Math Matters

Exponents & Powers

$$a^m \times a^n \Rightarrow a^{m+n}$$

$$(a^m)^n \Rightarrow a^{mn} \Rightarrow a^{nm} \Rightarrow (a^n)^m$$

$$a^m \times b^m \Rightarrow (ab)^m$$

$$a^m \% b^m \Rightarrow (a/b)^m$$

$$a^m \% a^n \Rightarrow a^{m-n} ; m > n$$

x^n : x is called base

n is called exponent.

Any such forms are called Exponential forms.

Set

- similar elements
- No duplicates
- A set having n elements will have 2^n subsets including ϕ and itself.

Addition

$$1+2+3+ \dots + n$$

$$\sum n = \frac{n(n+1)}{2} = \sum_{i=1}^{n} i$$

i.e. $1+2+3+4+5 \Rightarrow 15$

$$\Rightarrow \frac{5(5+1)}{2} \Rightarrow 15$$

Problem #1

How much does it take to find minimum from a given list of numbers size n ?

Depends

Answer ⇒ 1 If the list is sorted already, choose the lowest.

⇒ n If the list is not sorted.

Can we think of D&C
may be, only if we introduce some
parallelism. i.e. multi thread, etc.

Reason as we can not judge smallest without checking all elements from the list.

Normally, all algorithm first are studied without parallelism.

It's advised to study smaller or simpler algorithms analysis before those who use them. i.e. Selection sort uses minimum/maximum findings. So first understand analysis of finding minimum/maximam to start with.

Problem #2

Accessing element i^{th} from a list of size n.

Answer depends

⇒ 1

⇒ n

- If the list is implemented using array contiguous memory locations then addition of offset to base let access ith element. i.e arr[i] is direct access.

- If the list is implemented using linked list, we need to traverse till ith location node to access it.

Problem #3

Why most sites have complex password requirements?

i.e. minimum 8 length, one upper, one lower, one symbole & digit, etc ?

To stop brute force attack
from hacker.

If lets say 4 digit pin ;
All combinations 9999
can be tried in short time
with existing computational power.

This is one more reason account disable/
lock activated after certain attempts.

Problem #4

Search an element from a list

① Just answer present or not

Yes or No.

② Not only say yes if found but also its location so that other related information can be read.

Answer depends

⇒ For 1024 numbers
do ~10 comparisons

⇒ For 1024 numbers
max 1024 comparisons

⇒ less than 10 ??

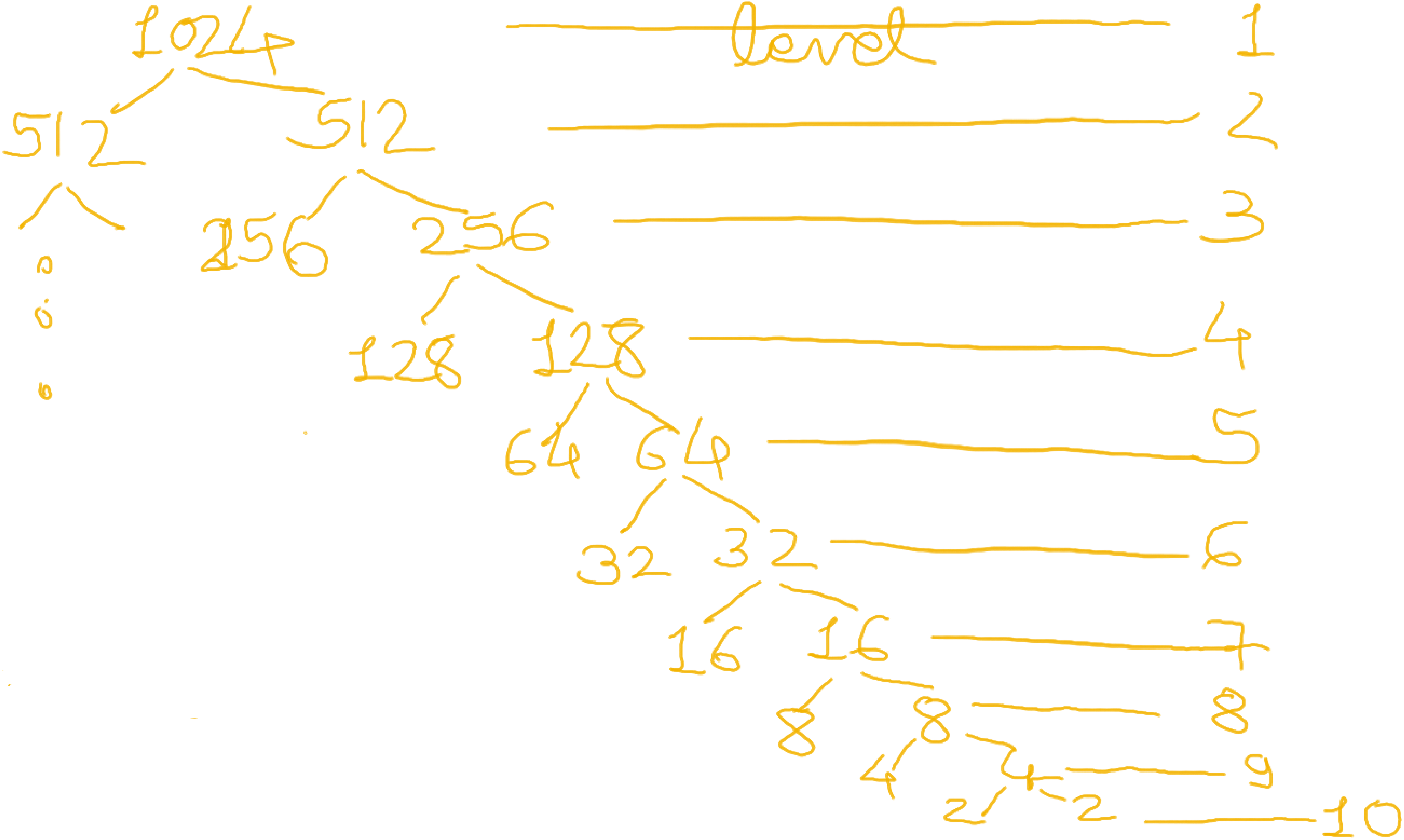
A) If inputdata is not sorted
then linear search
(with simplest datel structure)
start from first until last

B) If the data is sorted already then D&C

Binary Search method

How exactly D&C helps?

In binary search because when you decide key comparison with middle position element and use either left or right, YOU ARE REDUCING SEARCH SPACE by half.


1024
level
1
512
512
2
256
256
3
128
128
4
64
64
5
32
32
6
16
16
7
8
8
8
4
4
9
2
2
10

The data is in array but if you see the processing actually is following a route/path of a tree.

What if data is in linked list? Can we use binary search technique?

What will be worst case in terms of searching?