

1. Consider the following statements. [GATE CSE 2020]

- I. If $L_1 \cup L_2$ is regular, then both L_1 and L_2 must be regular.
- II. The class of regular languages is closed under infinite union.

Which of the above statements is/are **TRUE**?

- (A) I only
- (B) II only
- (C) Both I and II
- (D) Neither I nor II

Solution: Correct answer is (D)

2. Consider the language $L = \{ a^n \mid n \geq 0 \} \cup \{ a^n b^n \mid n \geq 0 \}$ and the following statements.

- I. L is deterministic and context-free.
- II. L is context-free but not deterministic context-free.
- III. L is not LL(k) for any k.

Which of the above statements is/are TRUE? [GATE CSE 2020]

- (A) I only
- (B) II only
- (C) I and III only
- (D) III only

Solution: Correct answer is c

3. Which one of the following languages over the alphabet $\{0,1\}$ is described by the regular expression: $(0+1)^*0(0+1)^*0(0+1)^*$? [GATE CSE 2019]

- (A) The set of all strings containing the substring 00.
- (B) The set of all strings containing at most two 0's.
- (C) The set of all strings containing at least two 0's.
- (D) The set of all strings that begin and end with either 0 or 1.

Solution: Correct answer is (C)

*4. Language L_1 is defined by the grammar: $S_1 \rightarrow aS_1b/\epsilon$
Language L_2 is defined by the grammar: $S_2 \rightarrow abS_2/\epsilon$ [GATE CSE 2016]*

Consider the following statements:
P: L_1 is regular

Q: L_2 is regular

Which one of the following is TRUE?

- (A) Both P and Q are true
- (B) P is true and Q is false
- (C) P is false and Q is true
- (D) Both P and Q are false

Solution: Correct answer is C

5. Consider the languages $L_1 = \emptyset$ and $L_2 = \{a\}$. Which one of the following represents $L_1L_2^* \cup L_1^*$? [GATE CSE 2013]

- (A) $\{\epsilon\}$
- (B) \emptyset
- (C) a^*
- (D) $\{\epsilon, a\}$

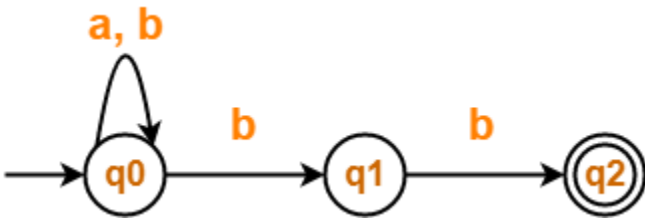
Solution: Correct answer is (A)

6. Let L_1 be a recursive language. Let L_2 and L_3 be languages that are recursively enumerable but not recursive. Which of the following statements is not necessarily true?

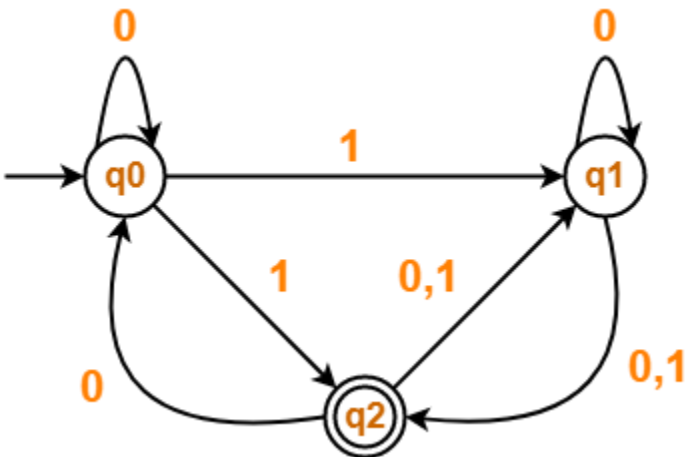
- a. $L_2 - L_1$ is recursively enumerable.
- b. $L_1 - L_3$ is recursively enumerable
- c. $L_2 \cap L_1$ is recursively enumerable
- d. $L_2 \cup L_1$ is recursively enumerable

