

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
LOKNAYAK JAI PRAKASH INSTITUTE OF TECHNOLOGY
CHAPRA, BIHAR

Subject: FLAT

Assignment- 2 (RE)

Subject Code: CS 1611

1. **Define Regular Expression.** What are the types of RE. List out the Algebraic properties and Identities of RE.
2. Explain the **Arden's Theorem** with suitable example.
3. For each of the following Language Write Regular Expression that accepts the Language in all cases over the alphabet {0,1}.
 - a. {w: the length of w is divisible by 3}
 - b. {w: 110 is not the substring of w}
 - c. {w: w contains at least five 1's}
 - d. {w: w contains the substring 1011}
 - e. {w: w contains at least two 1's and at most two 0's}
4. Construct Regular Expression that contains strings over {0,1} and **has even number of 0's.**
5. Construct RE that accepts all strings over {a,b} with **exactly two a's.**
6. Construct Regular Expression that accepts set of strings containing exactly four 1's in every string over alphabet {0, 1}.
7. Construct Regular Expression for the Language L= All string over {0, 1} that have **at least two consecutive 0's or 1's.**
8. Construct Regular Expression which accepts set of string such that every string **containing "00" as substring but not "000" as substring.**
9. Find the number of Prefix and Suffix of the string **"ENGINEERING"**. Also List them.
10. Construct Regular Expression that accepts all the string of a's and b's where every string
 - a. **Start with 'b'**
 - b. **Start with 'ba'**
 - c. **Start with 'bab'**
11. Construct Regular Expression that accepts all the string of a's and b's where every string
 - a. **Ends with 'a'**
 - b. **Ends with 'ba'**
 - c. **Ends with 'aab'**

12. Construct Regular Expression that accepts all the string of a's and b's where every string **Starts and ends with same symbol.**
13. Construct Regular Expression that accepts all the string of a's and b's where every string **Starts and ends with different symbol.**
14. Construct Regular Expression that accepts all the string of a's and b's where every string **Starts with 'aa' or 'bb' and ends with different symbol.**
15. Construct Regular Expression that accepts all the string of a's and b's where every string **Contains "DIBIT" as Substring.**
16. Construct Regular Expression that accepts all the string of a's and b's where each string
 - a. **Contain odd occurrences of substring 'ab'**
 - b. **Contain even occurrences of substring 'ab'**
17. Construct Regular Expression that accepts all the string of a's and b's where every string contains
 - a. **Exactly three 'a'**
 - b. **Atmost three 'a'**
 - c. **Atleast three 'a'**
18. Construct Regular Expression that accepts all the string of a's and b's where every string contains
 - a. **Even no. of a's**
 - b. **Odd no. of b's**
19. Construct NFA that accepts all the string of a's and b's where every string
 - a. **Starts with 'a'**
 - b. **Starts with 'abab'**
 - c. **Ends with 'a'**
20. Construct Regular Expression that accepts all the string of a's and b's where
 - a. **Every string do not contain substring 'ab'**
 - b. **Every string do not end with 'baa'**
21. Construct Regular Expression that accepts all the string of a's and b's where
 - a. **No. of a's is even and no. of b's even**
 - b. **No. of a's is even or no. of b's is odd.**
22. Construct Regular Expression that accepts all the string of a's and b's where every string
 - a. **Starts and ends with 'a'**
 - b. **Starts and ends with same symbol**
 - c. **Starts and ends with different symbol**
23. Construct Regular Expression that accepts all the string of 0's and 1's where every string contains
 - a. **The Substring '101'**

b. **The Substring '1010'**

c. **The Substring '1'**

24. Construct Regular Expression that accepts all the string of 0's and 1's

a. **Including E(Epsilon)**

b. **Excluding E(Epsilon)**

25. Construct Regular Expression for the following Languages

a. $\{0^n / n \geq 0\}$

b. $\{0^n / n \geq 1\}$

c. $\{1^n / n \geq 3\}$

d. $\{0^m 1^n / m, n \geq 0\}$

e. $\{0^m 1^n / m, n \geq 1\}$

f. $\{0^m 1^n / m \geq 0, n \geq 1\}$

g. $\{0^m 1^n 2^p / m \geq 0, n \geq 1, p \geq 2\}$

26. Construct Regular Expression for the Language $L = \{0^m 1^n / m + n = \text{Even}\}$.

27. Construct Regular Expression for the Language $L = \{0^m 1^n / m + n = \text{Odd}\}$.

28. Construct Regular Expression that generates all the string of 0's and 1's where every string starts with 0 and do not contain two consecutive 1's.

