PINGALA ASSIGNMENTS

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AI21BTECH11014

Contents

1 JEE 2019

Let α and β $(\alpha > \beta)$ be the roots of the equation $z^2 - z - 1 = 0$. Define,

$$a_n = \frac{\alpha^n - \beta^n}{\alpha - \beta}, \quad n \geq 1 \tag{1.1}$$

$$b_n = a_{n-1} - a_{n+1}, \quad n \geq 2, \quad b_1 = 1 \tag{1.2}$$

Verify the following using a python code.

Download the Python code using

```
wget https://https://github.
    com/HARI-donk-EY/
    sig_pros/tree/main/
    pingala/codes/1.py
```

and run it using,

```
$python3 1.py
```

1.1

$$\sum_{k=1}^{n} a_k = a_{n+2} - 1, \quad n \geq 1 \tag{1.3}$$

Solution:

From Fig. 1.1, both the graphs are similar for LHS and RHS.

Hence 1.1 is true.

1.2

$$\sum_{k=1}^{\infty} \frac{a_k}{10^k} = \frac{10}{89} \tag{1.4}$$

Solution: The Fig. 1.2 shoes that the difference between LHS and RHS tens to zero as the value of k increases.

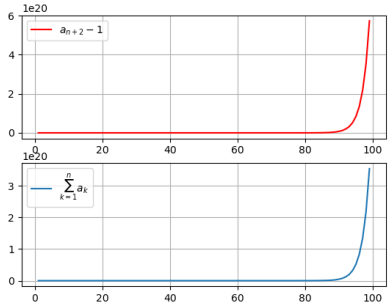

Fig. 1.1

It shows that for a large value of k, the

$$LHS \rightarrow RHS$$

Hence 1.2 is true.

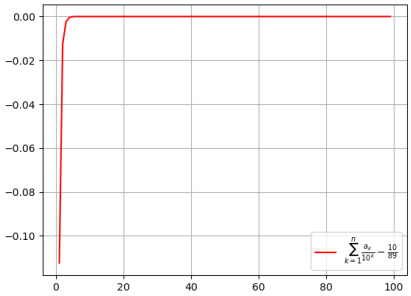

Fig. 1.2

1.3

$$b_n = \alpha^n + \beta^n, \quad n \geq 1 \tag{1.5}$$

Solution: From Fig. 1.3, both the graphs are similar for LHS and RHS.

Hence 1.3 is true.

1.4

$$\sum_{k=1}^{\infty} \frac{b_k}{10^k} = \frac{8}{89} \tag{1.6}$$

Solution:

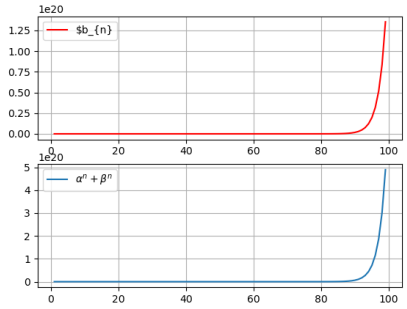

Fig. 1.3

The Fig. 1.4 shoes that the difference between *LHS* and *RHS* tends to $\frac{12}{89}$ as the value of k increases.
It shows that for a large value of k, the

$$LHS \nrightarrow RHS$$

Hence 1.4 is false.

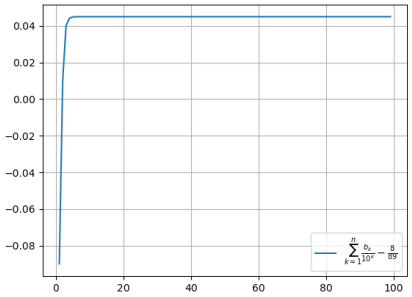

Fig. 1.4

2 Pingala Series

2.1 The *one sided* Z-transform of $x(n)$ is defined as

$$X^+(z) = \sum_{n=0}^{\infty} x(n) z^{-n}, \quad z \in \mathbb{C} \tag{2.1}$$

2.2 The *Pingala* series is generated using the difference equation

$$x(n+2) = x(n+1) + x(n) \tag{2.2}$$

$$x(0) = x(1) = 1, \; n \geq 0 \tag{2.3}$$

Generate a stem plot for $x(n)$.

Solution:

2.3 Find $X^+(z)$.

2.4 Find $x(n)$.

2.5 Find $Y^+(z)$.