

Q. 1 Attempt any four:

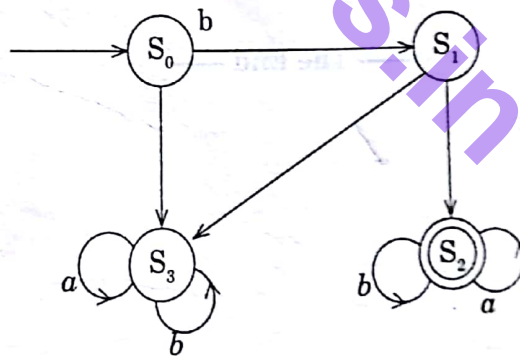
- State the inclusion - exclusion principle. How many positive integers not exceeding 100 are divisible by 3, 5 or 7?
- State the sum and product rule. How many bit string are there of length 8? Also find how many of them ends with two bits 00?
- State the Binomial theorem. Use it to prove:

$$(i) \sum_{k=0}^n \binom{n}{k} = 2^n, \text{ for non negative integer } n.$$

$$(ii) \sum_{k=0}^n \binom{n}{k} 2^k = 3^n, \text{ for non negative integer } n.$$

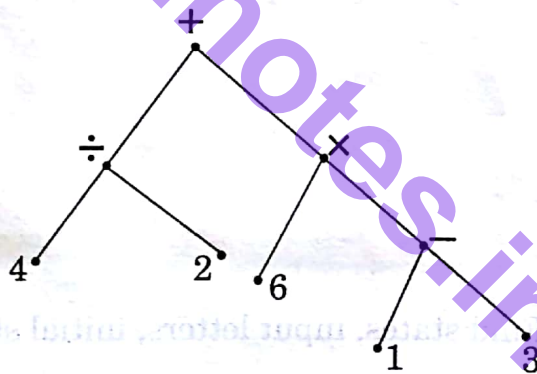
- State the Vandermonde's identity. Use it to prove  $\sum_{k=0}^n \binom{2n}{k}^2 = \binom{2n}{n}$  for non-negative integer  $n$ .
- State and prove Pascal's identity.
- Define the term Grammar. Explain the types of Grammar.
- Define the term:
  - Turning Machine
  - Finite state automata
  - Types of languages.

- Consider following FSA. Find states, input letters, initial state, accepting state,  $f(S_1, b)$ . Also write it's state table.



**Q. 4 Attempt any three:**

- a) Solve the recurrence relation  $an = 3a_{n-1} + 2n$ .
- b) Write a note on Tower of Hanoi.
- c) Define:
  - (i) Ordered rooted tree
  - (ii) Linked list representation using vertex and edge file.
- d) State the extended pigeonhole principle. Show that if seven colours are used to paint 60 bicycles atleast 9 bicycles will be of the same colour.
- e) A family of 4 brothers and 3 sisters are to be seated for photograph in one row. In how many ways can they selected if:
  - (i) all sisters are sit together.
  - (ii) no two sisters sit together
- f) (i) Define a tree on 5 vertices with a suitable example.  
(ii) Perform inorder search on the following tree using inorder search algorithm.



— The End —