Gajendra Purohit

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Subsequence : Let $\langle a_n \rangle$ be a given sequence. If $\langle n_k \rangle$ is strictly increasing sequence of natural numbers, then $\langle a_{n_k} \rangle$ is called a subsequence of $\langle a_n \rangle$.

2 1 5 3 4

$a_n = \langle n \rangle = \langle 1, 2, 3, 4, \cdots \rangle$

$a_{2n} = \langle 2n \rangle = \langle 2, 4, 6, \cdots \rangle$

$a_{2n+1} = \langle 2n+1 \rangle = \langle 1, 3, 5, \cdots \rangle$

$a_{n^2} = \langle 1, 4, 9, 16, \cdots \rangle$

$a_{n^2+1} = \langle 2, 5, 10, 17, \cdots \rangle$

$a_{2^n} = \langle 2, 4, 8, 16, \cdots \rangle$

$\langle a_n \rangle = \langle (-1)^n \rangle = \langle -1, 1, -1, 1, \ldots \rangle$

$\langle a_{2n} \rangle = \langle (-1)^{2n} \rangle = \langle 1, 1, 1, 1, \ldots \rangle$

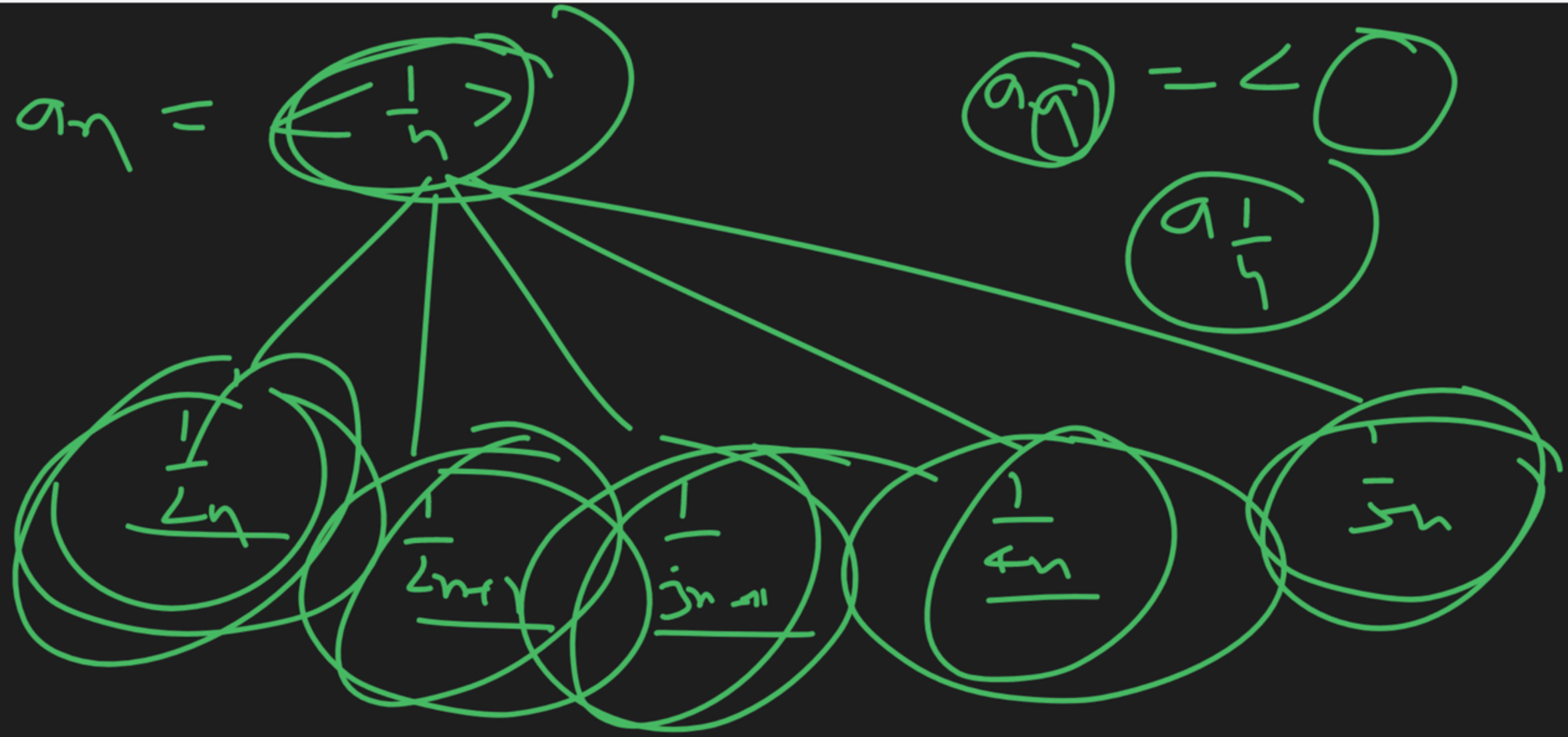
$\langle a_{2n+1} \rangle = \langle (-1)^{2n+1} \rangle = \langle -1, -1, -1, \ldots \rangle$

$$\langle a_n \rangle = \begin{cases} 2 & \text{if } n \text{ is Prime} \\ n & \text{if } n \text{ is not Prime} \end{cases}$$

