

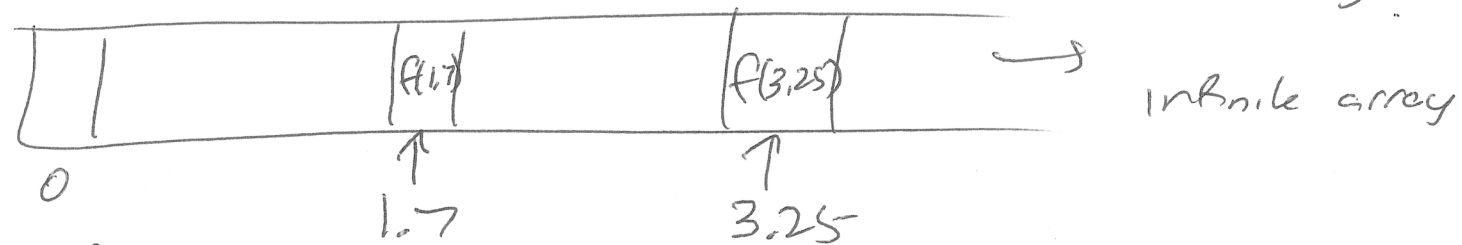
COP 3502 11/19/25

Binary Search

Crystal Problem

$$\frac{f_2 - f_1}{f_1 f_2} = \frac{at + b(1 - e^{-ct})}{f_1 f_2} \quad \text{RHS} = f(t)$$

$f(t)$ is increasing!



Real Value Binary Search (Bisection)

- (1) function has to be increasing or ~~de~~ decreasing (non-decreasing, non-increasing)
- (2) Useful when it's difficult to invert $f(t)$ but easy to calculate it forward.
- (3) Recommendation: fixed # of iterations because of floating pt error.
- (4) Watch out where:
 - 1) setting low init
 - 2) setting high init
 - 3+4) in loop what to set either low or high to

low = 0

(easy)

high = X/a

$$X = at + b(1 - e^{-ct})$$

$$X = at + b(1 - e^{-ct})$$

 > 0

$$X = at$$

$$t = \frac{X}{a}$$

Crystal Etching

$$X = \frac{f_2 - f_1}{f_1 f_2}$$

Need for Speed

3 → segment total time

Ans = 3

4 → 2
4 → 3
10 → 6

$$t = \frac{4}{2} + \frac{4}{3} + \frac{10}{6}$$

$$t = 2 + 3 = 5 \checkmark$$

if I added > 3 (10) then my time eval would be too small

if I added < 3 (2) then my time eval would be too big

low = - (min speed input)

high = 10^7 (safe)