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Answer 1

a) False. All real numbers are uncountably infinite, but strings over alphabet $\Sigma = \{0, 1, 2, \ldots, 9\}$ namely Σ^* countably infinite, and therefore there are uncountably many real numbers that cannot be represented as strings over Σ.

b) False. Set of strings over an alphabet Σ^* is countably infinite. This means possible representations of languages are countably infinite. Conversely, set of all possible languages over an alphabet 2^{Σ^*} is uncountably infinite. Therefore we cannot represent uncountable number of things with countable number of representations.

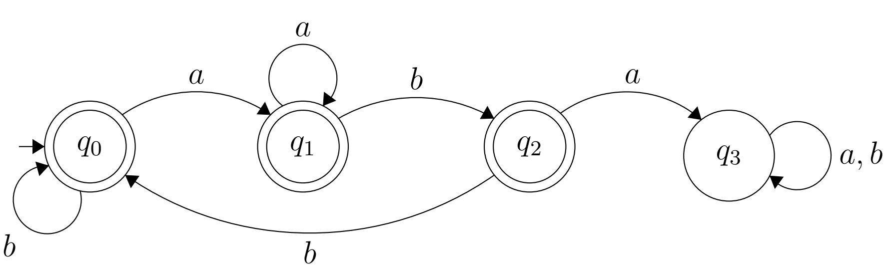
c) True. $bba \in \mathcal{L}$ we can create this string from $a^*b^*a^*b^*$ with 0-a, 2-b, 1-a, and 0-b.

d) False. It does not only represent strings that has ab as prefix. $a^+b^+(a \bigcup b)^*$ also creates aab.

Answer 2

a)
- $K = \{q_0, q_1, q_2, q_3\}$
- $\Sigma = \{a, b\}$
- $s = q_0$
- $F = \{q_0, q_1, q_2\}$
- δ :

	a	b
q_0	q_1	q_0
q_1	q_1	q_2
q_2	q_3	q_0
q_3	q_3	q_3



b)
- $$(q_0, abbaabab) \vdash_M (q_1, bbaabab) \vdash_M (q_2, baabab) \vdash_M (q_0, aabab) \vdash_M (q_1, abab)$$
$$\vdash_M (q_1, bab) \vdash_M (q_2, ab) \vdash_M (q_3, b) \vdash_M (q_3, e)$$

- No. DFA finishes with state q_3 and q_3 not in accepted states so it does not accept the input.

Answer 3

a)
- $E(q_0) = \{q_0, q_2\}$
- $E(q_1) = \{q_1\}$
- $E(q_2) = \{q_2\}$
- $E(q_3) = \{q_0, q_2, q_3\}$
- $E(q_4) = \{q_0, q_2, q_3, q_4\}$

b)
1) Define K' as the set consisting of all subsets of K. (It is correct $K' = 2^K$)
2) Define the alphabet Σ' as precisely the set Σ. (It is correct)
3) Define the set of starting states, s' as set whose only element is s. (It is also correct since question says that It is known that M does not have any empty transitions from its starting state. But to generalize instructions we can say Define the set of starting states, s' as $E(s)$)
4) Define the set of final states, F' as those elements of K' which consists of only the states $q \in F$. (There is a mistake here. It should be Define the set of final states, F' as those elements of K' which contain at least one state from F.)
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 $(q, a, p) \in \Delta$. (There is another mistake here. It should be 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 $E(p)$ where p in K for which there exists a $q \in Q$ and $(q, a, p) \in \Delta$).