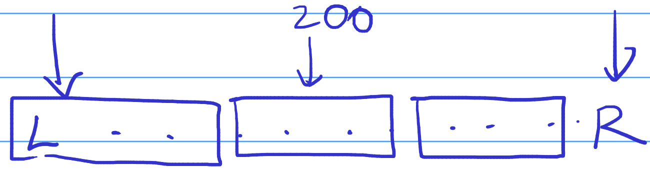
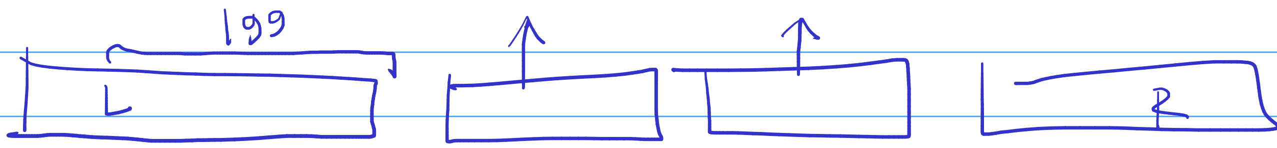
$N = 30000$

$\underline{N\sqrt{N}}$ ✓

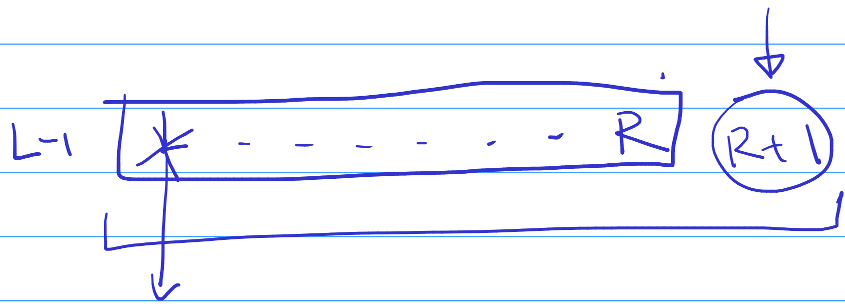
$\sqrt{N} = \underline{200}$

$\frac{N}{200}$, ~~200~~ $q = 2 \times 10^5 \times 200 = \underline{4 \times 10^7}$ ✓





Mo's algorithm



Fractional knapsack

$T = 8$ sec 0-1 Knapsack ✓

$R_1 = (100, 7\text{ sec}) = 14.28$

$R_2 = (50, 4\text{ sec}) = 12.5$

$R_3 = (55, 4\text{ sec}) = 13.75$

$f(i, k) = a_i - (k-1)^2 \cdot b_i$

$b_i = 1$ $k = \sqrt{a} = 30$

30×100

$= \boxed{3000} \times 25000$

$= 75 \times 10^6$ ← No. of itera

$= 7.5 \times 10^7$ ✓

0-1 Knapsack

$(W \cdot N)$ ✓

dp[20][t]

dp[19]

Ride i

dp[i][t] ← Ride Taken

Ride not taken ← dp[i-1][t]

dp[i-1][t - t_i]

```
vector <int> dp[3005] ;
```

1sec

2×10^8

```
for(int i=1; i<=3004; i++) {
   // dp[i] = vector<int> (25001, 0);
   // dp[i-2]. clear(); // 25000
   for (int y=1; y<=25000; y++) {
      dp[i][y] = - - - - -
   }

solve(int x, int y) ;   -> solve(x, y-1)
                        -> solve(x-1, y);

cout<< solve (1000, 1000) <<endl;
```

```
if dp[x][y] != -1 :
      return dp[x][y] ;
```

solve(2,2)

solve(1,2)   solve(2,1)

```
for (x=0; x<1000; x++)
   for(y=0; y<1000; y++)
      solve(x,y) ;

cout <<
```

solve(0,0)

solve(1,1)

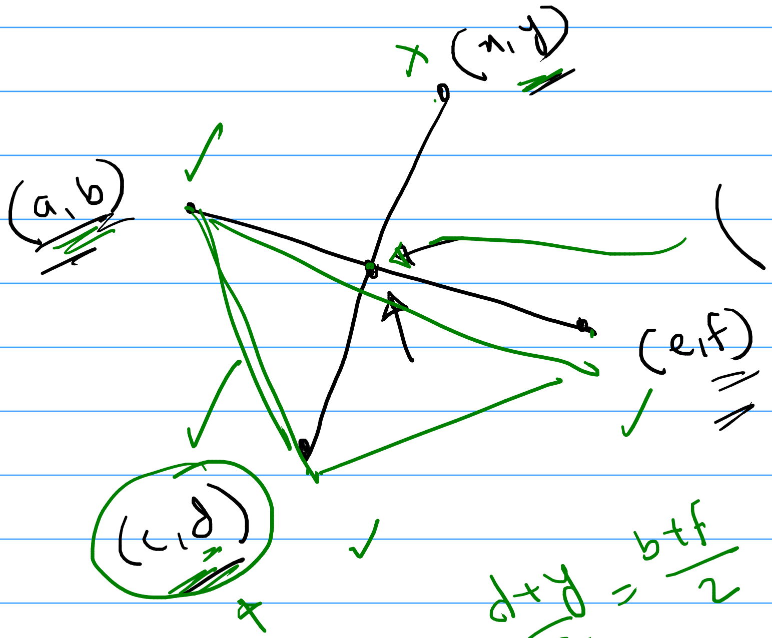
solve(0,1)   solve(1,0)

