SOLUTIONS

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TOM && JERRY

- EASY TO FIND IS A DP PROBLEM
- $dp[i,j] = \underset{k>j}{\mathrm{MAX}}\{dp[i-1,k] * (1-q[j])^{k-j}\}$
- $O(kn^2)$ $\Rightarrow$ TLE !!!
- ANSWER IS SMALL AND HARD TO BE EXPRESSED BY DOUBLE
- SO WE NEED A FASTER && MORE ACCURATE SOLUTION

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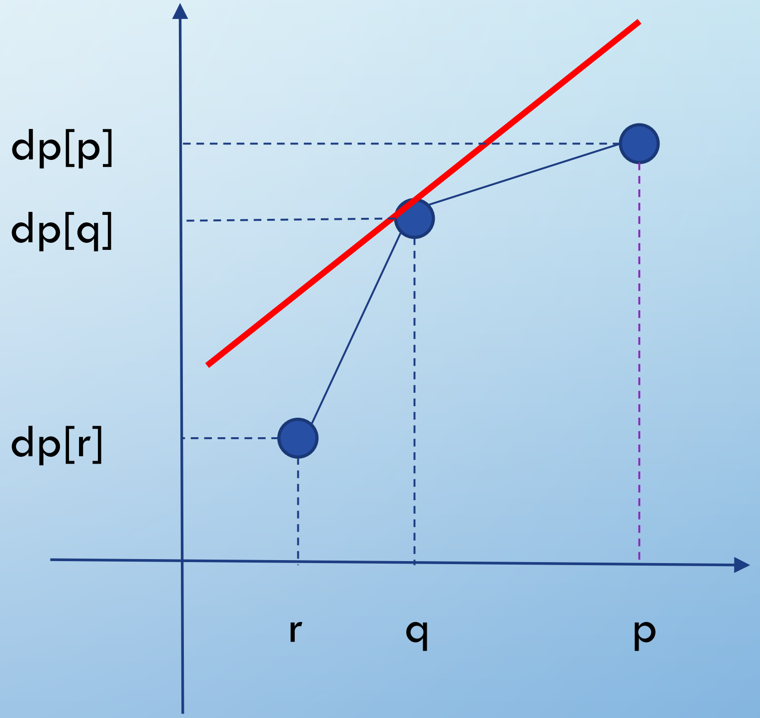
- $dp[i,j] = \mathrm{LOG}_{10}\, dp[i,j]$
- $dp[i,j] = \underset{k>j}{\mathrm{MAX}}\{dp[i-1,k] + (k-j) * \mathrm{LOG}_{10}(1-q[j])\}$
- $dp[i-1,p] + (p-j) * \mathrm{LOG}_{10}(1-q[j]) \qquad (1)$
- $dp[i-1,q] + (q-j) * \mathrm{LOG}_{10}(1-q[j]) \qquad (2)$
- $(1) - (2) > 0$
- $\frac{dp[i-1,p]-dp[i-1,q]}{p-q} < -\mathrm{LOG}_{10}(1-q[j])$



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- SLOPE OPTIMIZATION
- MONOTONOUS QUEUE MAINTAINING THE CONVEX HULL
- $O(kn)$
- IF $\mathrm{LOG}_{10} t = 12.1234$
- $x = 10^{0.1234}, y = 10^{12}$
- DONE

SEQUENCE SUM

- GENERATE THE STATE TRANSITION MATRIX A
- $x_n = Ax_{n-1} \ \rightarrow \ x_n = A^n x_0$
- LET $k = p(q+1)+1$ WHERE $\max_{p,q} k = 600$
- $O(k^3 logn)$ $\Rightarrow$ TLE !!!
- SO WE NEED A FASTER ALGORITHM

SEQUENCE SUM

- LET THE CHARACTERISTIC POLYNOMIAL OF A IS $p(x)$
- FROM HAMILTON–CAYLEY THEOREM WE GET $p(A) = \mathbf{0}$
- $A^n = p(A) * q(A) + r(A) = r(A) = A^n \% p(A)$
- LET $r(x) = \theta_0 + \theta_1 x + \cdots + \theta_{k-1} x^{k-1}$
- $x_n = r(A) x_0 = \theta_0 I x_0 + \theta_1 A x_0 + \cdots + \theta_{k-1} A^{k-1} x_0$
- $x_n = r(A) x_0 = \theta_0 x_0 + \theta_1 x_1 + \cdots + \theta_{k-1} x_{k-1}$
- SO IS OUR GOAL TO GET ALL θ_i THEN WE WILL GET AN $O(k^2 logn)$ APPROACH

SEQUENCE SUM

- CONSIDER THE FIRST SAMPLE
- THE CHARACTERISTIC POLY OF SUB-MATRIX
- $h(x) = x^p - a_1 x^{p-1} \ldots - a_{p-1}x - a_p$
- UPPER TRIANGULAR MATRIX AS IT IS
- $p(x) = (x-1) * h^{q+1}(x)$
- WE GET $p(x)$ IN $O(k^2)$

- $$\begin{bmatrix} S_n \\ (n+1)F_{n+1} \\ (n+1)F_n \\ F_{n+1} \\ F_n \end{bmatrix} = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix} * \begin{bmatrix} S_{n-1} \\ nF_n \\ nF_{n-1} \\ F_n \\ F_{n-1} \end{bmatrix}$$

THANKS

Q && A