How to find the sum of the numbers 1 to x:

$$\frac{x(x+1)}{2}$$

$\sum$: The sum of

End value

$\sum$ the sum of

Index and start value

Time complexity or Computational time:

Measures the rate the time an algorithm takes to complete a process relative to the complexity of the input set.

Factorial (!): the product of the natural numbers <= a given number

O(): model of how quickly time increases to complete the equation

Polynomial:

O (n^2): Quadratic time

O (1): constant

O (n): linear

Roots: O ($\sqrt[x]{n}$)

O ($\sqrt{n}$): Square root

O (2^n): Exponential with c>1

O (n!): Factorial

O ($n\log_2 n$): LinLog

Order from slowest to fastest time:

- Factorial
- Exponential
- Polynomial: Quadratic
- LinLog
- Linear
- Root: Square Roots

- log
- Constant

Data Search

Asks a data set if it contains x

<u>Linear or Series Search:</u>

Examines one element at a time, one after another

Runs in linear time: O(n)

<u>Binary Search:</u>

How to search for a particular value

1. Order the data set
2. Halve the data set and examine which half to keep
3. Havle the kept set and examine which “new” half to keep
4. Repeat till complete

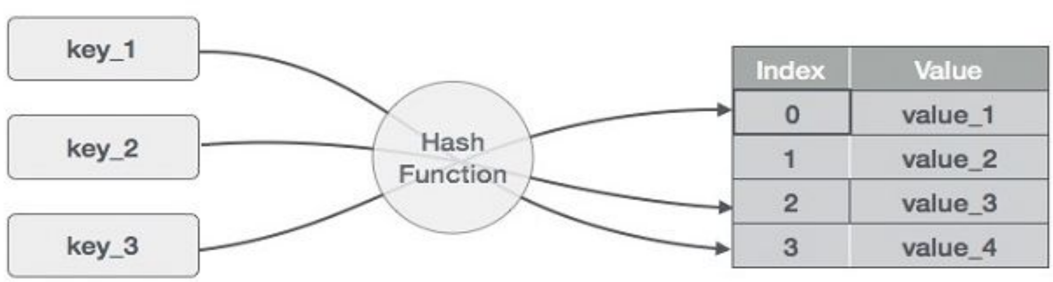
O(log): steps 2 through 4

<u>Hash Table:</u>

A data is stored in an index list with a Hashing Function (a rule) to associate a data point and an index. Data may then be called by index rather than dealing with the full data entry.

Linear time: O (n)

Hashing is a technique to convert a range of key values into a range of indexes of an array. We're going to use modulo operator to get a range of key values. Consider an example of hash table of size 20, and the following items are to be stored. Item are in the (key,value) format.



Hash Function: Takes input data and uses a mathematical calculation to put the data into the hash table. It also allows the user to search up data in the hash table. If the data doesn’t exist in the table then the hash function will send you to an empty slot in the hash table.

If the data is a letter or letters then the hash function will look at the first letter and will decide from that where it goes. If there are two of the same letters then the hash function will move the data to the next line. This is the same logic for searching. How many times the hash function has to search separate positions determines if it is linear or constant time.

Example:

A pizza making robot builds the following pizzas with the stated number of steps, cheese (12), 1 topping (16), 2 topping (20), 3 toppings (24). Find the time complexity.

Change: +4, +4, +4

Linear time O(n)

A computer program finds the locations of the local maximums and minimums of a polynomial. The higher the order of the polynomial the greater the possibility of more local extremes. Order 1 (3 steps), Order 2 (6 steps), Order 3 (11 steps), Order 4 (19 steps), Order 5 (28 steps).

Change: +3, +5, +8, +9

Quadratic Time (n^2)

The fair has a jelly bean jar guessing contest each year. Every year the jar gets bigger and bigger. Below are the total number of steps Jimmy used in his winning algorithm. 1996 (4 steps), 1997 (4 steps), 1998 (4 steps), 1999 (4 steps), 2000 (4 steps).

Change: +0,+0,+1,-1

Constant time O(1)