**Sequence**

* Sequence is an ordered list of numbers, like natural numbers, odd numbers, powers of two, or the Fibonacci sequence. They are functions defined on the domain of natural numbers.
* Sequence can be defined in two ways: closed and recurrence form. In closed form, the values are given explicitly as a function of the domain, whereas in recurrence form, each element is defined in terms of preceding elements, with an initial state specified.
* The number of preceding elements in a function in a function is the recurrence order.
* Partial sums are the sum of the first k elements of a sequence. Partial sums can be defined recursively.
* It is mainly used in problem solving, computer science, and mathematics, genetics and bioinformatics and analytical thinking.

**Arithmetic and geometric sequences**

* There are 3 types of sequences: Arithmetic, Quadratic, Geometric sequences.
* Arithmetic Sequence
  + Defined by the recurrence relation an = an – 1 + d, where do is a constant.
  + Closed form: an = a0 + nd
  + Difference equations: analyzing the first and second difference provides insights into the sequence’s nature.
  + Difference equation for linear sequences lead to constant values.
* Quadratic sequence
  + Defined by the formula an = an^2 + bn + c
  + The second difference for quadratic sequence is constant
  + This information aids in determining the closed form of quadratic sequences.
* Geometric sequences
  + Defined by the recurrence relation an = kan – 1, where k is a constant multiplier.
  + Closed form: an = kna0
  + Partial sums: calculated by a specific process involving multiplication, subtraction, and division.
* Geometric sequences and series have numerous applications in real life, including compound interest, population growth, growth of bacteria, electrical circuits, present value, and amortization of loans or mortgages.

**Linear recurrence**

* Linear recurrence of order 1 is defined by an equation of the form an = kan – 1 + d.
* Some characteristics of this are; linear, with constants k and d. Order 1, referring only to the first previous element.
* Closed form of order 1 linear recurrence involves finding the closed form,
* Example involves computing the first difference, finding the closed form for the first difference, and using it to derive the closed form for the original sequence.
* Linear recurrence of order 2 is defined by an = k1an -1 + k2an – 2 + d
* It has characteristics like; linear, with constants k1, k2 and d. order 2, referring to the two previous elements. Emphasis on the homogenous case (d=0)
* Closed form of order 2 linear recurrence involves solving a quadratic equation known as the characteristic polynomial.
* Solutions of the quadratic equation (𝑥1, 𝑥2) determine the closed form of the sequence.
* Utilizes initial conditions (a0 and a1) to find the values of coefficients (s1 and s2).
* Concepts like interest rates, deposit calculations, and growth patterns are directly applicable to real-world scenarios. Offers a bridge between mathematical concepts and practical problem-solving.

Reference

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