

Mathematricks

- Sreenivasa Rao Ainapurapu.

In the previous issue we concluded with a question,
find the value of $\left\{ 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \dots + \frac{1}{99} \right\}$

***Note:** You should teach these techniques to kids only after they are ready to understand these methods. Then only they can appreciate these tips and the concepts behind. It is always better to use basic concrete methods to verify till they are comfortable.*

Before answering the question, we need to know little about progressions. What is progression? It is a series of numbers following a formula. Depending on nature we usually come across (i) Arithmetic progression (ii) Geometric progression (iii) Harmonic progression. The given series comes under third category.

What is Arithmetic progression? This follows a pattern where the difference of two consecutive terms is same. For example 1, 4, 7, 10, 13 are in Arithmetic progression. See the common difference $4 - 1 = 7 - 4 = 10 - 7 = 13 - 10 = 3$.

What is Geometric progression? This follows a pattern where the ratio of two consecutive terms is same. For example 1, 3, 9, 27, 81 are in Geometric progression. See the common ratio is $3/1 = 9/3 = 27/9 = 81/27 = 3$.

What is Harmonic progression? This follows a pattern where the reciprocal of each term arranged forms an Arithmetic progression. In our case, the reciprocals of each term forms a series 1, 2, 3, 4, ... 99. We need to figure out the sum of those fractions (which are in Harmonic progression). Harmonic progression does not provide any formula to find out this. So, we need to work on case to case basis.

In this type of situation computer program comes handy. Let us write an algorithm to calculate this. We need to find the reciprocals of numbers from 1 to 99. Let us initiate the SUM to 0. Now we need to follow the steps shown below.

```
SUM = 0;
For N = 1 to 99
{
  // Find the reciprocal value
  TEMP = 1/N;
  SUM = SUM + TEMP;
}
```

Using this algorithm, we can find the value of the specific harmonic progression in our problem. The sum comes to 5.1773775

We can use any programming language like BASIC, PASCAL, C, FORTRAN, C++ etc. While solving problem, we should understand it thoroughly. That is when we write algorithm. Algorithm is sequence of steps which leads to solution.

Let us learn the algorithm for 'Towers of Hanoi' problem in the next issue.

Towers of Hanoi problem: It is a mathematical game or puzzle. It consists of three rods, and a number of disks of different sizes which can slide onto any rod. Initially the disks stacked in order of size on one rod, the smallest one at the top. The objective of the puzzle is to move the entire stack to another rod, obeying the following rules.



- Only one disk may be moved at a time.
- Each move consists of taking the upper disk from one of the rods and sliding it onto another rod, on top of the other disks that may already be present on that rod.
- No disk may be placed on top of a small disk.

(Let us continue in the next issue, till then good bye!)