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Definition : A function whose domain is the set of natural numbers N and range a subset of real numbers R is called a real sequence.

i.e. A function $f : N \to R$ is called a sequence and we denoted by $f(n) = a_n$.

Notation : $\langle a_n \rangle$ or $\{a_n\}$ or $\langle a_1, a_2, ... a_n ..... \rangle$

Terms of Sequence : Let $\langle a_n \rangle$ be a sequence then $a_1, a_2, ..., a_n, ...$ are called terms of sequence.

Range of a sequence : The set of all distinct terms of sequence is called its range.

Bounded and unbounded sequence :

1. **Bounded Above Sequence :** A sequence $\langle a_n \rangle$ is said to be bounded above if there exist a real number k s.t. $a_n \leq k$, for all $n \in N$.

   i.e. if the range set of the sequence is bounded above.

2. **Bounded Below Sequence :** A sequence $\langle a_n \rangle$ is said to be bounded below if there exist a real number k s.t. $a_n \geq k$; for all $n \in N$ i.e. if the range set of the sequence is bounded below.

Bounded Sequence : A sequence is said to be bounded iff its range set is bounded. i.e. if a sequence is bounded above and bounded below both, the this sequence is called a bounded sequence.

Unbounded above sequence : A sequence $\langle a_n \rangle$ is said to be unbounded

above if the Range set of this sequence is not bounded above.

Unbounded below sequence : A sequence $\langle a_n \rangle$ is said to unbounded

below if the range set of this sequence is not bounded below.

Unbounded Sequence : A sequence is said to be unbounded if it is not

bounded.

i.e. if a sequence is neither bounded above nor bounded below then it is called a unbounded

sequence.

Supremum (least upper bound) of sequence :

The supremum of the range set of the sequence is called supremum of sequence.

Infimum or greatest lower bound (glb) :

The infimum of the range set of the sequence is called infimum of sequence.

Note :

(1) If sequence is unbounded above then supremum of sequence is ∞.

(2) If sequence is unbounded below then infimum of sequence is $-\infty$.

(3) If supremum and infimum of the sequence are finite then sequence is bounded.

Monotonicity of Sequence :

(1) **Monotonic increasing sequence :** Let $\langle a_n \rangle$ be a sequence of real number, this sequence is called monotonic increasing sequence if $a_{n+1} \geq a_n$ for all $n \in N$.

(2) **Strictly increasing sequence :** Let $\langle a_n \rangle$ be a sequence and $a_{n+1} > a_n$; for all $n \in N$, then $\langle a_n \rangle$ is called strictly increasing sequence.

(3) Monotonic decreasing sequence : Let $\langle a_n \rangle$ be a sequence and $a_{n+1} \leq a_n$ for all $n \in N$. Then this sequence is called monotonic decreasing sequence.

(4) Strictly decreasing sequence : Let $\langle a_n \rangle$ be a sequence and $a_{n+1} < a_n$; for all $n \in N$.

Q.1. Which of the following is bounded sequence.

(a) $\langle n(-1)^n \rangle$

(b) $a_n = \left\langle \frac{(-1)^n}{n} \right\rangle$

(c) $\langle 1 + (-1)^n \rangle$

(d) $a_n = \begin{cases} 2 & \text{if } n \text{ is prime} \\ n & \text{if } n \text{ is not prime} \end{cases}$

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Q.2. Let $\langle a_n \rangle$ be a sequence of real number given by $a_n = \begin{cases} 2 & n \text{ is prime} \\ n & \text{n is not prime} \end{cases}$, then which of the following is true

(a) a_n is monotonic

(b) It has supremum

(c) It has infimum

(d) None of these

Q.3. The greatest lower bound of the sequence $\{(e^n + 2^n)^{1/n}; n \in N\}$ is

(a) e

(b) e/2

(c) 1

(d) 0

Q.4. Let $<a_n>$ be a sequence of real number where $a_n = \sin\frac{n\pi}{2}, n \in N$.

Then supremum and infimum of the sequence is

(a) 1 & -1 (b) -1 & -2

(c) 1 & 0 (d) -1 & 0

Q.5. Which of the following is true?

(a) Every bounded sequence is monotonic sequence

(b) Every monotonic sequence is bounded sequence

(c) Every unbounded sequence is monotonic sequence

(d) A monotonic sequence need not be bounded.

Q.6. Let $<a_n>$ be a sequence of real number given by $a_n = 2^{(-1)^n}\left(1-\frac{1}{n}\right)\sin\frac{n\pi}{2}; n \in N$, then the least upper bound of sequence is

(a) 1/6 (b) 1/2

(c) 1/3 (d) 1/4

Q.7. The sequence $\frac{20^n}{n!}$ is

(a) Monotonic increasing sequence

(b) Monotonic decreasing sequence

(c) Eventually monotonic increasing

(d) Eventually monotonic decreasing

Q.8. Consider the sequence $\{a_n\}$ defined by $a_1 = 2$, $a_{n+1} = \frac{1}{2}(a_n + 6)$.

Then

(a) $\{a_n\}$ is bounded but not monotonic

(b) $\{a_n\}$ is monotonic but not bounded

(c) $\{a_n\}$ is neither bounded or monotonic

(d) $\{a_n\}$ is bounded and monotonic.

Q.9. Consider the sequence $\{a_n\}$ of real number where $a_1 > 1$ and $a_{n+1} = 2 - \frac{1}{a_n}$, $n \geq 1$, then the sequence $\{a_n\}$ is

(a) Bounded but not monotone

(b) Not bounded but monotone

(c) Both bounded and monotone

(d) Neither bounded nor monotone

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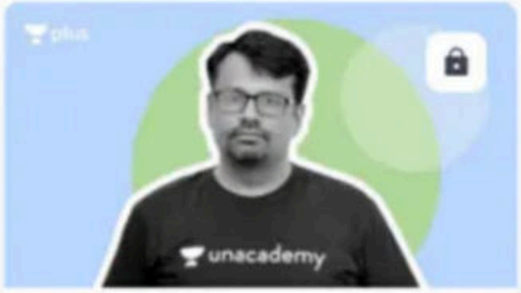

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Educator highlights

- Works at **Pacific Science College**
- Studied at **M.Sc., NET, PhD(Algebra), MBA(Finance), BEd**
- PhD, NET | Plus Educator For CSIR NET | Youtuber (260K+Subs.) | Director Pacific Science College |
- Lives in **Udaipur, Rajasthan, India**
- Unacademy Educator since

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