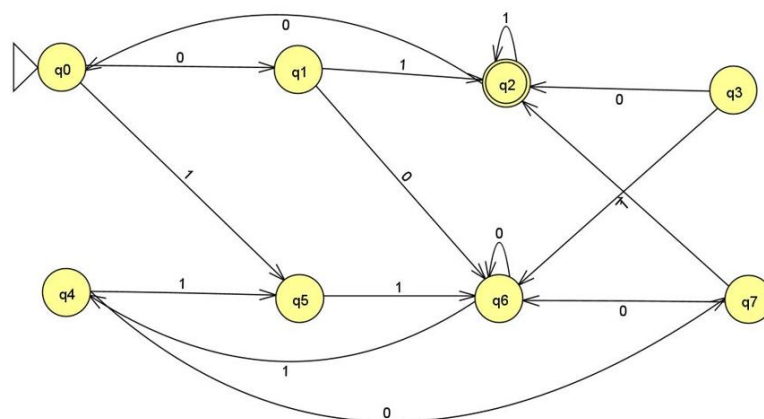


Assignment – 1

| Subject/ Subject code | Semester/Branch | Issue Date | Due Date |
|-----------------------|--|------------|----------|
| TOC/01CE0608 | 6 th – (TC1, TC2, TC3, TC4, TC5, EC1, EC2, EC3) | 18/02/25 | 17/02/25 |

- Define one-to-one, onto and bijection function.
 - Check whether the function $f: \mathbb{R}^+ \rightarrow \mathbb{R}$, $f(x) = x^2$ is one to one and onto.
 - Explain equivalence relation with example
 - Explain reflexivity, symmetry, and transitivity properties of relations.
- State the principle of mathematical induction and prove by Mathematical Induction for the following:
 - Prove that all positive integers n $1+2+3+\dots+n = n(n+1)/2$.
 - Prove that $\sqrt{2}$ is Irrational.
- Explain Types of Grammar/Chomsky's Hierarchy.
- Explain Moore Machine and Mealy machine in detail with Example.
- Define NFA- Λ . Explain how to convert NFA- Λ into NFA and DFA with suitable example.
- State pumping lemma for regular languages.
- Differentiate between DFA and NFA with example.
- Construct a Regular Expression over $\Sigma = \{a,b\}$ for set of all string for the following:
 - Strings whose length is at the most 2.
 - String which starts and end with different symbols.
 - Strings in which no 2 a's are not together/String should not contain 'aa' as substring.
 - Strings in which no 2 a's and no 2 b's are not together/String should not contain 'aa' & 'bb' as substring.
- Do as directed.
 - Construct a Minimal DFA which accepts set of all string over $\Sigma = \{a,b,c\}$ which when interpreted as Ternary No. divisible by 4.
 - Minimize the following DFA:





- c. Construct a Mealy's Machine that takes a binary number as input and produces 2's Complement of that number as output. Assume that the string is read from Least Significant Bit (LSB) to Most Significant Bit (MSB) and end carry is discarded.
 - d. Construct a Moore's Machine that takes set of all string over $\Sigma = \{0,1\}$ and produces "A" as Output if string ends with "10" or produces "B" as Output if the String ends with "11" other produces "C".
 - e. Construct an NFA over $\Sigma = \{a,b\}$ for set of all strings in which 3rd symbol from the Right Hand Side (RHS) is "a".
 - f. Convert the following Regular Expression to DFA.
 $a(a+b)^*b + b(a+b)^*a$.
10. Construct a Context Free Grammar (CFG) for the following defined over $\Sigma = \{a, b\}$:
- 1. $L = \{a^i b^j c^k \mid i = j + k\}$
 - 2. $L = \{a^i b^j c^k \mid i = j \text{ or } j = k\}$
 - 3. $L = \{a^i b^j c^k \mid j > i + k\}$