Implementation of RecConcave

input: $S, T, Q, r, \alpha, \epsilon, \delta$
we also get as input two function[1]

1. $L(S, T', j)$ - from step 3 - returns $max \underset{\substack{[a,b]\subseteq[0,T'] \\ b-a+1=2^j}}{max} \left(\underset{i\in[a,b]}{min} \left(Q\left(S,i\right)\right)\right)$
2. $u(S, I)$ - from step 8 -returns $max \underset{i\in I}{\left(Q\left(S,i\right)\right)}$

algorithm implementation:

1. $l \leftarrow \lceil log_2\left(T\right)\rceil$
2. $T' \leftarrow 2^l$
3. define an extended quality function:
   - Q(S,j):
     - if $T < j \leq T'$:
       - return $min\left(0, Q\left(S,j\right)\right)$
     - else:
       - return $Q(S, j)$
4. define q(S,j):
   - return $min\left(L\left(S,T',j\right) - \left(1-\alpha\right)r, r - L\left(S,T',j+1\right)\right)$
5. $k \leftarrow Exponential - Mechanism(S, [0, .., l], q, \epsilon)$
6. $K \leftarrow 8 \cdot 2^k$
7. $As \leftarrow [(i, i+K) \mid i\ from\ 0\ to\ T'\ in\ steps\ of\ K]$ # that's a list of tuples
8. $Bs \leftarrow [(i, i+K) \mid i\ from\ {}^{K}/_{2}\ to\ T'\ in\ steps\ of\ K]$ # that's a list of tuples
9. $A \leftarrow A_{dist}(S, As, u, \epsilon, \delta)$
10. $B \leftarrow A_{dist}(S, Bs, u, \epsilon, \delta)$
11. if $A =' bottom'$ or $B =' bottom'$ raise $Error$
12. convert the tuples A and B to lists A' and B' # i.e $(x, y) \Rightarrow [x, ..., y]$
13. $answer \leftarrow Exponential - Mechanism(S, A' \cup B', Q, \epsilon)$
14. return $answer$

[1] the implementation of them is in a different file