Tutorial Practice Set 2
IT3202 Automata and Compiler design
DFA and NFA Design and Minimization

Batch: B.Tech. IT VI F **Deadline: 10/02/2024**
Note: Submit before Deadline
Discussion: Only selected questions.

Q1. Obtain a DFA to accept strings of a's and b's having even number of a's and b's.

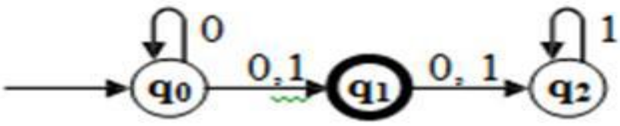
Q2. Give Applications of Finite Automata.

Q3. Obtain a DFA to accept strings of a's and b's starting with the string ab.

Q4. Draw a DFA to accept string of 0's and 1's ending with the string 011.

Q5. Write DFA to accept strings of 0's, 1's & 2's beginning with a 0 followed by odd number of 1's and ending with a 2.

Q6. Convert the following NFA into an equivalent DFA.



Q7. Convert following NFA to DFA using subset construction method.

δ	0	1
→ p	{p,r}	{q}
q	{r,s}	{p}
*r	{p,s}	{r}
*s	{q,r}	—

Q8. For each of the following languages over the alphabet $\Sigma = \{a, b\}$, give a DFA that recognizes the language:

(a) $A = \{\varepsilon, b, ab\}$.

(b) For any string $w \in \Sigma^*$, let $n_a(w)$ denote the number of a's in w. For example, $n_a(abaaba) = 4$. Define the language $B = \{w \in \Sigma^* \mid n_a(w) \bmod 3 = 1\}$, i.e., $w \in B$ if and only if the number of a's in w is 3k+ 1for some $k \geq 0$.

(c) $C = \{w \in \Sigma^* \mid w = saba$ for some strings $\in \Sigma^*\}$, i.e., C consists of strings that end in aba.

(d) D = C', where C is the language in the previous part; i.e., D consists of strings that do not end in aba.

(e) $E = \{w \in \Sigma^* \mid w$ begins with b and ends with a$\}$.

(f) For any string $w \in \Sigma^*$, let $n_b(w)$ denote the number of b's in w. Define the language $F = \{ w \in \Sigma^* \mid n_a(w) \geq 2, n_b(w) \leq 1 \}$.

(g) $G = \{w \in \Sigma^* \mid |w| \geq 2$, second-to-last symbol of w is b$\}$. If string $w = w_1 w_2 \ldots\ldots w_n$ where each $w_i \in \Sigma$, then the second-to-last symbol of w is $w_n - 1$.

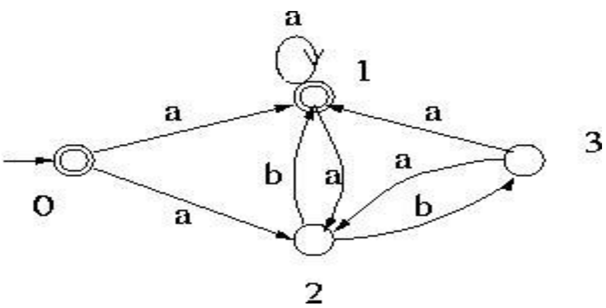
Q9. Design a DFA recognizing the given languages:

a) The language of all strings that do not end with 01.
b) The language of all strings that begin or end with 00 or 11.
c) The language of all strings containing no more than one occurrence of the string 00. (The string 000 should be viewed as containing two occurrence of 00.)
d) The language of all strings containing both 00 and 010 as substrings.

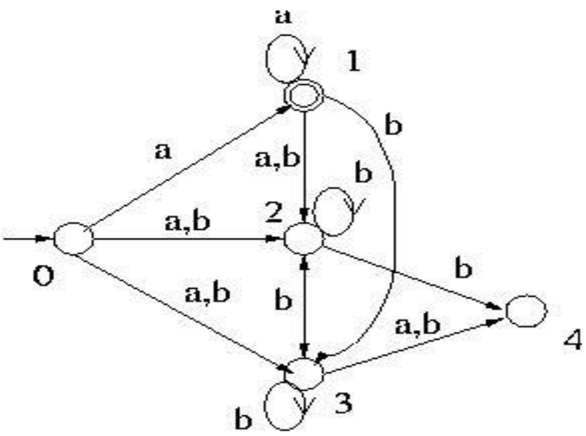
Q10. Automaton recognizing binary numbers that are multiples of 5.

Q11. How to design a DFA that accepts all binary strings that represent an even number? (e.g., accepts 110, 010, but rejects 111, 010101)

Q12. Convert the following NFA to DFA {0, 1, 2, 3 are State}



Q13. Convert the following NFA to DFA {0, 1, 2, 3, 4 are State}.



Q14.Give NFAs with the specified number of states recognizing each of the following languages. In all cases, the alphabet is $\Sigma = \{0, 1\}$.

(a) The language $\{ w \in \Sigma^* \mid w \text{ ends with } 00 \}$ with three states.

(b) The language $\{ w \in \Sigma^* \mid w \text{ contains the substring } 0101, \text{ i.e., } w = x0101y \text{ for some } x, y \in \Sigma^* \}$ with five states.

(c) The language $\{ w \in \Sigma^* \mid w \text{ contains at least two } 0\text{s, or exactly two } 1\text{s} \}$ with six states.

(d) The language $\{\varepsilon\}$ with one state.

(e) The language $0^*1^*0^*0$ with three states.

Q15. Design the equivalent minimize DFA.