29. Construct Regular Expression that generates all the string of 0's and 1's where every string do not contain two consecutive 0's or 1's.

30. Obtain the Regular Expression for the following Sets

a. Set of strings over $\{a, b\}$ with at least one a and at least one b

b. Set of strings over $\{0, 1\}$ of alternate 0's and 1's.

c. $L = \{2^{n+1} / n \geq 0\}$

d. Set of strings over $\{a, b, c\}$ where all runs of a's have length that are multiples of three.

e. Set of all possible strings of length four over alphabet $\{0, 1\}$.

31. Construct NFA equivalent to the following Regular Expression: $RE = (10|(0|11)0^*1)$

32. Construct DFA equivalent to the following Regular Expression: $RE = (ab|ba)^* aa(ab|ba)$

33. Find a Regular Grammar for the following Regular Expression: $RE = (abbb|ba)^* ab$

34. Find a Context free Grammar for the following Regular Expression: $RE = (a + b)^*$

35. **Covert each of the following Regular Expression to an NFA:**

a. $(0 \cup 1)^* 000(0 \cup 1)^*$

b. $((10)^*(00)) \cup 10)^*$

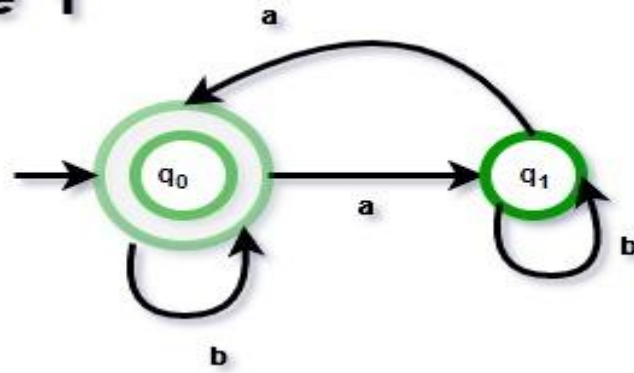
36. Construct NFA with e-moves equivalent to the following Regular Expression:

- a. $(a^* + b^*)$
- b. $(a + ba)^*a$
- c. $(a+b)^* ba^* ba^* (ab)^*$
- d. $(a^*b + (ba)^*)^*$
- e. $(a+b)^*$
- f. $(ab)^*$
- g. (a^*b^*)

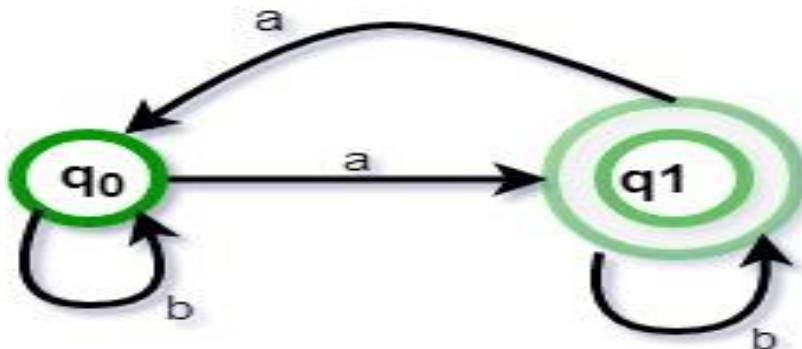
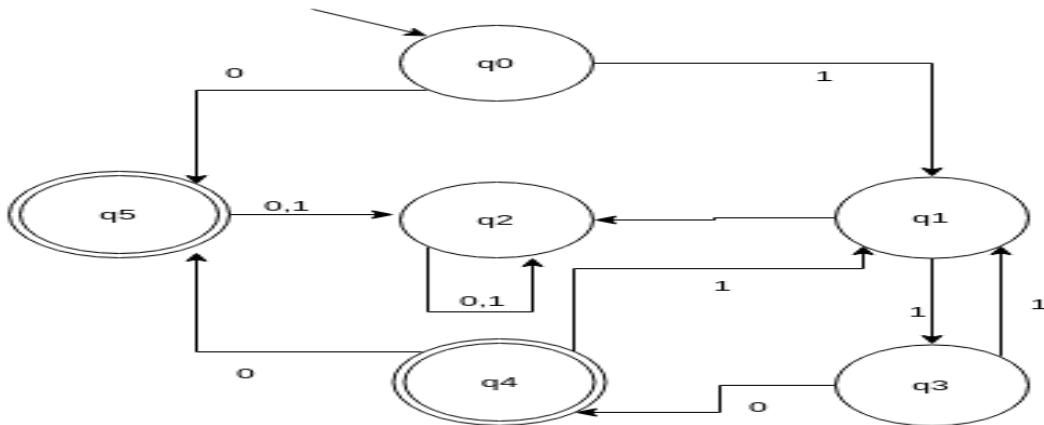
37. Construct the Regular Expression for the following DFA

