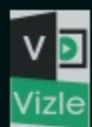


Introduction to Discrete Mathematics



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Introduction to Discrete Mathematics



Target Audience:

- » Students who are preparing for GATE and other competitive exams.
- » Students who want to learn competitive programming.
- » College going students who have Discrete Mathematics in their syllabus.
- » Everyone who wants to learn Discrete Mathematics as a whole or may be a small subset of this subject.



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Why Study Discrete Mathematics?



- (1) It develops your mathematical thinking.
- (2) Improves your problem solving ability.
- (3) If you are computer science student, then no need to go anywhere else because Discrete Mathematics is for you.

Discrete Mathematics is important to survive in subjects like: compiler design, databases, computer security, operating system, automata theory etc.

- (4) Many problems can be solve using Discrete Mathematics:

For Example:

- Sorting the list of integers.
- Finding the shortest path from your home to your friend's home.
- Drawing a graph with two conditions:
 1. You are not allowed to lift your pen.
 2. You are not allowed to repeat edges.
- How many different combinations of passwords are possible with just 8 alphanumeric characters.
- Encrypt a message and deliver it to your friend and you don't want anybody to read that message except your friend.



What is Discrete Mathematics?

>> Discrete Mathematics is the study of discrete objects.

Discrete means: "distinct or not connected".

>> It is not a branch of Mathematics. It is rather a description of set of branches that have one common property - that they are "discrete" and not "continuous".

Discrete vs Continuous

>> The whole world of Mathematics is divided in two realms:

1. Discrete

2. Continuous

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Discrete vs Continuous

>> The whole world of Mathematics is divided in two realms:

1. Discrete

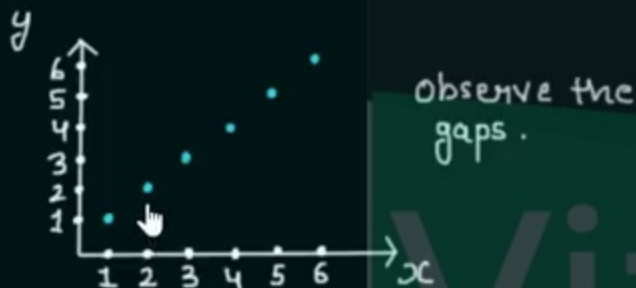
2. Continuous

Discrete Objects:

1. Natural Numbers are discrete.

For Example: 1, 2, 3, 4, 5...

$$y = x \quad x \in \mathbb{N} \quad y \in \mathbb{N}$$



2. Digital clock is "discrete" in nature.

- there is no continuous time,

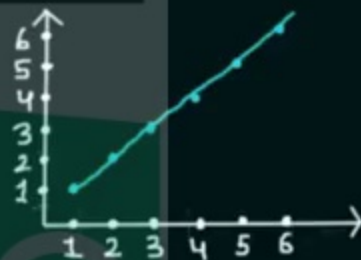
Transition from one time to another is sharp

Continuous Objects:

1. Real numbers are continuous

For Example: between 0 and 1 -

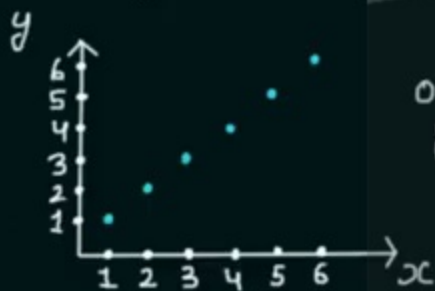
0, 0.001..., 0.000001..., 0.10001..., and so on



2. Analog clock is continuous in nature.

- In Analog clock - hour, minute and second hands move smoothly over time

$$y = x \quad x \in \mathbb{N} \quad y \in \mathbb{N}$$



Observe the gaps.

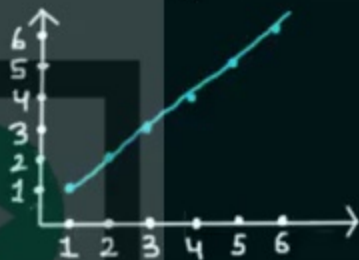
2. Digital clock is "discrete" in nature.

- there is no continuous time,
- Transition from one time to another is sharp.

10:42:57 → 10:42:58

0, 0.001..., 0.000001..., 0.10001..., and so on

$$y = x \quad x \in \mathbb{R} \quad y \in \mathbb{R}$$



Continuous line
No gaps.

2. Analog clock is continuous in nature.

- In Analog clock - hour, minute and second hands move smoothly over time.

Consider the clock where minute hand, hour hand and second hand sweeps around the time smoothly





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