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 $\max\limits_{\substack{[a,b] \subseteq [0,T'] \\ b-a+1=2^j}} \left(\min\limits_{i \in [a,b]} (Q(S,i)) \right)$

2. $u(S, I)$ - from step 8 -returns $\max\limits_{i \in I} (Q(S,i))$

algorithm implementation:

1. $l \leftarrow \lceil log_2(T) \rceil$

2. $T' \leftarrow 2^l$

3. define an extended quality function:

   - Q(S,j):
     - if $T < j \leq T'$:
       * return $min(0, Q(S,j))$
     - else:
       * return $Q(S,j)$

4. define q(S,j):

   - return $min(L(S, T', j) - (1 - \alpha)r, r - L(S, T', j+1))$

5. $k \leftarrow Exponential - Mechanism(S, range(l+1), q, \epsilon)$

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