3. Python program to generate the sequence of binary numbers of n bits recursively following Piṅgala's algorithm :

```
# importing necessary library
import numpy as np

# function to generate binary sequence
def binary(n):
    # initialising the pattern for 1 digit
    # "dvikau glau"
    a = np.matrix('0;1')
    # "misrau ca"
    for i in range(1,n):
        a = build(a)
    print(a)

#function to implement - "pruthaglā miśrāh"
def build(a):
    # mixing zeros/laghus
    m1 = np.hstack((a,np.zeros((a.shape[0],1))))
    # mixing ones/gurus
    m2 = np.hstack((a,np.ones((a.shape[0],1))))
    #joins both vertically and returns for further mixing
    return np.vstack((m1,m2))

#taking input for number of digits from the user
n = input("Enter number of digits = ")

# calling the function to generate binary patterns
binary(int(n))
```

Outputs:

user@debian:~/Documents/Python/sanskrit$ python pingalaBinary.py
Enter number of digits = 1
[[0]
[1]]
user@debian:~/Documents/Python/sanskrit$ python pingalaBinary.py
Enter number of digits = 4
[[0. 0. 0. 0.]
[1. 0. 0. 0.]
[0. 1. 0. 0.]
[1. 1. 0. 0.]
[0. 0. 1. 0.]
[1. 0. 1. 0.]
[0. 1. 1. 0.]
[1. 1. 1. 0.]
[0. 0. 0. 1.]
[1. 0. 0. 1.]
[0. 1. 0. 1.]
[1. 1. 0. 1.]
[0. 0. 1. 1.]
[1. 0. 1. 1.]
[0. 1. 1. 1.]
[1. 1. 1. 1.]]
user@debian:~/Documents/Python/sanskrit$ python pingalaBinary.py
Enter number of digits = 3
[[0. 0. 0.]
[1. 0. 0.]
[0. 1. 0.]
[1. 1. 0.]
[0. 0. 1.]
[1. 0. 1.]
[0. 1. 1.]
[1. 1. 1.]]

**4.Python program to generate the sequence of binary numbers of n bits
following Kedara's algorithm.**

```
# Keadara's algorithm to generate binary sequence with n bits

# reading no: of bits from user
n = int(input("Enter no: of bits = "))

#starting with all zeros
seq=[0]*n
print(seq)

# copying initial sequence to start changing bit values
c=seq

#condition to repeat till all values are 1
while c!=[1]*n:
    for i in range(len(seq)):
        #looking for first 0 and changing it's value to 1
        if seq[i]==0:
            c[i]=1
            # leaving the next values unchanged
            break
        else :
            # changing values before encountering first 0
            c[i]=0
    print(c)
```

```
user@debian:~/Documents/Python/sanskrit$ python kedarasBinary
Enter no: of bits = 3
[0, 0, 0]
[1, 0, 0]
[0, 1, 0]
[1, 1, 0]
[0, 0, 1]
[1, 0, 1]
[0, 1, 1]
[1, 1, 1]
user@debian:~/Documents/Python/sanskrit$ python
kedarasBinary.py
Enter no: of bits = 4
[0, 0, 0, 0]
[1, 0, 0, 0]
[0, 1, 0, 0]
[1, 1, 0, 0]
[0, 0, 1, 0]
[1, 0, 1, 0]
[0, 1, 1, 0]
[1, 1, 1, 0]
[0, 0, 0, 1]
[1, 0, 0, 1]
[0, 1, 0, 1]
[1, 1, 0, 1]
[0, 0, 1, 1]
[1, 0, 1, 1]
[0, 1, 1, 1]
[1, 1, 1, 1]
user@debian:~/Documents/Python/sanskrit$ python
kedarasBinary.py
Enter no: of bits = 2
[0, 0]
[1, 0]
[0, 1]
[1, 1]
user@debian:~/Documents/Python/sanskrit$
```

1. Write a programme to generate the Ghanapāṭha of a mantra. Test it with the following string of a Mantra.
uú® ~ ¥ ú± ú®d¥R w®¨ú® y³¯{©§R
For the purpose of input, instead of Devanagari, use the following roman transliterated string.
dasrA yuvAkavaH nAsatyA pqktabarhiRaH
(Note: We have used lower case letters for short vowels and upper case for long vowels. Also note the use of 'q' and 'R'.)

```
user@debian:~/Documents/Python/sanskrit$ python pata2.py
1.Jata
2.Mala
3.Sikha
4.Rekha
5.Ghana
6.All
Enter Choice: 5
```

Ghana paat sequence for 5 words :

1 2 2 1 1 2 3 3 2 1 ;
2 3 3 2 2 3 4 4 3 2 ;
3 4 4 3 3 4 5 5 4 3 ;
4 5 5 4 4 5 _ _ 5 4 ;
5 _ _ 5 5 _ _ _ _ 5 ;
5 ithi 5 ;

Ghana paat for " dasrA yuvAkavaH na satyA pqktabarhiRaH " is as follows :

dasrA yuvAkavaH yuvAkavaH dasrA dasrA yuvAkavaH na na yuvAkavaH dasrA ;
yuvAkavaH na na yuvAkavaH yuvAkavaH na satyA satyA na yuvAkavaH ;
na satyA satyA na na satyA pqktabarhiRaH pqktabarhiRaH satyA na ;
satyA pqktabarhiRaH pqktabarhiRaH satyA satyA pqktabarhiRaH _ _ pqktabarhiRaH satyA ;
pqktabarhiRaH _ pqktabarhiRaH pqktabarhiRaH _ _ _ _ pqktabarhiRaH ;
pqktabarhiRaH ithi pqktabarhiRaH ;