x   x

solve(x, y) → solve(x+1, y) ✓

→ solve(x, y-1) ✓

Bitmask DP ✓



$\left(\frac{a+e}{2}, \frac{b+f}{2} \right)$

$x = a + e - c$

$c + x = a + e$

$\frac{d+y}{2} = \frac{b+f}{2}$ $\frac{c+x}{2} = \frac{a+e}{2}$

All submask of a mask → 3^N

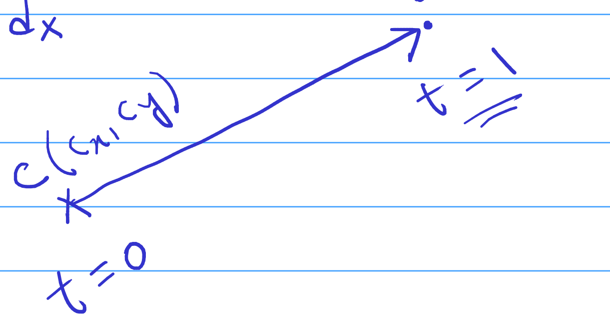
$N \longrightarrow 2^N$

$s = (-s) \&$

$$x = c_x + t(d_x - c_x) \longleftarrow \text{parametric}$$

$t=1$, $x = c_x + d_x - c_x$
$= d_x$

$t=0$, $x = c_x$



$$x_1 = c_x + t(d_y - c_y)$$
$$y_1 = c_y + t(d_y - c_y)$$

$$x_2 = a_x + t(b_x - a_x)$$
$$y_2 = a_y + t(b_y - a_y)$$

$$d^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2$$

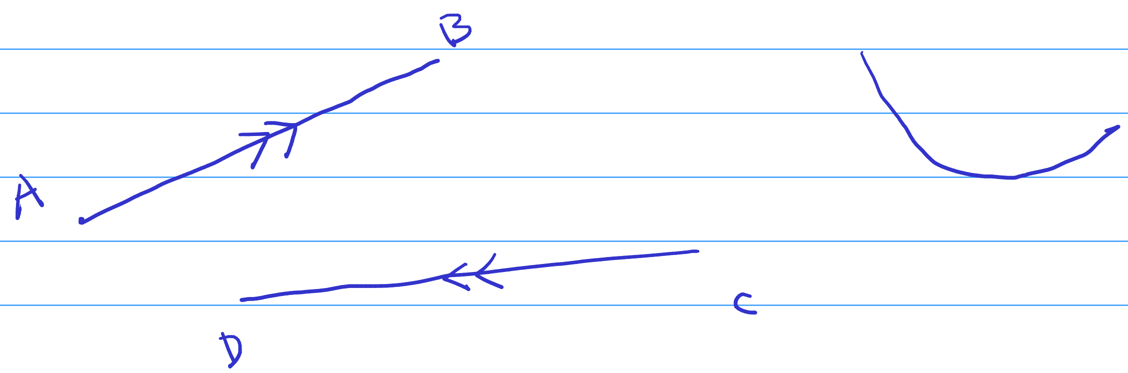
$$d^2(t) = (\underbrace{(c_x - a_x)}_{p} + t\underbrace{(d_x - c_x - b_x + a_x)}_{q})^2$$

