SSN COLLEGE OF ENGINEERING, KALAVAKKAM
(An Autonomous Institution, Affiliated to Anna University, Chennai)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

LAB EXERCISE 3

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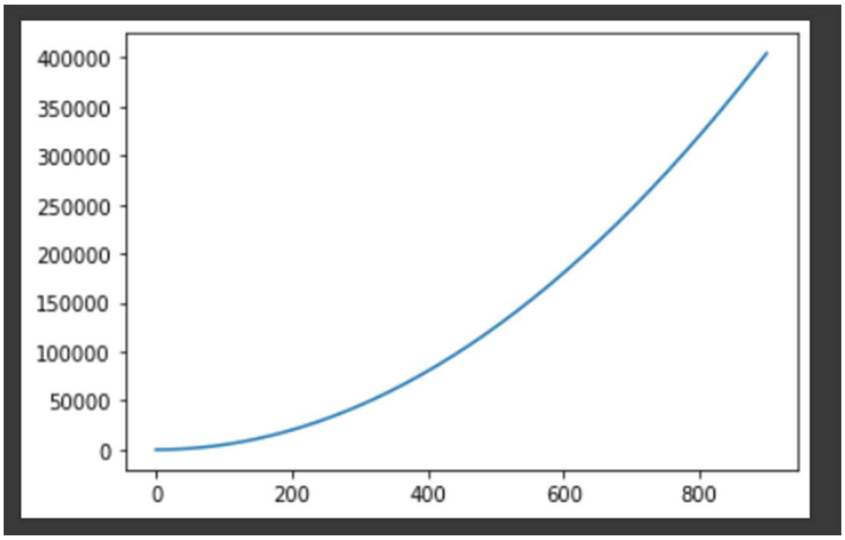
1. Use import matplotlib.pyplot as plt and plot the graph for n and complexity for the following recurrence relations:
   a. $T(n)=T(n-1)+n$

Code:

```
import matplotlib.pyplot as plt
import math
import numpy as np

xpoints = np.array(range(900))

def yarray(k):
    if(k <= 1):
        return 1
    else:
        return yarray(k-1)+k


ypoints = []

for i in xpoints:
    # print(i)
    ypoints.append(yarray(i))

plt.plot(xpoints, ypoints)
plt.show()
```

Output:

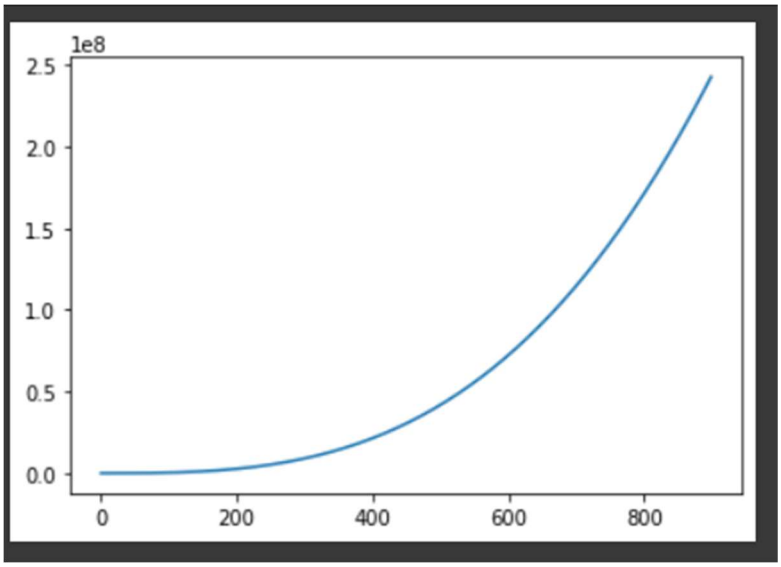


b. b. $T(n)=T(n-1)+n2$

Code:

```
# T(n)=T(n-1)+n^2

xpoints = np.array(range(900))

def yarray(k):
    if(k <= 1):
        return 1
    else:
        return yarray(k-1)+(k*k)


ypoints = []

for i in xpoints:
    ypoints.append(yarray(i))

plt.plot(xpoints, ypoints)
plt.show()
```

Output:

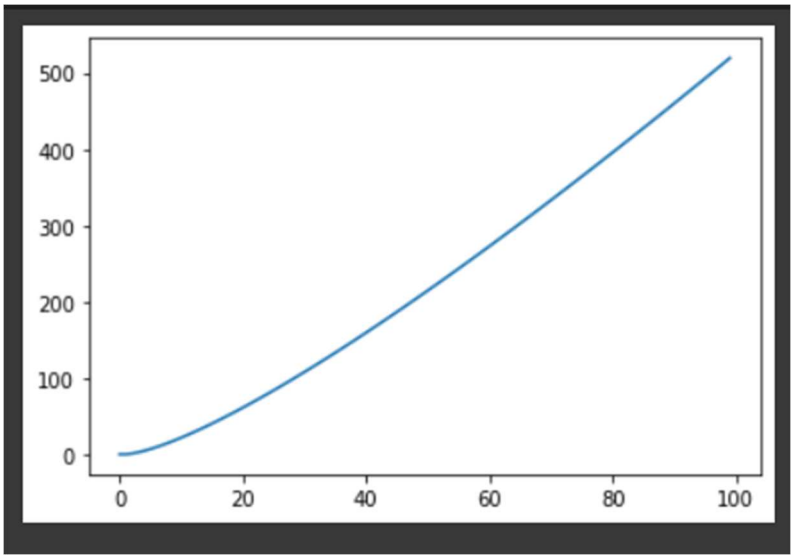


c. c. $T(n)=T(n-1)+logn$

Code:

```
# T(n)=T(n-1)+logn

xpoints = np.array(range(100))

def yarray(k):
    if(k <= 1):
        return 1
    else:
        return yarray(k-1)+math.log(k, 2)

ypoints = []

for i in xpoints:
    ypoints.append(yarray(i))

plt.plot(xpoints, ypoints)
plt.show()
```

