JGi JAIN | SCHOOL OF COMPUTER SCIENCE AND IT
DEEMED-TO-BE UNIVERSITY

DEPARTMENT OF MASTER OF COMPUTER APPLICATION

ACTIVITY - 3

Mathematical Foundation for Computer Applications

JUPG22MCA17494

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PELL NUMBER

In mathematics, the Pell numbers are an infinite sequence of integers, known since ancient times, that comprise the denominators of the closest rational approximations to the square root of 2. The sequence of Pell numbers begins with 1, 2, 5, 12, and 29.

The Pell numbers are defined by the recurrence relation:

$$P_n = \begin{cases} 0 & \text{if } n = 0; \\ 1 & \text{if } n = 1; \\ 2P_{n-1} + P_{n-2} & \text{otherwise.} \end{cases}$$

In words, the sequence of Pell numbers starts with 0 and 1, and then each Pell number is the sum of twice the previous Pell number and the Pell number before that. The first few terms of the sequence are

0, 1, 2, 5, 12, 29, 70, 169, 408, 985, 2378, 5741, 13860,…

The Pell numbers can also be expressed by the closed form formula

$$P_n = \frac{\left(1 + \sqrt{2}\right)^n - \left(1 - \sqrt{2}\right)^n}{2\sqrt{2}}.$$

Pell Number Example

$P_0 = 0$

$P_1 = 1$

$P_2 = 1 * 2 + 0 = 2$

$P_3 = 2 * 2 + 1 = 5$

$P_4 = 5 * 2 + 2 = 12$

CODE :

```
1.   a = 1
2.   b = 2
3.   c = 0
4.   print(a)
5.   print(b)
6.   for i in range(10):
7.       c = a + 2*b
8.       a = b
9.       b = c
10.  print(c)
```

OUTPUT :

```
1
2
5
12
29
70
169
408
985
2378
5741
13860
```

Code Explanation :

- The first number of the series needs to be initialised (a = 1).

- The second number of the series needs to be initialised (b = 2).

- Initialise the variable where we shall generate the series (c = 0).

- Now, print the first two numbers of the series and we shall print the other generated numbers consequently.

- Initiate a for loop to print multiple numbers of the Pell series. We shall be printing 10 numbers in this Python tutorial!

- Add twice the previous number and the number previous to the previous number (c = a + 2*b).

- Swap the previous number to the number previous to the previous number (a = b).

- Swap the generated number to the previous number (b = c).

- Print the generated number.