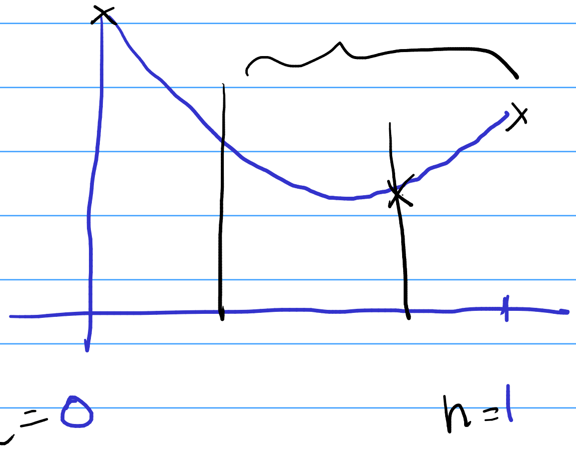
$$= (p + qt)^2 + (m + nt)^2$$

$$= p^2 + m^2 + t(2pq + 2mn) + t^2(q^2 + n^2)$$

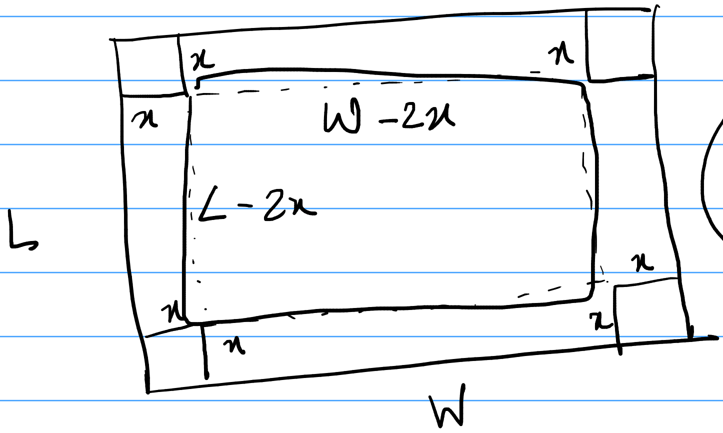
$$\frac{d}{dt}[D^2] = 0 + \cancel{2}pq + \cancel{2}mn + \cancel{2}t(q^2 + n^2)$$
$$= 0$$

$$t = \frac{-pq - mn}{q^2 + n^2}$$





$$V = (W - 2x)(L - 2x)(x)$$



$$\frac{dV}{dx} = \quad = 0$$

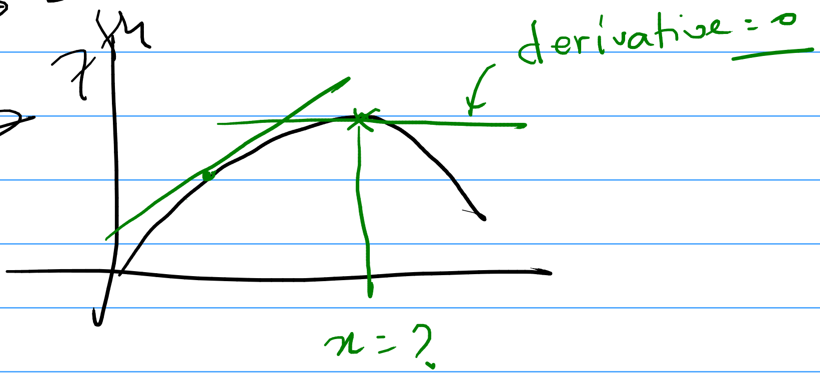
$$\frac{\partial V}{\partial x} =$$

$= \phi$

maxima
minima

32 → 8th

27 → 7th



sum = 5

1 0 1 0 1 1 0 1 0 0 0 1

4th

5th one

$\boxed{>=5}$

oset = {1, 3, 5, 6, 7, 11}

$n \log n$

5th

0, → 1

$n \log^2 n$

4

1 0 1 0 1 1 0 1 0 0 1 1 0 0

l = 1

n = 14

mid = 7

K = 3

l = 1

2

high = 7

l = 5

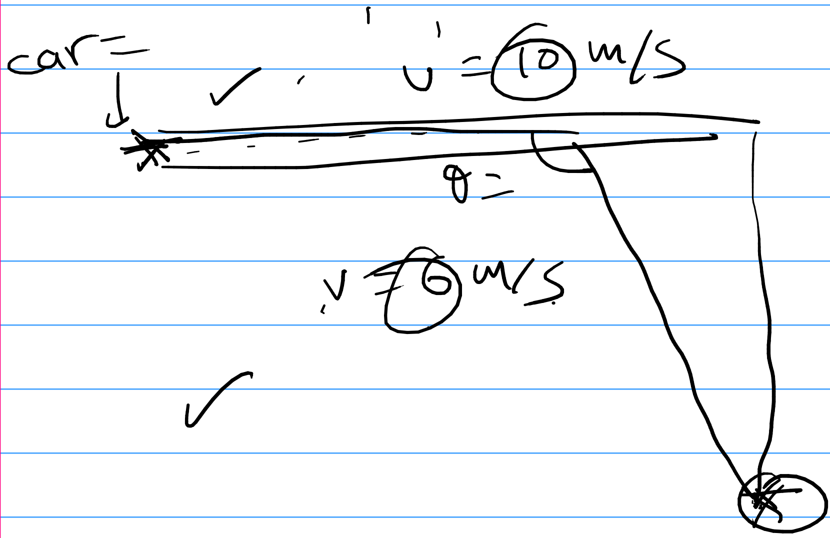
high = 7

Parse Tree

sparse tree

RMQ → O(1)

