Questions Bank

Introduction to Python Course

Mathematics 2023-2024

First Python Homework

1. Write a Python program that calculates the area of a circle based on the radius entered by the user.
2. Write a Python program to calculates the value of $z = y^2 + e^{f(x)} - 5$, where

$$f(x) = \begin{cases} x^2 & x > 1 \\ 2 & -1 \leq x \leq 1. \\ -x & x < -1 \end{cases}$$

3. Write a Python program to Check if the first and last number of a list is the same.
4. Write a Python program to swap two elements in a list.
5. Write a Python program to check if element exists in list.
6. Write a Python program to find sum and average of List, find smallest number in a list, and find largest number in a list.
7. Write a Python program to reverse words in a given String in Python and remove i'th character from string in Python, also to remove first n characters from a string.
8. Write a Python program that takes a number as input from the user and prints "Even" if the number is even and "Odd" if the number is odd.

9. Write a Python program that takes a number as input from the user and prints “Integer” if the number is integer and “Non Integer” if the number is not integer.
10. Write a Python program that takes two numbers as input from the user and prints the larger of the two numbers.
11. Write a Python program that takes a string as input from the user and prints whether the string is a palindrome or not.
12. Take values of length and breadth of a rectangle from user and check if it is square or not.
13. Take input of age of 3 people by user and determine oldest and youngest among them without using List.

Q01) Write a program to count prime elements in the List L.

Q02) Write a program to find the sum of each List in the Multi-Dimensional List L.

Q03) Write a program to find the frequency of the minimum element in the List L.

Q04) Write a program to find the frequency of each element in the List L.

Q5) Write a program to remove all repeated elements in the List L.

Q06) Write a program to find the maximum value in each List in the Multi-Dimensional List L.

Q07) Write a program to find the sum of series s where

$$s = \sum_{i=1}^{n} \sum_{j=1}^{m} \left(\frac{x^i y^j}{(i+j)!} \right)$$

Q08) Let $f: A \to B$ where A and B are two List, write a program to find elements of $B = f(A)$, where

$$f(x) = \begin{cases} 1 \ if \ \ x \ is \ even \\ 0 \ \ if \ x \ is \ zero \\ -1 \ if \ x \ is \ odd \end{cases}$$

Q09) Write a program to locate and find all intersection points between $y = \sin(x)$ and $y = \frac{1}{10}x - \frac{1}{2}$ use Newton Raphson method.

Q10) Write a function to find the greatest common divisor between two positive integers.

Pseudo Code of the Algorithm-

1. Let a, b be the two numbers
2. a mod b = R
3. Let a = b and b = R
4. Repeat Steps 2 and 3 until a mod b is greater than 0
5. GCD = b
6. Finish

HW3

1. Write a Python function to find the maximum of three numbers.
2. Write a Python function to sum all the numbers in a list.
3. Write a Python function to multiply all the numbers in a list.
4. Write a Python program to reverse a string.
5. Write a Python function to calculate the factorial of a number (a non-negative integer). The function accepts the number as an argument.
6. Write a Python function that accepts a string and counts the number of upper and lower case letters.
7. Write a Python function that takes a list and returns a new list with distinct elements from the first list.
8. Write a Python program to print the even numbers from a given list.
9. Write a Python function that prints out the first n rows of Pascal's triangle.

HW3

Q1) Let **a** be a matrix then use Numpy to do the following by one-line statement

1. From **a** find the minimum positive number.
2. Find the number of negative integer elements in **a**.
3. Find the number of odd elements in each column of **a**.
4. Replace the diagonal elements in **a** to ones.
5. Replace all integer odd number in **a** to zeros.
6. Find the sum of positive even numbers in matrix **a**.
7. Find the number of non-zero elements in diagonal of **a**.
8. Find the number of zero rows in matrix **a**.
9. Find the sum of positive elements in diagonal of **a**.

Q2) Use Numpy method ***concatenate*** to create the following matrix.

1.

$$\mathbf{c} = \begin{pmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 2 & 3 & 0 \\ 0 & 4 & 5 & 6 & 0 \\ 0 & 7 & 8 & 9 & 0 \end{pmatrix}$$

2.

$$\mathbf{d} = \begin{pmatrix} 9 & 0 & 0 & 9 & 6 & 3 \\ 0 & 9 & 0 & 8 & 5 & 2 \\ 0 & 0 & 9 & 7 & 4 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{pmatrix}$$

Q3) Find matrix **b** from matrix **a** where $b_{ij} = \begin{cases} a_{ij}^2 + 1 & if\ a_{ij} > 0 \\ |a_{ij}| & if\ a_{ij} \leq 0 \end{cases}$.