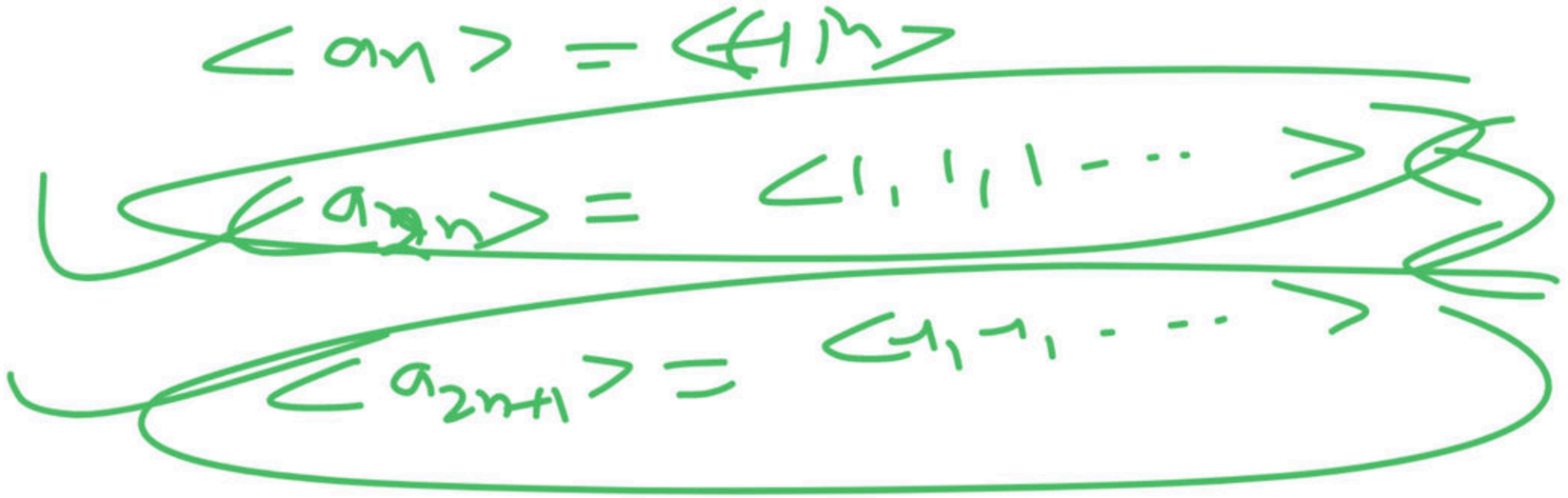
$= \langle 1, 2, 2, 4, 2, 6, 2, 8, 9, 10, 2, \ldots \rangle$

$a_{n=p} = \langle 2, 2, 2, \ldots 2 \rangle$

$a_{n \neq p} = \langle 1, 4, 6, 8, 10, \ldots \rangle$



Complementry Subsequence : If all the terms of two subsequence are distinct then these subsequences are called complementary subsequences.



Important result :

