CS 332 – Spring 2021, Assignment 2

Colaborators: None

Answer 1

(a)

(1) $\{q_0, q_1, q_2, q_3, q_4, q_5\}$

(2) $\{\epsilon, A, B\}$

(3)

	A	B	ϵ
q_0	$\emptyset$	$\emptyset$	$\{q_1, q_4\}$
q_1	$\{q_1\}$	$\{q_1, q_2\}$	$\emptyset$
q_2	$\{q_3\}$	$\emptyset$	$\emptyset$
q_3	$\emptyset$	$\emptyset$	$\emptyset$
q_4	$\{q_4\}$	$\{q_5\}$	$\emptyset$
q_5	$\{q_4\}$	$\{q_5\}$	$\emptyset$

(4) q_0

(5) $\{q_3, q_5\}$

(b) Yes, via $q_0 - > \epsilon - > q_4 - > A - > q_4 - > A - > q_4 - > B - > q_5$

(c) Yes, via $q_0 - > \epsilon - > q_1 - > B - > q_1 - > B - > q_1 - > B - > q_2 - > A - > q_3$

(d) No, it needs at least 1 B

(e) This machines accepts the following language:

$$L = \{xy | x \in \{A, B\}^* \wedge (y = BA \vee y = B)\}$$

Answer 2

(a)

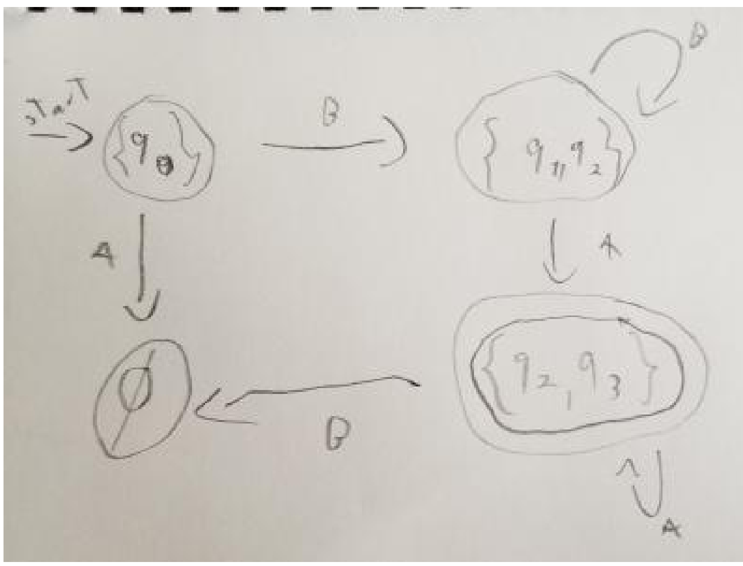
(i) $q_0- > B- > q_1- > B- > q_1- > \epsilon- > q_2- > A- > q_3$

(ii) $q_0- > B- > q_1- > B- > q_1- > \epsilon- > q_2- > A- > q_2$

(iii) $q_0- > B- > q_1- > \epsilon- > q_2- > B- > fail$

(b) $L = \{BxA | x \in \{A, B\}^*\}$

(c)

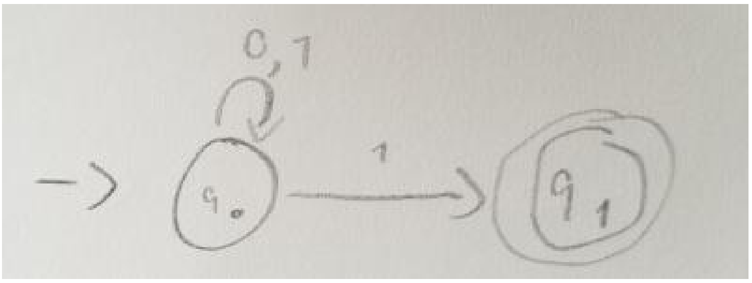


Answer 3

If we have a language $L = \{xABA | x \in \{A, B\}^*\} \cup \{\epsilon\}$, then we need at least 2 accept states, one for when the Empty String, and another for whenever the String ends with ABA, since we are working with a DFA, we can't have any non-deterministic behaviour, which means we need at least two accept states.

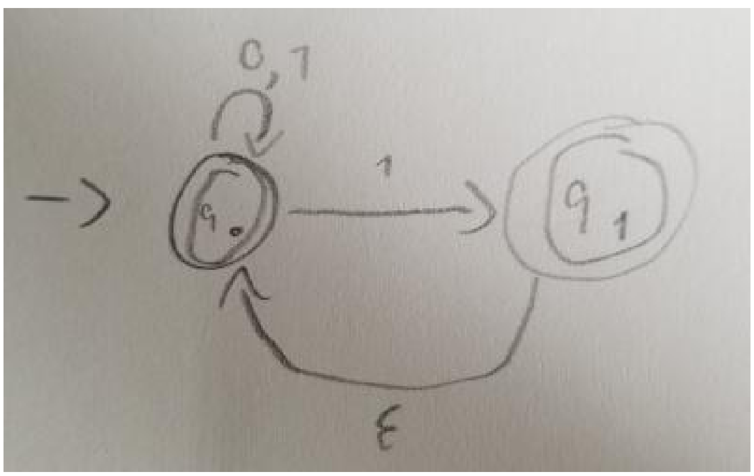
Answer 4

(a)



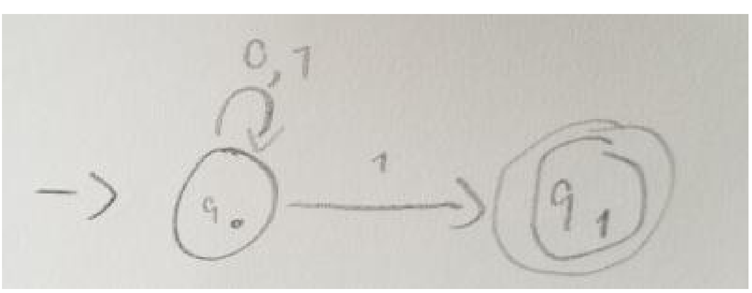
(b) $L = \{w \in \{0,1\}^* | w \text{ end with } 1\}$

(c)



(d) The empty string ϵ

(e)



Answer 5

(a) The MIX operator when applied to a language A as $MIX(A, A)$ is the same thing as A^*, since it's just joining n amount of strings in A. Since the class of regular languages is closed under A^*, it's also closed under MIX.

(b) Since $\sum^* = \sum$, we have that $TAIL(A) = \{y \in \sum^* | xy \in A \text{ for some } x \in \sum^*\} \equiv \{y \in \sum | xy \in A \text{ for some } x \in \sum\}$.

Since A is over an alphabet $\sum$, what we have here is $TAIL(A) = \{y \in \sum | xy \in A \text{ for some } x \in \sum\} = \{z \in A\}$ since if both x and y are in $\sum$, and the concatenation is in A, all strings in $TAIL(A)$ are in A.

As such, all regular languages are closed under $TAIL(A)$.