a.

Figure 1



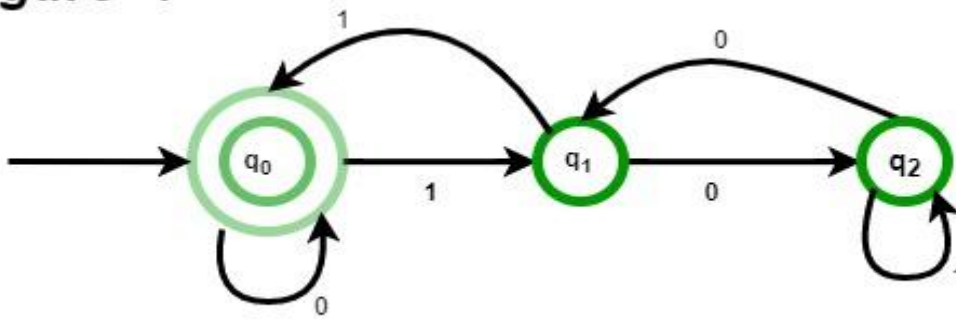
b.



c.

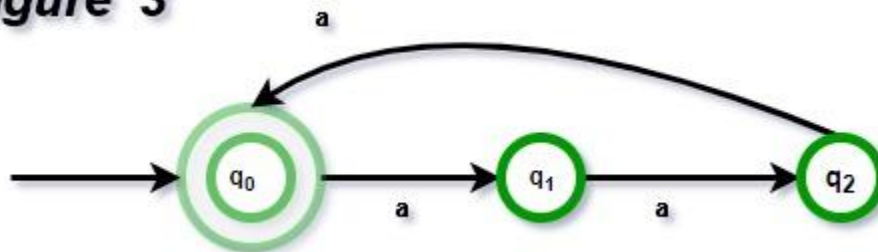
d.

Figure 4

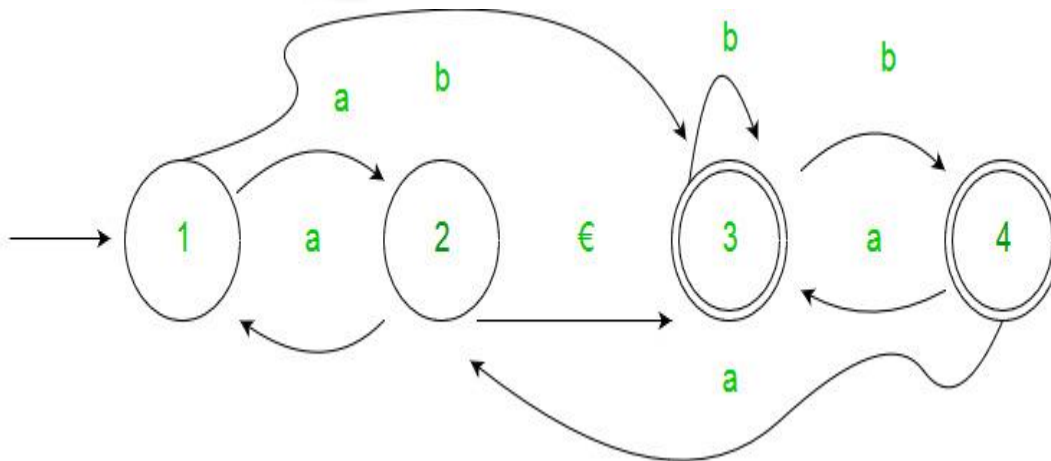


e.

