))
    features.append(feat)
print(f'Given flower was a {map[mlp.predict(pd.DataFrame([features]))[0]]}')
```

```
Given flower was a Versicolor
```