

Binary Search

4/15/25
COP4516

Final Exam STRUCTURE

- ① Talk About
- ② When it applies
- ③ Real Valued (hitting)
- ④ Int Value (airport shuttle)
- ⑤ Most Common Errors

2	3	5	6	22	40	50	90
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↑ ↑ ↑
low mid high

Is 23 in the array?

if ($val > arr[mid]$)

low = mid + 1

else if ($val < arr[mid]$)

high = mid - 1

When it applies

① Underlying "function" governing the problem is either increasing or decreasing.

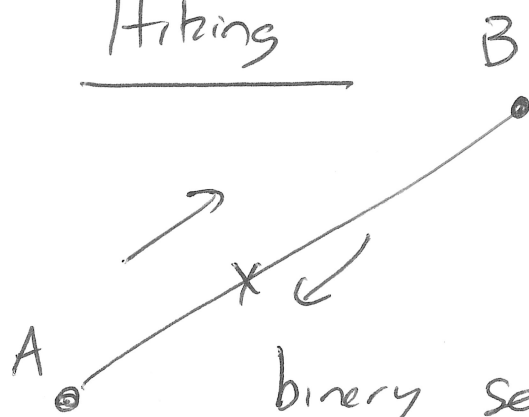
② Hard to calculate backwards, but easy to calc forwards + you want to compute it backwards!

$$f(t) = \frac{f_2 - f_1}{f_1 f_2} = a \underline{t} + b e^{\underline{-tc}} \quad \left. \vphantom{\frac{f_2 - f_1}{f_1 f_2}} \right\} \begin{array}{l} \text{given } a, b, c, f_1, f_2 \\ \text{find } t, \end{array}$$

given a, b, c, t , easy f_2

hard a, b, c, f_1, f_2 hard t

Hiking



binary search time

low = 0, high = time down

Tips for restructured binary search

1) Do a fixed # of iteration (60-100)

2) Pay careful attention low, high.

- low $\leq$ real ans
- high $\geq$ real ans
- no math exception occurs
- no overflow occurs

Int Bin Search Issues

$$\text{mid} = (\text{low} + \text{high}) / 2 \quad \text{OR}$$

$$\text{mid} = (\text{low} + \text{high} + 1) / 2$$

decide
plus is
low=2
high=3

$$\text{low} = \text{mid} \quad \text{OR} \quad \text{low} = \text{mid} + 1$$

$$\text{high} = \text{mid} \quad \text{OR} \quad \text{high} = \text{mid} - 1$$

while (low < high) {

...

} Depends
on
your
conception
of your
function

}

	<u>D</u>	<u>t</u>
A	4 miles	2 mph $t = 3 \text{ hrs}$
	0 miles	$t = 1 \text{ hr}$
	1 miles	$t = 2 \text{ hrs}$
		etc.

Final Team Contest

① Webcourses msg which teams in which rooms

② & PROBLEMS

③ Different Pt Values

5, 5, 10, 10, 15, 15, 20, 20

- Tie break penalty in system