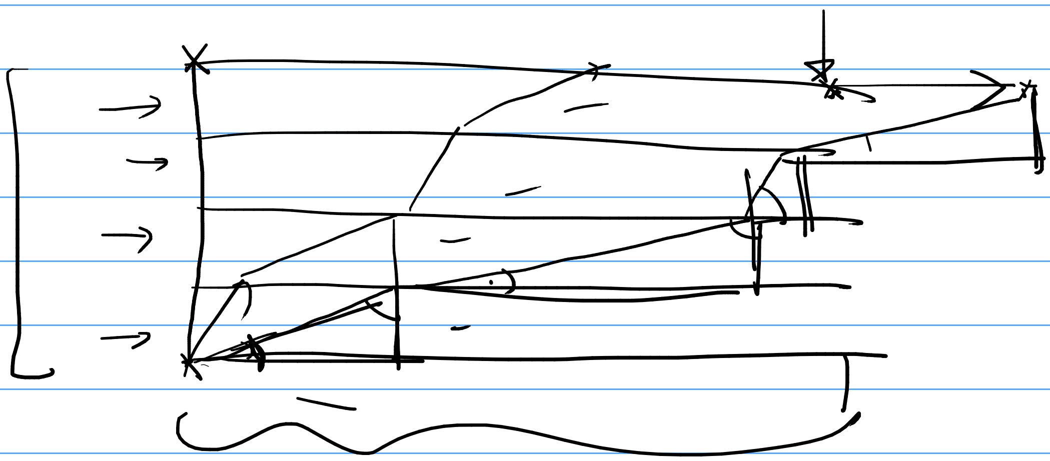
IRODOV



Kinematic

$\eta =$

photonics



dp[1][2]

dp[4][2]

n

Seg Tree mem comp

O(n)

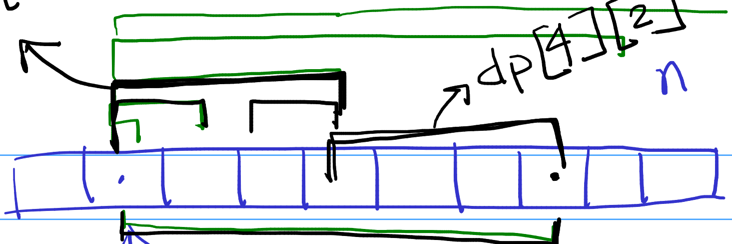
↑

logn

*

mem → nlogn

O(1)



i=1

↓

len=7

4

n^2

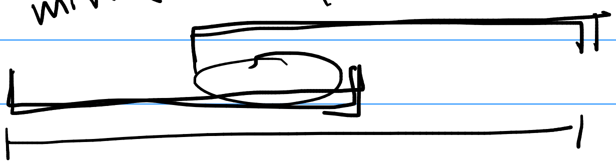
dp[1][2]

min(dp[1][1], dp[3][1])

dp[1][0] → pos=1, leng = 2^0

dp[1][1] → pos=1, leng = 2^1

dp[1][2] → pos=1, leng=4



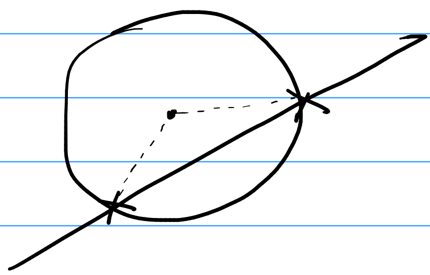
min, max

gcd

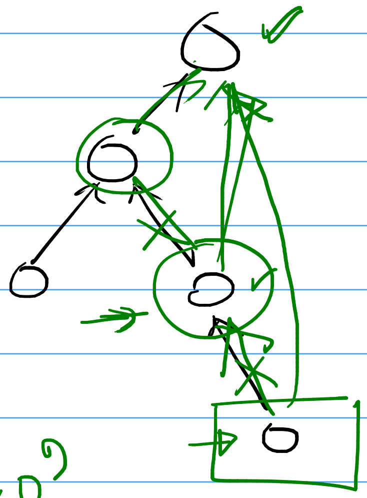
Fenwick Tree → BIT

Faster

1 . . . . . n



parametric equation of line



path compression

DSU

10^9

αn

$\alpha < 4$

n^2

a, b, c given

$\boxed{ax + by = c}$

$\boxed{x, y} \rightarrow$ integer solution