Figure 3

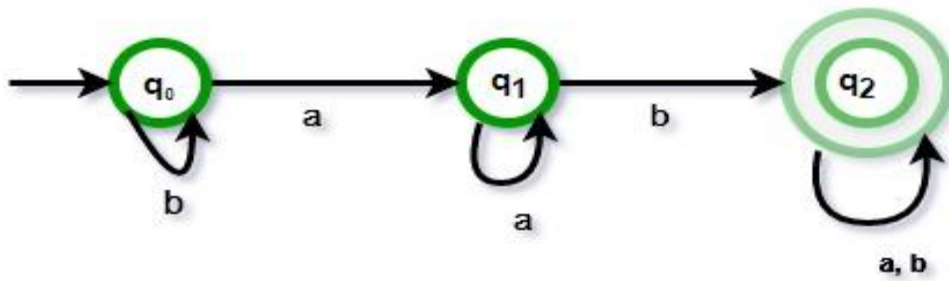


f.



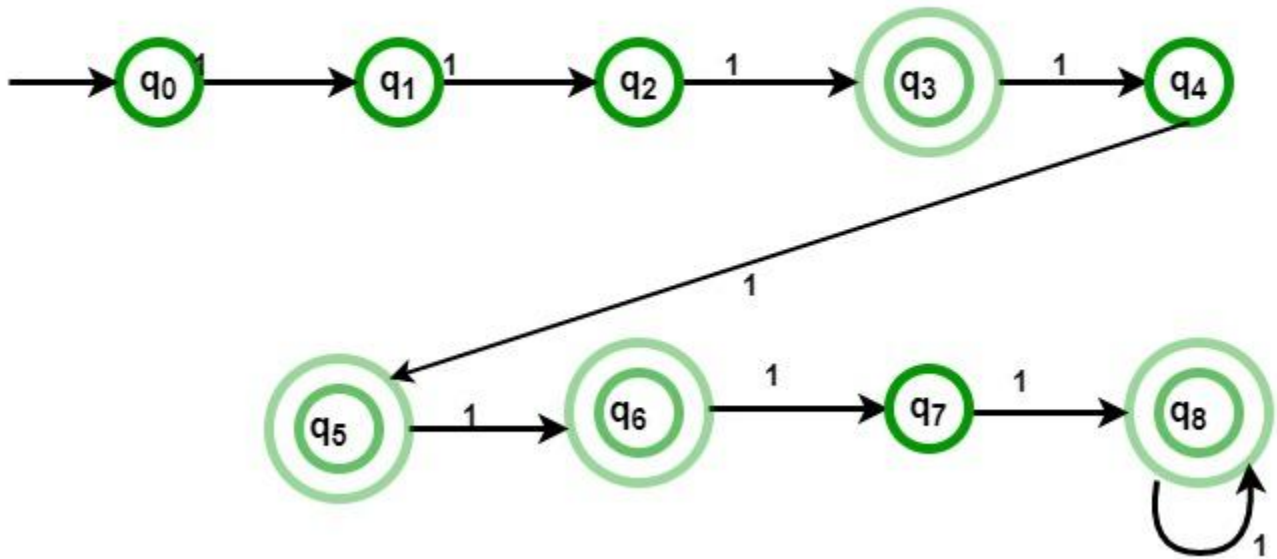
g.

Figure 2

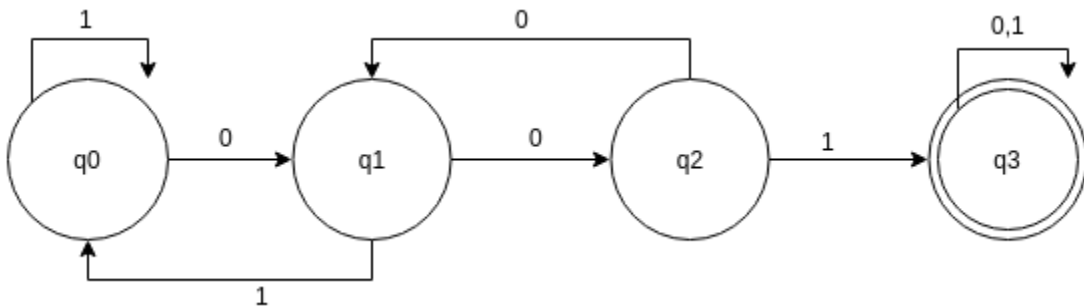


h.