Program for generating the paata sequences :

```
sent = "dasrA yuvAkavaH na satyA pqktabarhiRaH"
w = sent.split(" ")
def jata(n):
    print("\nJata paat sequence for %d words :" %n)
    for j in range(1,n):
        print(j, j+1, end =' ')
        print(j+1,j,end = ' ')
        print(j,j+1, end=';\n')
    print(n," ithi ",n, ";\n")
    print("Jata paat for","\"",sent,"\" is as follows :" )
    for j in range(1,n):
        print(w[j-1], w[j], end =' ')
        print(w[j],w[j-1],end = ' ')
        print(w[j-1],w[j], end=';\n')
    print(w[n-1]," ithi ",w[n-1], ";\n")

def mala(n):
    print("Maala paat sequence for %d words :" %n)
    for j in range(1,n):
        print(j,j+1, end='; ')
        print(j+1,j,end='; ')
        print(j,j+1, end=';\n')
    print(n," ithi ",n, ";\n")
    print("Mala paat for","\"",sent,"\" is as follows :" )
    for j in range(1,n):
        print(w[j-1],w[j], end='; ')
        print(w[j],w[j-1],end='; ')
        print(w[j-1],w[j], end=';\n')
    print(w[n-1]," ithi ",w[n-1], ";\n")

def sikha(n):
    print("Sikha paat sequence for %d words :" %n)
    for j in range(1,n-1):
        print(j,j+1, end='; ')
        print(j+1,j,end='; ')
        print(j,j+1,j+2, end=';\n')
    print(n," ithi ",n, ";\n")
    print("Sikha paat for","\"",sent,"\" is as follows :" )
    for j in range(1,n-1):
        print(w[j-1],w[j], end='; ')
        print(w[j],w[j-1],end='; ')
        print(w[j-1],w[j],w[j-1], end=';\n')
```

```
    print(w[n-1]," ithi ",w[n-1], ";\n")

def rekha(n):
    print("Rekha paat for %d words :" %n)
    for j in range(1,n):
        for q in range(j-1,range(1,n+1).index(j+1)+j):
            if q+1<n+1:
                print(q+1,"",end = '')
            else:
                continue
        print("; ", end="")
        for q in reversed(range(j-1,range(1,n+1).index(j+1)+j)):
            if q+1<n+1:
                print(q+1,"",end = '')
            else:
                continue
        print("; ", end="")
        print(j,j+1,";")
    print(n," ithi ",n,";\n")
    print("Rekha paat for","\"",sent,"\" is as follows :" )
    for j in range(1,n):
        for q in range(j-1,range(1,n+1).index(j+1)+j):
            if q+1<n+1:
                print(w[q],"",end = '')
            else:
                continue
        print("; ", end="")
        for q in reversed(range(j-1,range(1,n+1).index(j+1)+j)):
            if q+1<n+1:
                print(w[q],"",end = '')
            else:
                continue
        print("; ", end="")
        print(w[j-1],w[j],";")
    print(w[n-1]," ithi ",w[n-1],";\n")
def ghana(n):
    print("Ghana paat sequence for %d words :" %n)
    for i in range(1,n+1):
        if i<=n : print(i, end=" ")
        if i+1<=n : print(i+1, end=" ")
        else : print("_", end=" ")
        if i+1<=n : print(i+1, end=" ")
        else : print("_", end=" ")
        if i<=n : print(i,i, end=" ")
```

```
            else : print("_", end=" ")
            if i+1<=n : print(i+1, end=" ")
            else : print("_", end=" ")
            if i+2<=n : print(i+2, end=" ")
            else : print("_", end=" ")
            if i+2<=n : print(i+2, end=" ")
            else : print("_", end=" ")
            if i+1<=n : print(i+1, end=" ")
            else : print("_", end=" ")
            if i<=n : print(i, end=" ")
            else : print("_", end=" ")
            print(";")
      print(n," ithi ",n, ";\n")
      print("Ghana paat for","\"",sent,"\" is as follows :" )
      for i in range(0,n):
            if i<n : print(w[i], end=" ")
            if i+1<n : print(w[i+1], w[i+1], end=" ")
            else : print("_", end=" ")
            if i<n : print(w[i],w[i], end=" ")
            else : print("_", end=" ")
            if i+1<n : print(w[i+1], end=" ")
            else : print("_", end=" ")
            if i+2<n : print(w[i+2], end=" ")
            else : print("_", end=" ")
            if i+2<n : print(w[i+2], end=" ")
            else : print("_", end=" ")
            if i+1<n : print(w[i+1], end=" ")
            else : print("_", end=" ")
            if i<n : print(w[i], end=" ")
            else : print("_", end=" ")
            print(";")
      print(w[n-1]," ithi ",w[n-1],';\n')


n = len(w)
option =
int(input("1.Jata\n2.Mala\n3.Sikha\n4.Rekha\n5.Ghana\n6.All\nEnter
Choice: "))
if option == 1:
      jata(n)
elif option == 2:
      mala(n)
elif option == 3:
      sikha(n)
```

```
elif option == 4:
    rekha(n)
elif option == 5:
    ghana(n)
elif option == 6:
    jata(n)
    mala(n)
    sikha(n)
    rekha(n)
    ghana(n)
else :
    print("wrong choice")
```