Definitions

Discrete : Different, independents, separate, not of same type

Discrete Mathematics (discrete structures) : Mathematical topic that are different, independents, separate, not of same type

Integer : whole number without fraction

Even : even integer

Odd : odd integer

At least : same or more (more means bigger by value)

At most : same or less (less means smaller by value)

Non-negative: 0 or positive

Non-positive : 0 or negative

Increasing sequence : left to right values are always bigger (same not allowed)

Non-decreasing sequence : left to right values are same or bigger

Decreasing sequence: left to right values are always smaller (same not allowed)

Non-increasing sequence : left to right values are same or less

rational number : can be represented by the fraction (ratio) of two integers as p/q, where q is non-zero

irrational number : is a number that cannot be represented by a ratio of two integers

Real numbers : include integers, rational and irrational numbers

Decimal number : the number that we usually see and use (0, 1, 2…9)

Binary number : number has only two digits, (0 and 1)

Definitions (cont)

Absolute value of a number : is its value without sign

Equality : is another name of mathematical equation

Factorial : of a non-negative integer n (written as n!)

mod (also called modulus) of two integers a mod b is the remainder after a is divided by b

At least and At most

At least :

example 1: At least 12 (means 12 or more)

12 , 13 , 13.5 , 1000 etc

example 2 : At least -4

-4 , -3.5 , 0 , 4 etc

At most :

example 1: At most 12 (means 12 or less)

12 , 11.99 , 10 ,0 ,-1 etc

example 2 : At most -4

-4 , -4.1 , -5 , -10 etc

Definitions

Inequality means if the expression has no "=". Instead, it has <, ≠, >, ≥, ≤ etc.

Although ≥ and ≤ have "=" within them, they are still inequalities

Definition of **log** is this: If $a^x = y$, then $x = \log_a y$

Some warmup preliminaries

> and ≥: If a > b is correct, then a ≥ b is also correct

If a ≥ b is correct, then a > b may not be correct, because it may happen that a = b

<, -, and Inverse

If a < b is correct, then -a > -b is correct,

Inverse of x is $\frac{1}{x}$

If a < b is correct, then (inverse of a) > (inverse of b) is correct, that means, $\frac{1}{a} > \frac{1}{b}$ is correct

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Odd, even Integers

Addition and subtraction

Not same type = odd

even + odd = odd.

even – odd = odd.
odd – even = odd.

Same type = even

odd + odd = even.
even + even = even.

odd – odd = even.
even – even = even.

$\frac{odd+odd}{2}$ = odd or even

$\frac{even+even}{2}$ = odd or even

$\frac{even+odd}{2}$ = Fraction (not even or odd because is not an integer)

Addition and subtraction

↓

Plus or minus one

odd + 1 = even
odd – 1 = even
even + 1 = odd
even -1 = odd

Even = 2k

Odd = 2k+1

(for some integer k. k may be even or odd)

0 is even

Odd, even Integers

multiplication

Not same type = even

odd * even = even.

Same type = itself

odd * odd = odd.
even * even = even

division

even/2 = may be even, may be odd!

exponential

odd

$(\text{even or odd})^{0} = 1 = \text{odd}$
$(\text{odd})^{\text{positive even or positive odd}} = \text{odd}.$

even

$(\text{even})^{\text{positive even}} = \text{even}.$
$(\text{even})^{\text{positive odd}} = \text{even}.$

Note Non-negative and Non-positive

0 is not positive, not negative

Non-negative and **at least 0** are same

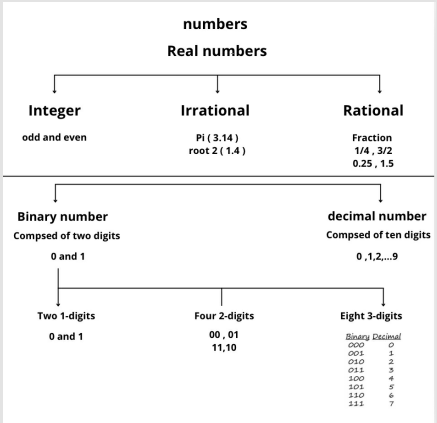
Non-positive and **at most 0** are same

Increasing and decreasing

increasing	L to R value are always bigger same not allowed type : 1 \ increasing values with same increase speed (rate) 2 \ increasing curve with different increasing speed at different places
Non-decreasing	L to R value are same or bigger same allowed Increasing sequence is also non-decreasing
Decreasing	L to R value are always smaller same not allowed type : 1 \ decreasing values with same decreasing speed (rate) 2 \ decreasing curve with different decreasing speed at different places
Non-increasing	L to R value are same or smaller same allowed decreasing sequence is also non-increasing

The term **increasing** usually come with **sequence**

Numbers



Binary numbers have equivalent decimal values

For example: 00, 01, 10,11 are equivalent to 0, 1, 2, 3

log

Some **common formula** for log (here a, b, c > 0):

- $\log_a a = 1$
- $b^{\log_b a} = a$
- $\log_a b^n = n\log_a b$
- $\log_a(bc) = \log_a b + \log_a c$
- $\log_a(1/b) = -\log_a b$
- Next here

- $\log_a b = \frac{\log_c b}{\log_c a}$
- $\log_a b = \frac{1}{\log_b a}$
- $a^{\log_b c} = c^{\log_b a}$

Ceil and floor

Floor	Ceil
$\lfloor k \rfloor = k$, if k integer $\lfloor k \rfloor$ = previous integer, if k fraction	$\lceil k \rceil = k$, if k integer $\lceil k \rceil$ = next integer, if k fraction

mod

It is also written as **a % b**

(any even integer) % 2 = 0
(any odd integer) % 2 = 1

Mod means remainder

even%2 = 0

odd%2 = 1