Output:

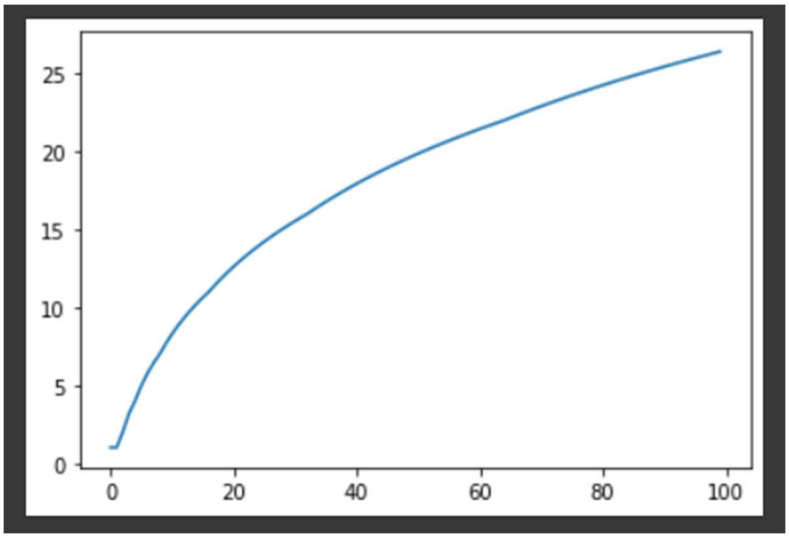


d. d. $T(n)=T(n/2)+logn$

Code:

```
# T(n) = T(n/2) + logn

xpoints = np.array(range(100))


def yarray(k):
    if(k <= 1):
        return 1
    else:
        return yarray(k/2)+math.log(k, 2)


ypoints = []

for i in xpoints:
    ypoints.append(yarray(i))

plt.plot(xpoints, ypoints)
plt.show()
```

Output:

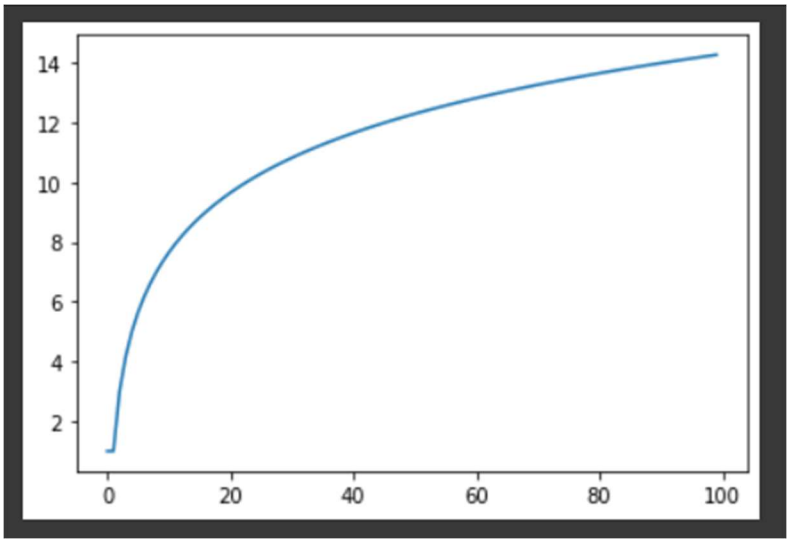


e. e. $T(n)=T(\sqrt{n})+logn$

Code:

```
# T(n) = T (√n) +logn

xpoints = np.array(range(100))


def yarray(k):
    if(k <= 1):
        return 1
    else:
        return yarray(math.sqrt(k))+math.log(k, 2)


ypoints = []

for i in xpoints:
    ypoints.append(yarray(i))

plt.plot(xpoints, ypoints)
plt.show()
```

Output:



2. Implement Strassen Matrix multiplication

Code:

```
import numpy as np


def split(mat):
    r, c = mat.shape
    r2, c2 = r // 2, c//2
    return mat[: r2, : c2], mat[: r2, c2:], mat[r2:, : c2], mat[r2:, c2:]


def strassen(x, y):
    if len(x) == 1:
        return x * y
    a, b, c, d = split(x)
    e, f, g, h = split(y)

    p1 = strassen(a, f - h)
    p2 = strassen(a + b, h)
    p3 = strassen(c + d, e)
    p4 = strassen(d, g - e)
    p5 = strassen(a + d, e + h)
    p6 = strassen(b - d, g + h)
    p7 = strassen(a - c, e + f)
    c11 = p5 + p4 - p2 + p6
    c12 = p1 + p2
    c21 = p3 + p4
    c22 = p1 + p5 - p3 - p7

    c = np.vstack((np.hstack((c11, c12)), np.hstack((c21, c22))))

    return c
strassen(np.array([[1, 2], [3, 4]]), np.array([[1, 2], [3, 4]]))
```

Output:

```
array([[ 7, 10],
       [15, 22]])
```