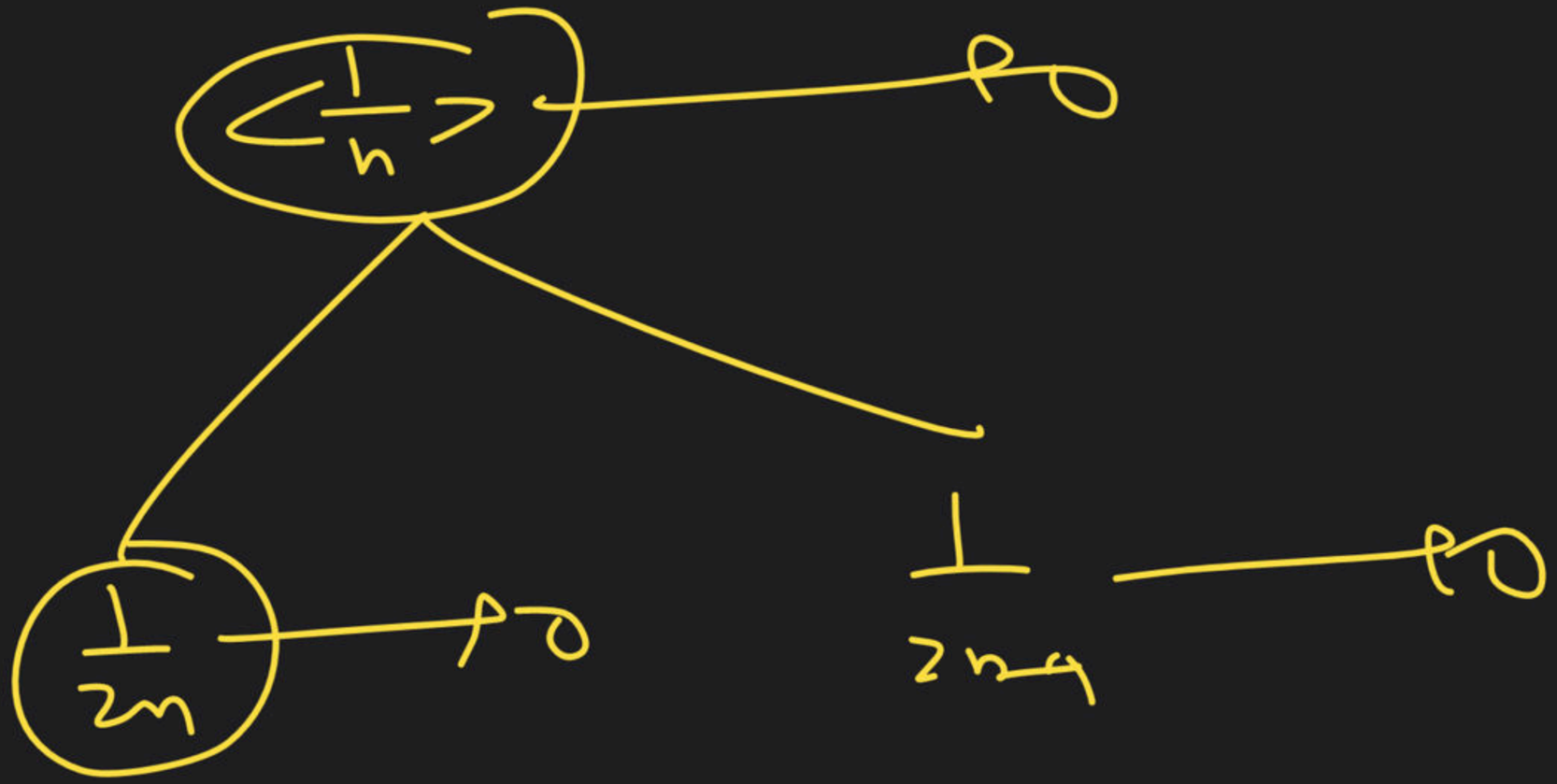
(1) If a sequence $\langle a_n \rangle$ converges to l, then every subsequence of $\langle a_n \rangle$ converges to l. Converse may not be true

(2) If two complementry subsequences of a sequence $\langle a_n \rangle$ are converges to same limit l, then $\langle a_n \rangle$ converge to l. This is best process for show that sequence is not converge.

Important result :

(1) If a sequence $\langle a_n \rangle$ converges to l, then every subsequence of $\langle a_n \rangle$ converges to l.

i.e. all subsequences of a convergent sequence converge to same limit but converse need not be true.

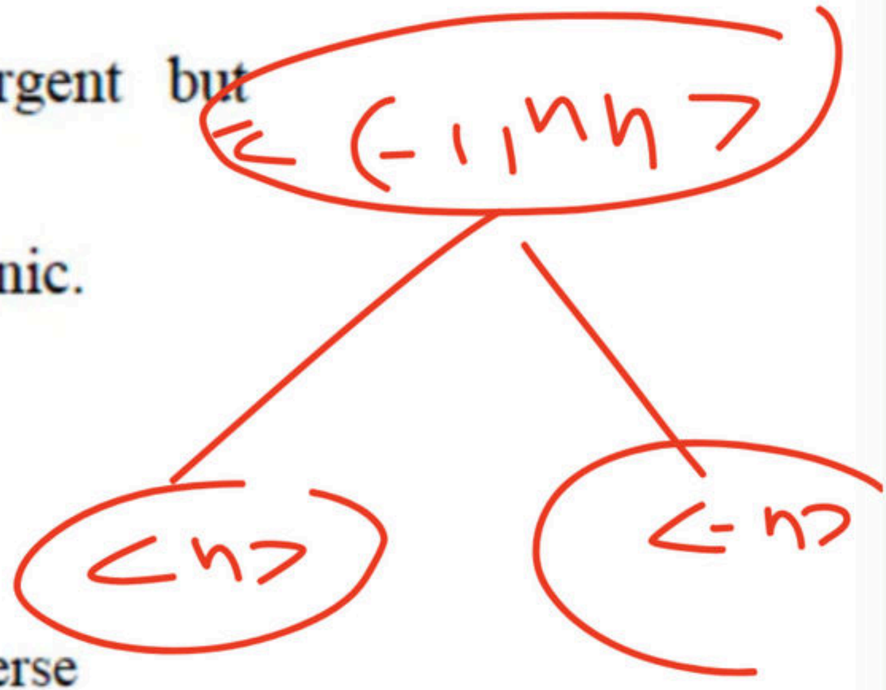

1/n
p0
1/2n
p0
1/2n+1
p0

(2) If two complementary subsequence of a sequence $\langle a_n \rangle$ are converges to same limit l, then $\langle a_n \rangle$ converges to l.

