Q:> $x^2 + \sqrt{x} = C$

$C \rightarrow$ real number

given the value of c, find x. $(1 \le C \le 10^{10})$

$\downarrow$

real no.

$C = 2$

$x = 1$

$C = 15.6$

$x \rightarrow 3.6982321\ldots$

$\downarrow$

print upto 6 decimal places

generally in binary search, we remove half of the search space by while doing lo = mid + 1 or hi = mid - 1.

But here our ans can be a real no, so if we reduce by doing a +1 or -1 then we can loose the most accurate ans.

Better solution $\Rightarrow$ $\underbrace{lo = mid \quad \text{or} \quad hi = mid}$

while (l <= r) or whle (l < r) ----

Calc a mid

lo hi

real 1 real 2

closer to ans

infinite mid values

enfinity

while (r - l > ϵ) {

}

$\epsilon \rightarrow 10^{-6}$

for → possible soln
treating real no. → we calculate the
delta between l & r & compare with ϵ
precision you want for your ans
$>10^{10}$
while ($r - l > \epsilon$)
fail
this always converges ??
$\epsilon \to 10^{-6}$ 10^{-7}
Mathematically it always con
Computer
but so slow
decimal places
$x.y \times 10^{2}$

200 iteration

while (l ≤ r) $\rightarrow$ $O(\log (r-l))$

$\boxed{r - l > e}$

$\log (r - l - e)$

$\log (10^{30})$

$r \rightarrow 10^9$ $l = 1$ $e \rightarrow 10^{-9}$

$10^9 - 1 - 10^{-9}$

$\hookrightarrow \dfrac{10^9 - 1}{10^{-9}}$ $\approx \boxed{\log (10^{18})}$

$- 2\log (10^9)$

$10^3 \rightarrow 10$

$10^6 \rightarrow 20$

$10^9 \rightarrow 30$

$10^{12} \rightarrow 40$

$10^{15} \rightarrow 50$

$10^{18} \rightarrow 60$

$10^{21} \rightarrow 70$

$10^{24} \rightarrow 80$

$10^{27} \rightarrow 90$

$10^{30} \rightarrow 100$

for (i in range (0, 200)):

200

100

10^-4

$x^2 + \sqrt{x} = C$ → search space monotonic BS

$1.0 \le C \le 10^{10}$

$l \to 1.0$ $r = 10^{10}$

double

real ← $m = (l+r)/2$ ← d

valid →

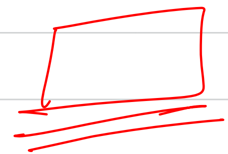
if mid*mid + sqrt(mid) == C
return mid

→ $d > C$
left side → $l = mid$

else right side → low = mid

IEEE - 754

standard



Q: There are n ropes, you need to cut them into K small ropes of equal length. Find the max length of pieces you can get.

802
743
457
539

$n = 4$

$k = 11$

precision reqd $\rightarrow 10^{-6}$

$1 \le n, K \le 10^4$

$1 \le$ lg of i^{th} rope $\le 10^9$

ans 200.5

1e10

1e10

mid

802
743
457
539

K = 11

200.5

per $\le x$

l

cut smaller rope of len x

l/x

802 / 200.5 → 4

743 / 200.5 → 3

457 / 200.5 → 2

539 / 200.5 → 2

11

$sum \leftarrow \sum (a[i]/x)$

sum ≥ K → right $l = m$

else $r = mid$

You took small piece of size $\underline{x}$

$$\text{sum} \longrightarrow \sum \left(\frac{a[i]}{x} \right)$$

no of pieces we will get

$$\text{sum} \geq K$$

Sqrt

Integer part

precision

sqrt of n ??

n

lo = 1

mid

hi = leo

mid * mid == n → sqrt

precision

$mid^2 \le x$

mid * m > n

hi = mid

mid * m < n

lo = mid

sqrt(x) → 10^{-3} precision

common approach

BS no code — integer part → ⌊sqrt(x)⌋

Go loop

y. _ _ _ _ _ _ _ _ _ 6

0–9

0 → 9

$y.1^2 \le x$

$y.2^2 \le x$

$y.3^2 \le x$

⋮

$y.6^2 > x$

→ y.5

(to)

$y.51^2 \le x$

$y.52^2 \le x$

$y.53^2 \le x$

⋮

$y.57^2 > x$ → $y.56^2$