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Answer 1

a) False, because the real numbers are uncountable but the strings over this alphabet is infinitely countable. (Also it is not possible to create irrational numbers as strings)

b) False, languages have infinitely countable strings meaning that they are not finitely representable.

c) True, starts with zero a followed by 2 b's followed by one a then zero b.

d) False, for example the string aabb is in the language but it does not have ab as prefix.

Answer 2

a) M = {K, Σ, δ, s, F}

K : $\{q_0, q_1, q_2, q_3\}$
Σ : $\{a, b\}$
s : q_0
F : $\{q_0, q_1, q_2\}$
δ :
$\delta(q_0, a) = q_1$ $\delta(q_0, b) = q_0$
$\delta(q_1, a) = q_1$ $\delta(q_1, b) = q_2$
$\delta(q_2, a) = q_3$ $\delta(q_2, b) = q_0$
$\delta(q_3, a) = q_3$ $\delta(q_3, b) = q_3$

b) Tracing "abbaabab":

$(q_0, abbaabab) \vdash_M (q_1, bbaabab) \vdash_M (q_2, baabab) \vdash_M (q_0, aabab)$

$\vdash_M (q_1, abab) \vdash_M (q_1, bab) \vdash_M (q_2, ab) \vdash_M (q_3, b) \vdash_M (q_3, e)$

since q_3 is not a final state the input is not accepted.

Answer 3

a) $E(q)$ be the set of all states of M that are reachable from state q without reading any input.

$E(q_0) = \{q_0, q_2, \}$

$E(q_1) = \{q_1\}$

$E(q_2) = \{q_2\}$

$E(q_3) = \{q_3, q_0, q_2\}$

$E(q_4) = \{q_4, q_3, q_0, q_2\}$

b) The steps are:

1. Define K' as the set consisting of all subsets of K.

This step is correct.

2. Define the alphabet Σ' as precisely the set Σ.

This step is correct.

3. Define the set of starting states, s' as the set whose only element is s.

This step is not correct because we should define s' as $E(s)$ with letting $E(q)$ be the set of all states of M that are reachable from state q without reading any input. .

4. Define the set of final states, F' as those elements of K' which consists of only the states $q \in F$.

This step is not correct. Because the set of final states F' consist of all those subsets of K that contain at least one final state of M.

5. Define the transition function δ as taking two inputs: an element Q of K' and an element of a of Σ'. The function returns the set whose elements are precisely those states p in K for which there exists a $q \in Q$ and (q, a, p) in Δ.

This step is not correct. Because the function returns the union of sets E(p) for p in K for which there exists a $q \in Q$ and (q, a, p) in Δ.