Problem

Let $\Sigma = \{a, b\}$. For each $k \geq 1$, let C_k be the language consisting of all strings that contain an a exactly k places from the right-hand end. Thus $C_k = \Sigma^* a \Sigma^{k-1}$. Describe an NFA with k + 1 states that recognizes C_k in terms of both a state diagram and a formal description.

Step-by-step solution

Step 1 of 2

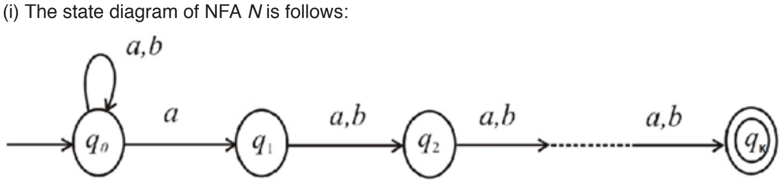
Given language is

$C_k = \Sigma * a\ \Sigma^{k-1}$ for each $K \geq 1$, over the alphabet $\Sigma = \{a, b\}$

C_k is the language consisting of all strings that contains an '*a*' exactly *K* places from the right – hand end.

Let *N* be the NFA with $K+1$ states that recognizes C_K

(i) The state diagram of NFA *N* is follows:



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Step 2 of 2

(ii) The formal description of NFA *N* is as follows:

$N = (Q, \Sigma, \delta, q_0, F)$

$Q =$ set of sates $= \{q_0, q_1 \ldots, q_K\}$

$\Sigma =$ set of alphabet $= \{a, b\}$

$q_0 =$ start state $= \{q_0\}$

$F =$ set of final states $= \{q_K\}$

$\delta =$ The transition function is given as follows:

$$\delta(q_i, a) = \begin{cases} \{q_0, q_1\} & \text{if } i = 0 \\ \{q_{i+1}\} & \text{if } 0 < i < k \\ \phi & \text{if } i = k \end{cases}$$

$$\delta(q_i, b) = \begin{cases} \{q_0\} & \text{if } i = 0 \\ \{q_{i+1}\} & \text{if } 0 < i < k \\ \phi & \text{if } i = k \end{cases}$$

$\delta(q_i, \in) = \phi\ \forall i$.

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