OPEN SOURCE SOFTWARE LAB (15B17CI575)

Lab Assignment 5 (Practice Lab)

Odd 2021

Week 5 & 6: 28 Sept- 9 Oct

Topic Coverage: Python- Matplotlib and SciPy package

Matplotlib Practice Questions

1. Creating simple plots of sin(x) and cos(x)

```
import numpy as np

X = np.linspace(-np.pi, np.pi, 256, endpoint=True)
C, S = np.cos(X), np.sin(X)
import matplotlib.pyplot as plt
plt.plot(X, C)
plt.plot(X, S)
plt.show()
```

Here, X is numpy array with 256 values ranging from -π to +π. C is cosine (256 values) and S is sine (256 values).

2. Exploring all the figure settings that influence the appearance of the plot.

```
# Create a figure of size 8x6 inches, 80 dots per inch
plt.figure(figsize=(8, 6), dpi=80)

# Create a new subplot from a grid of 1x1
plt.subplot(1, 1, 1)

# Plot cosine with a blue continuous line of width 1 (pixels)
plt.plot(X, C, color="blue", linewidth=1.0, linestyle="-")


# Plot sine with a green continuous line of width 1 (pixels)
plt.plot(X, S, color="green", linewidth=1.0, linestyle="-")

# Set x limits
plt.xlim(-4.0, 4.0)

# Set x ticks
plt.xticks(np.linspace(-4, 4, 9, endpoint=True))
```

```
# Set y limits
plt.ylim(-1.0, 1.0)

# Set y ticks
plt.yticks(np.linspace(-1, 1, 5, endpoint=True))

# Save figure using 72 dots per inch
plt.savefig("exercise_2.png", dpi=72)
```

3. Adding legends

```
plt.plot(X, C, color="blue", linewidth=2.5, linestyle="-", label="cosine")
plt.plot(X, S, color="red", linewidth=2.5, linestyle="-", label="sine")
plt.legend(loc='upper left')
```

4. Regular Plots

```
n = 256
X = np.linspace(-np.pi, np.pi, n, endpoint=True)
Y = np.sin(2 * X)
plt.plot(X, Y + 1, color='blue', alpha=1.00)
plt.plot(X, Y - 1, color='blue', alpha=1.00)
```

5. Scatter Plot

```
n = 1024
X = np.random.normal(0,1,n)
Y = np.random.normal(0,1,n)
plt.scatter(X,Y)
```

6. Bar Chart

```
n = 12
X = np.arange(n)
Y1 = (1 - X / float(n)) * np.random.uniform(0.5, 1.0, n)
plt.bar(X, +Y1, facecolor='#9999ff', edgecolor='white')
plt.show()
Y2 = (1 - X / float(n)) * np.random.uniform(0.5, 1.0, n)
plt.bar(X, -Y2, facecolor='#ff9999', edgecolor='white')
plt.show()
```

7. Plot tan(x), cot(x), sec(x) and cosec(x) for the values of x= [-pi,-pi/4, -pi/2, 0, pi/4, pi/2, pi]

8. Represent the following table using bar chart

Method	Result1	Result2
A	2	3
B	5	2
C	8	5
D	5	7

SciPy Practice Questions

SciPy:

- SciPy is built in top of the NumPy
- SciPy is a fully-featured version of Linear Algebra while Numpy contains only a few features.
- Most new Data Science features are available in Scipy rather than Numpy.
- SciPy is organized into subpackages covering different scientific computing domains. These are summarized in the following table:

Subpackage	Description
cluster	Clustering algorithms
constants	Physical and mathematical constants
fftpack	Fast Fourier Transform routines
integrate	Integration and ordinary differential equation solvers
interpolate	Interpolation and smoothing splines
io	Input and Output
linalg	Linear algebra
ndimage	N-dimensional image processing
odr	Orthogonal distance regression
optimize	Optimization and root-finding routines
signal	Signal processing
sparse	Sparse matrices and associated routines
spatial	Spatial data structures and algorithms
special	Special functions

Subpackage	Description
stats	Statistical distributions and functions

- SciPy sub-packages need to be imported separately, for example:

```
>>>
>>> from scipy import linalg, optimize
```

1. Import the essential library scipy with i/o package and Numpy. Create 4 x 4, dimensional one's array. Store array in **test.text** file. Get data from **test.text** file and print the output.

2. Find cubic root of 27, 64, 891 using sciPy special package.

3. Create two matrices with 2x2 dimensions. Initialize them with values [4,5], [3,2]. Calculate determinant of a two-dimensional matrix using scipy.linalg.

4. Calculate the inverse of a matrix in Q3.

5. Define two-dimensional array with values {(5,4),(6,3)}. Output eigen values and eigen vectors of the matrix.

6. Create Sparse matrices A and B and analyze various functions of sciPy sparse package.