NPTEL

NPTEL ONLINE CERTIFICATION COURSE

Discrete Mathematics
Set Theory

Example, definition and notation

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Let me consider the set of all planets Mercury, Venus, and so on, I write all of them. And then

{ Mercury , Venus, Earth, Mars, Jupiter, Saturn,
Uranus, Neptune }

{ Jawaharlal Nehru, Lal Bahadur Shastri , Indira
Gandhi, Morarji Desai, Charan Singh, Rajiv Gandhi,
V.P. Singh, Chandra Shekhar, P.V. Narasimha Rao,
Atal Bihari Vajpayee, H.D. Deve Gowda, I.k.Gujral,
Manmohan Singh , Narendra Modi }

let me consider the set of all Prime Ministers of India, you see this is the list let me consider the set of all single-digit numbers which is 0, 1, 2, 3, up to 7, 8, 9, 10 of them, right, let me consider all days of the week, comes to be Monday, Tuesday, Wednesday, so on up to Saturday, Sunday. Let me consider the months of the year Jan, Feb, March, April so on up to

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

{Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday}

{January, February, March, April, May, June, July, August, September, October, November, December}

December. Do you see what is in common in whatever I wrote so far they all are called sets in

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SET

{0, 1, 2, 3, 4, 5, 6, 7, 8, 9}

{Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday}

{January, February, March, April, May, June, July, August, September, October, November, December}

the language of mathematics, you see certain things in math is best left undefined, set is one such thing but for completeness sake we may have to define what is a set and it may do it in about a sentence here. A set as you can see above is a collection you collect a few objects, collection of a few objects that is what you mean by a set in fact there are a whole lot of paradoxes involving sets so if you start defining exactly what is a set you'll run into problems, but throughout our course by a set we mean a list of things, a list of things, and this list as you

saw above that all finitely many, but a set can indeed contain infinitely many entities, for example set of all numbers starting from 1, 2, 3, so on up to infinity, set of all even numbers, right, set of all prime numbers right and so on.
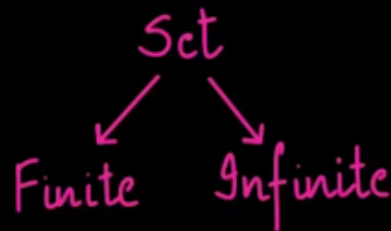
A set can contain infinitely many entities.

Example: $\{1, 2, 3, \ldots\ldots\}$

$\{2, 4, 6, 8 \ldots\ldots\}$

$\{2, 3, 5, 7, \ldots\}$

$\vdots$

Set

Finite   Infinite

So you just now saw that a set can be finite or also infinite, before going any further let us look at some handy notations let me consider a set, let's say S with elements A, B, C, D, please note a set can have anything as its elements, and mostly we use capital letters to denote the set and generally we use small letters to denote the elements of the set, there is no hard and fast rule but this is mostly the convention, all right.

So now as you can see A is an element of S, or we can say A belongs to S there's a notation we use in math for this we say A belongs to S and this is the notation you should get used to, and as you know the letter Z is not here in the set, so we say Z does not belong to the set.

$$S = \{ \textcircled{a}, b, c, d \} \not\leftarrow\!\!\!\times z$$

* Capital letters to denote the set.
* Small letters to denote elements of the set.

NO RULE!

* a belongs to S.

$$a \textcircled{\in} S$$

$$z \notin S$$

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Let us consider a set of all numbers, let's say set A comprises of 1, 2, 3, 4 up to 100, there are many ways in which you can write a set, this is a standard notation that I'm going to tell you right now where I can also write this set which I wrote just now as X such that please note it will be very clear to you as you see more examples such that X is between 1 to 100, and X is an integer, right, so this is same as this but it becomes very handy for you to write something like this, for example a set S comprising of all those real numbers between let's say 0 and 1, now it

$$A = \{1, 2, 3, 4, \ldots, 100\} \checkmark$$

$$A = \{x \,/\, 1 \leq x \leq 100, \; x \text{ is an integer}\} \rightarrow \text{Very handy}$$

$$S = \{x \,/\, 0 \leq x \leq 1\} \quad \text{Impossible}$$

is not just difficult but impossible to enumerate it like this, there are times when you may want to enumerate it with a definition like this, right, so a set can be written this way also, don't worry much with a lot of examples, things will become very clear to you.

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