

Juggler Sequence

By-Akash Pujar(01FE15BCS015)

Definition-

- Juggler Sequence is a series of integer number in which the first term starts with a positive integer number a and the remaining terms are generated from the immediate previous term using the below recurrence relation :

$$a_{k+1} = \begin{cases} \left\lfloor a_k^{\frac{1}{2}} \right\rfloor, & \text{if } a_k \text{ is even} \\ \left\lfloor a_k^{\frac{3}{2}} \right\rfloor, & \text{if } a_k \text{ is odd.} \end{cases}$$

Code Snippet-

```
def Juggler(n):  
    a=n  
    print(a) #print first term  
    while(a!=1):  
        b=0  
        if(a%2==0):  
            b=floor(sqrt(a))  
        else:  
            b=floor(sqrt(a)*sqrt(a)*sqrt(a))  
        printf(“%d”,b)  
        a=b
```

Examples-

For a given initial term n , one defines $l(n)$ to be the number of steps which the juggler sequence starting at n takes to first reach 1, and $h(n)$ to be the maximum value in the juggler sequence starting at n . For small values of n we have:

n	<i>Juggler sequence</i>	$l(n)$	$h(n)$
2	2, 1	1	2
3	3, 5, 11, 36, 6, 2, 1	6	36
4	4, 2, 1	2	4
5	5, 11, 36, 6, 2, 1	5	36
6	6, 2, 1	2	6
7	7, 18, 4, 2, 1	4	18
8	8, 2, 1	2	8
9	9, 27, 140, 11, 36, 6, 2, 1	7	140
10	10, 3, 5, 11, 36, 6, 2, 1	7	36

Important Points-

- The terms in Juggler Sequence first increases to a peak value and then starts decreasing.
- The last term in Juggler Sequence is always 1.
- If a juggler sequence reaches 1, then all subsequent terms are equal to 1.
- It is conjectured that all juggler sequences eventually reach 1. This conjecture has been verified for initial terms up to 10^6 , but has not been proved.

Reference Links

- [Weisstein, Eric W. "Juggler sequence". MathWorld.](#)
- [Juggler sequence](#) (A094683) at the [On-Line Encyclopaedia of Integer Sequences](#). See also:
 - [Number of steps needed for juggler sequence \(A094683\) started at n to reach 1.](#)
 - [n sets a new record for number of iterations to reach 1 in the juggler sequence problem.](#)
 - [Number of steps where the Juggler sequence reaches a new record.](#)
 - [Smallest number which requires n iterations to reach 1 in the juggler sequence problem.](#)
 - [Starting values that produce a larger juggler number than smaller starting values.](#)
- [Juggler sequence calculator](#) at Collatz Conjecture Calculation Center
- [Juggler Number pages](#) by Harry J. Smith