Problem

Show that P is closed under the star operation. (Hint: Use dynamic programming. On input y = $y_1 \cdots y_n$ for y_i ? Σ, build a table indicating for each i ≤ j whether the substring $y_i \cdots y_j$? A^* for any A ? P.)

Step-by-step solution

Step 1 of 2

<u>Class *P* :</u> *P* is a class of languages that are decidable in polynomial time on a deterministic single tape Turing machine. That is $P = \bigcup_k \text{TIME}\left(n^k\right)$.

Comments (4)

Step 2 of 2

Now, prove that *P* is closed under star operation. Consider a language $A \in P$. The following procedure decides *A**:

$M =$ "*On input assume* $y = y_1 y_2 ... y_n \in \Sigma$.

1) if $y = \varepsilon$, output ACCEPT and halt.

2) Initialize the table $T[i, j] = 0$ for $i \le j$.

3) For $i = 1$ to n

  a) Run M on y_i, *if* $y_i \in L$ then set $T[i,\ i] = 1$.

4) For $k = 2$ to n

  For $i = 1$ to $n - k + 1$

  a) Assume $j = i + k - 1$

  b) Run M on $y_i ... y_j$, *if* $y_i ... y_j \in L$ then set $T[i, j] = 1$.

  c) For $l = i$ to $j - 1$

    Set $T[i, j] = 1$, *if* $T[i, l] = 1$ and $T[l, j] = 1$

5) Output ACCEPT if $T[1, n] = 1$; otherwise output REJECT.

The above algorithm is a polynomial time algorithm. Therefore, *P* is closed under star operation.

Comments (2)