Solution: Correct answer is (b)

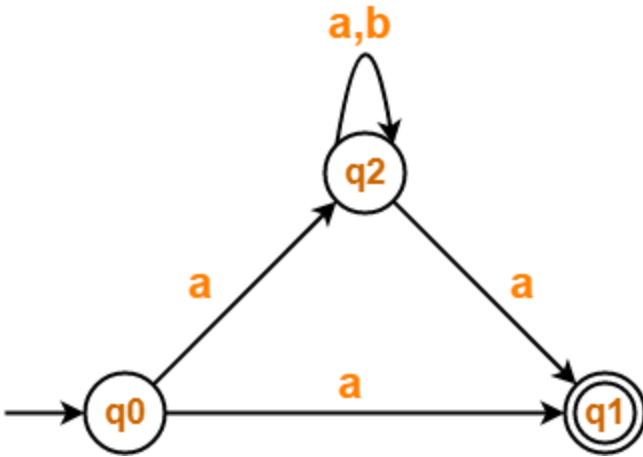
7. Convert this NFA to DFA



8. Convert this NFA to DFA

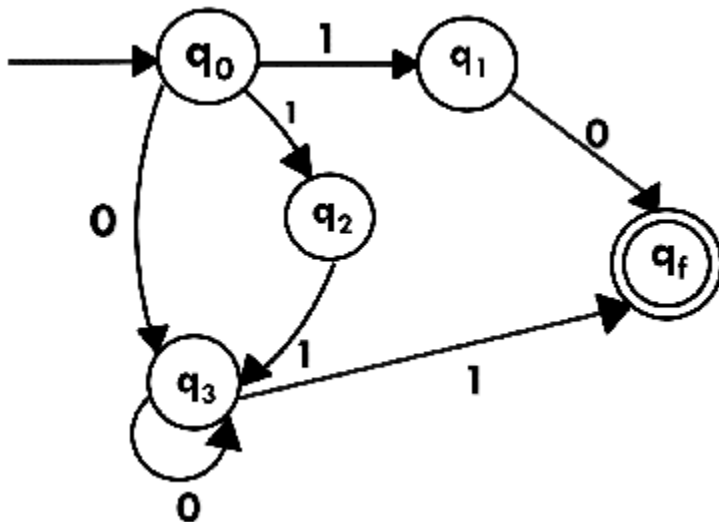


9. Convert this NFA to DFA



11. Design a DFA from given regular expression : $(a+b)^*b$

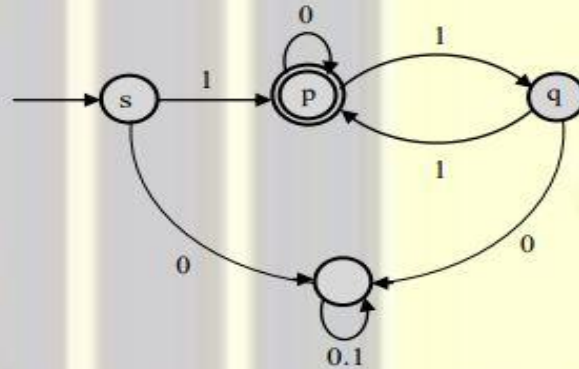
10. Design a FA from given regular expression $10 + (0 + 11)0^*1$.



11. $(a+b)^*b$

12.

Consider the Deterministic Finite-state Automaton (DFA) A shown below. The DFA runs on the alphabet $\{0, 1\}$, and has the set of states $\{s, p, q, r\}$, with s being the start state and p being the only final state.



Which one of the following regular expressions correctly describes the language accepted by A?

(A) $1(0^*11)^*$

(B) $0(0 + 1)^*$

(C) $1(0 + 11)^*$

(D) $1(110)^*$

Answer: C