Figure class and Axes Class

```
import numpy as np
import matplotlib.pyplot as plt
x = np.arange(1, 5)
y=x**2
fig = plt.figure(figsize =(7, 5))
ax=fig.add_axes([0.1,0.1,0.5,0.5])
ax.plot(x,y)
ax.set_title('Squre')
ax.set_xlabel('x-axis')
ax.set_xlim([-1,6])
plt.show()
```

```
import numpy as np
import matplotlib.pyplot as plt
x = np.arange(1, 5)
y=x**2
fig = plt.figure(figsize =(7, 5))
ax1=fig.add_axes([0.1, 0.1, 0.5, 0.5])
ax1.plot(x, y)
ax1.set_title('Squre')
ax1.set_xlabel('x-axis')
ax1.set_xlim([-1, 6])
ax2=fig.add_axes([0.65, 0.65, 0.2, 0.2])
ax2.plot(x, y)
ax2.set_title('Squre')
ax2.set_xlabel('x-axis')
ax2.set_xlim([0, 10])
plt.show()
```

Subplot

```
import numpy as np
import matplotlib.pyplot as plt
x = np.arange(-2,2,0.1)
y1=x
y2=x**2
y3=np.sin(x)
y4=np.exp(x)
plt.figure()
plt.subplot(221)
plt.title('Linear')
plt.plot(x, y1)
```

```
plt.subplot(222)
plt.title('Squre')
plt.plot(x, y2)
plt.subplot(223)
plt.title('Sin')
plt.plot(x, y3)
plt.subplot(224)
plt.title('Exp')
plt.plot(x, y4)
plt.show()
```

3D Plots

```
import numpy as np
import matplotlib.pyplot as plt
from math import pi
t = np.arange(0,10*pi,pi/50)
x=np.cos(t)
y=np.sin(t)
z=t
fig = plt.figure()
ax = plt.axes(projection='3d')
ax.plot3D(z, y, x)
plt.show()
```

```
import numpy as np
import matplotlib.pyplot as plt
from math import pi
t = np.arange(-pi,pi,pi/20)
x, y = np.meshgrid(t, t)
z = (np.sin(x **2) + np.cos(y **2) )
fig = plt.figure(figsize=(6, 5))
ax = plt.axes(projection='3d')
my_cmap = plt.get_cmap('hot')
surf=ax.plot_surface(x, y, z,cmap=my_cmap)
fig.colorbar(surf, ax = ax)
ax.set_xlabel('X-axis')
ax.set_xlim(-5, 5)
ax.set_ylabel('Y-axis')
ax.set_ylim(-5, 5)
ax.set_zlabel('Z-axis')
ax.set_zlim(np.min(z), np.max(z))
ax.set_title('3D surface having 2D contour plot
```

```
projections')
plt.show()
```

List Comprehension

```
numbers = [1, 2, 3, 4, 5]
squared = [x ** 2 for x in numbers]
print(squared)
```

```
List = [c**2 for c in [1, 2, 3]]
print(List)
```

```
list = [i for i in range(11) if i % 2 == 0]
print(list)
```

```
matrix = [[j+i for j in range(3)] for i in range(3)]
print(matrix)
```

```
List = [character for character in 'Geeks 4 Geeks!']
print(List)
```

```
lis = ["Even number" if i % 2 == 0 else "Odd number" for i
in range(8)]
print(lis)
```

Q) Let

$$\mathbf{a} = \begin{pmatrix} -2 & 0 & 1 & 0 \\ 3.1 & 2 & 1 & 1 \\ 0 & 2.3 & -5 & 2 \\ 2 & 4 & 1.5 & 0 \end{pmatrix}$$

Find the following use numpy

1. Finding the sum of diagonal elements of **a**.
2. Finding the **b**=$\mathbf{a}^2$.
3. Finding the Eigen values of **a**.
4. Finding how many rows contain zero elements in **a**.
5. Finding all elements between 1 and 3.
6. Finding number of even elements in each column.
7. Replace all zero elements in a with one.

Solution:

```
import numpy as np
import numpy.linalg as alg
a=np.array([[-2,1,1,0],[3.1,2,1,1],[0,2.3,-
5,2],[2,4,1.5,0]])
#1
sd=np.trace(a)
print(sd)
#2
b=a.dot(a)
print(b)
#3
e=alg.eigvals(a)
print(e)
#4
nrz=sum(np.any(a==0,1))
print(nrz)
#5
c=a[(a>1) & (a<3)]
print(c)
#6
noe=sum(a%2==0,0)
print(noe)
#7
```

```
a[a==0]=1
print(a)
```