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QUESTION 1:

A) False. It is given in the book under 1.8. “For the set ∑* of strings over an alphabet ∑ is countably infinite, so the number of possible representations of languages is countably infinite”. Since the real number set is uncountably infinite set, All real numbers **“can not”** be represented as strings over the alphabet Σ = {0, 1, 2, . . . , 9}.

B) False. It is given in the book under 1.8 “On the other hand, the set of all possible languages over a given alphabet ∑-that is, 2^{Σ^*} - is uncountably infinite... With only a countable number of representations and an uncountable number of things to represent, we are unable to represent all languages finitely.” So, it is clear that we can not finitely represent all languages on an alphabet ∑.

C) True. bba is in this language because we can get it by this: $a^0b^2a^1b^0$

D) False. Because we can represent “aab” with this notation but “aab” does not have ab as prefix. (To get aab we can use these powers $a^2b^1\{a,b\}^0$)

QUESTION 2:

A)

$K=\{q_0,q_1,q_2,q_3\}$

$\Sigma=\{a,b\}$

$S=q_0$

$F=\{q_0, q_1, q_2\}$

$\delta=\{((q_0,a),q_1), ((q_0,b),q_0), ((q_1,b),q_2), ((q_1,a),q_1), ((q_2,a),q_3), ((q_2,b),q_0), ((q_3,a),q_3), ((q_3,b),q_3)\}$

B)

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

Since it ends at trap state which is not a final state (accepted state) then “abbaabab” is not in our language, which means our DFA doesn’t accept this input.

QUESTION 3:

A)

- $E(q0)= \{q_0,q_2\}$

$(q0,e,q2) \in \Delta$ $(q_0,e) \vdash^*_M (q_2,e)$

- $E(q1)=\{q_1\}$
- $E(q2)=\{q_2\}$
- $E(q3)=\{q_0,q_2,q_3\}$

$(q3,e,q0) \in \Delta$, $(q_3,e) \vdash^*_M (q_0,e)$

$(q0,e,q2) \in \Delta$, $(q_3,e) \vdash^*_M (q_2,e)$

- $E(q4)=\{q_0,q_2,q_3,q_4\}$

$(q4,e,q2) \in \Delta$, $(q_4,e) \vdash^*_M (q_2,e)$

$(q4,e,q3) \in \Delta$, $(q_4,e) \vdash^*_M (q_3,e)$

$(q3,e,q0) \in \Delta$, $(q_4,e) \vdash^*_M (q_0,e)$

B)

I think there are mistakes in fourth and fifth statements.

For the fourth one, I think the statement should be like this:

Define the set of final states, F ′ as those elements of K′ which contain at least one final state of q ∈ F.

- Because it should not only include the q, but it can also contain the subsets included in K′ which include other states.
- Also, in the book (in Theorem 2.2.1) it is given like this:
  "The set of final states of M' will consist of all those subsets of K that contain at least one final state of M."

For the fifth one, I think the statement should be like this:

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 which consists of the unions of E(p)'s such that p is in K for which there exists a q ∈ Q and (q, a, p) ∈ Δ.

- Because as a definition in theorem 2.2.1 we find transition function according to this this definition:

  "For each Q ∈ K and each symbol a ∈ ∑.
  $\delta'(Q, a) = \cup\{E(p) : p \in K \text{ and } (q, a,p) \in \Delta \text{ for some } q \in Q\}$"