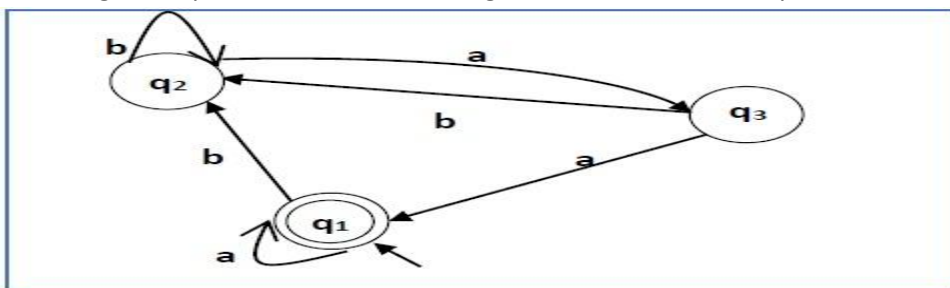
Figure 5



i.

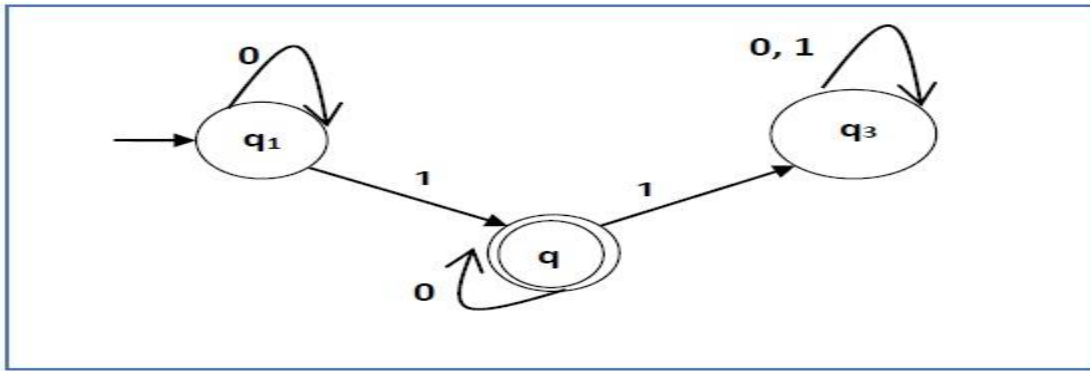


38. Construct the Regular Expression for the following Automata with the help of ARDEN'S THEOREM



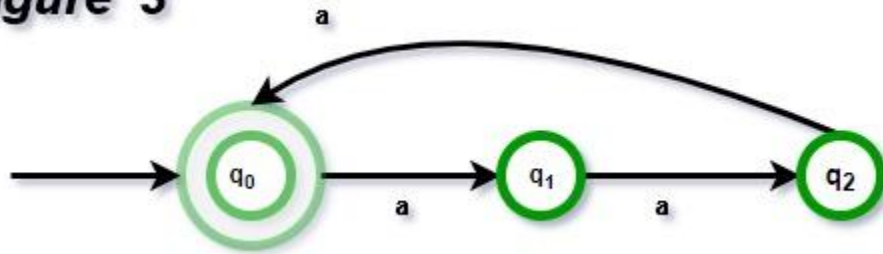
a.

b.

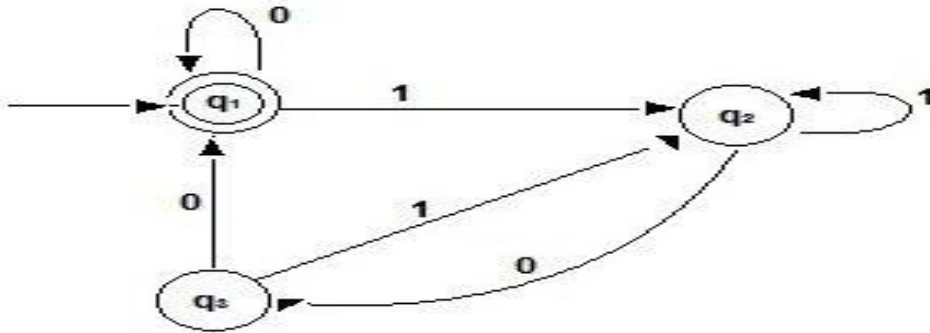


c.

Figure 3



39. State the ARDEN'S THEOREM and prove it. Find the Regular Expression for the following Automata.



40. What are the various steps to construct Regular Expression . Explain with suitable example.

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