(3) Every subsequence of divergent sequence is divergent but converse need not true.

(4) Every subsequence of a monotonic sequence are monotonic.

(5) A non-monotonic sequence can have monotonic subsequence.



(6) Every subsequence of bounded sequence is bounded but converse need not be true.

(7) Every sequence have atleast one monotonic subsequence.

(8) A bounded sequence have atleast one convergent subsequence.

(9) If two subsequence are convergent then sequence need not be convergent.

Cauchy Sequence : A sequence is called a cauchy sequence iff it is convergent sequence.

Q1. Let $\langle a_n \rangle$, $\langle b_n \rangle$ and $\langle c_n \rangle$ be sequences of real numbers such that $b_n = a_{2n}$ and $c_n = a_{2n+1}$. Then $\langle a_n \rangle$ is convergent.

(a) Implies $\langle b_n \rangle$ is convergent but $\langle c_n \rangle$ need not be convergent.

(b) Implies $\langle c_n \rangle$ is convergent but $\langle b_n \rangle$ need not be convergent.

(c) Implies both $\langle b_n \rangle$ and $\langle c_n \rangle$ are convergent.

(d) If both $\langle b_n \rangle$ and $\langle c_n \rangle$ are convergent.

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▲ 1 • Asked by Megha

Dekhiye sir

Q2. If $\langle x_n \rangle$ is a convergent sequence in R and $\langle y_n \rangle$ is a bounded sequence in R, then we can conclude that

(a) $\langle x_n + y_n \rangle$ is convergent

(b) $\langle x_n + y_n \rangle$ is bounded

(c) $\langle x_n + y_n \rangle$ has no convergent subsequence

(d) $\langle x_n + y_n \rangle$ has no bounded subsequence.

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Q3. Which of the following is true?

(a) Every sequence that has convergent subsequence is a Cauchy sequence.

(b) Every sequence that has convergent subsequence is bounded sequence

(c) The sequence $\langle \sin n \rangle$ has convergent subsequence.

(d) The sequence $\left\langle n\cos\frac{1}{n} \right\rangle$ has a convergent subsequence.

Q.4. Which of the following is false?

(a) Every bounded sequence has a convergent subsequence.

(b) Every sequence has a monotonic sub-sequence.

(c) Every sequence has a limit point.

(d) Limit points of a sequence is always limit of sequence.

Q.5. Which of the following statements about a sequence of real numbers are true

(a) Every bounded sequence has a convergent subsequence

(b) Every sequence has monotonic subsequence

(c) Every sequence has a limit point

(d) Every sequence has countable number of terms

Q.6. Let $< a_n >$ be a bounded sequence of real numbers. then

(a) There is a subsequence of $< a_n >$ which is convergent

(b) Every subsequence of $< a_n >$ is convergent

(c) There is exactly one subsequence of $< a_n >$ which is convergent

(d) None of these

a_{2n}

a_{2n+1}

$a_{4n} = \langle 1 + (-1)^{4n} \rangle$

$a_{3n} = \langle 1 + (-1)^{3n} \rangle$

$a_{2n} \quad \langle 1 + (-1)^{2n} \rangle$

$a_{3n} = \langle 1 + (-1)^{3n} \rangle$

Q.7. If a sequence $\langle a_n \rangle$ is bounded, then the sequence

(a) has no convergent subsequence

(b) has a convergent subsequence

(c) must be converge

(d) is monotonic

Q.8. Consider the statement :

S_1 : Every Cauchy sequence of R is convergent.

S_2 : Every convergent sequence is a Cauchy sequence.

S_3 : Every Cauchy sequence is bounded.

Which of the following is true?

(a) Only S_1 (b) Only S_1 and S_3

(c) Only S_2 and S_3

(d) All the statements

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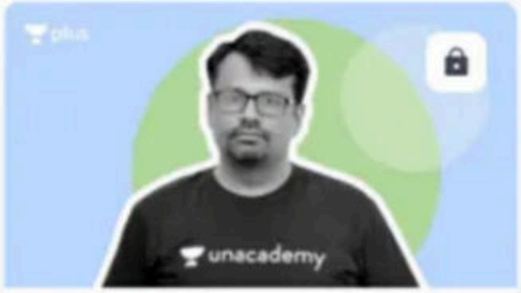

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Educator highlights

- 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**
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