Branch : CSE & IT Batch: Hinglish

WEEKLY TEST – 02

Subject : Theory of Computation

Topic : Finite Automata

Maximum Marks 15

Q.1 to 5 Carry ONE Mark Each

[MCQ]

1. For language L = {w | w ∈{a, b}*}, |w| = 4}. How many states are required in NFA for above language?

(a) 4 (b) 5

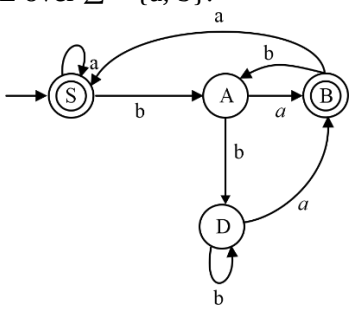
(c) 6 (d) None of these

[NAT]

2. For language L = {X a w | X, w ∈{a, b}*, |X| = 1}. Minimum number of states required in finite automata (NFA) is _____.

[NAT]

3. Consider the following DFA that accepts regular language L over ∑ = {a, b}.



How many states in equivalent minimized DFA that accepts the language?____.

[NAT]

4. Let

$L_1 = a^* b^*$

$L_2 = b^* a^*$

$L_3 = (a + b)^*$

$L_4 = a^* b^* a^*$

$L = (L_1 \cap L_2) - (L_3 \cap L_4)$

Number of strings in above language L will be _____.

[MCQ]

5. Consider a regular expression (R):

$R = (a + b)^* (a + b)^2 (a + b)^*$.

How many equivalences classes are existing for above regular expression R?

(a) 2 (b) 3

(c) 4 (d) None

Q.6 to 10 Carry TWO Mark Each

[MCQ]

6. Consider the language L given by the regular expression $(a + b)^* ab(a + b)^*$ over the alphabet {a, b}. What is the correct regular expression of $\bar{L}$?

(a) $(a + b)^* (ab + ba + bb + aa) + \in$

(b) $(a^* b^*)^* (ba + bb + aa) (a^* b^*)^* + a + b$

(c) $(a + b)^* ba (a + b)^* + a + b$

(d) $(a + b)^* (ba + bb + aa) (a + b)^* + \in + a + b$

[MSQ]

7. Which of the following option is/are correct?

(a) For L = {w|w ∈ {a, b}*, |w| = 5} Minimum number of states in DFA is 7.

(b) For L = {w|w ∈ {a, b}* |w| ≤ 5} minimum number of stater in NFA is 6.

(c) L = {w|w ∈ {a, b}*}, 6th symbol from begin is 'a'} minimum number of states in DFA is 64.

(d) L = {w|w ∈ {a, b}*, 10th symbol from ends is 'a'} minimum number of states in DFA is 1024.

[MCQ]

8. Consider the following statements:

S_1: If a finite automata M with n states accepts a string of length w, $w \geq n$ then surely L(M) is infinite.

S_2: If a finite automata m with n states accepts a string of length w, $w < n$ then, surly L(M) is finite.

S_3: The pumping length for any regular language is unique.

Which of the following is correct:

(a) S_1 and S_2 are correct.

(b) S_1 and S_3 are correct.

(c) S_2 and S_3 are correct.

(d) None of this.

[MSQ]

9. For language L = {Every odd bit is a}

On alphabet $\sum$ = {a, b}. Which of the following is/are correct regular expression?

(a) $(aa + ab)^* (\in + a)$

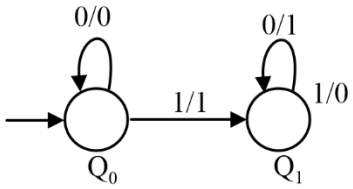
(b) $(aa + ab + ba + b)^*a$

(c) $(aa + ba)^*(\in + a + b)$

(d) $(a(a + b))^* + (a(a + b))^* a$

[MCQ]

10. The following diagram represents a finite state machine which takes as input a binary number from the least significant bit



Which one of the following is TRUE?

(a) It computes 1's complement of the input number

(b) It computes 2's complement of the input number

(c) It increments the input number

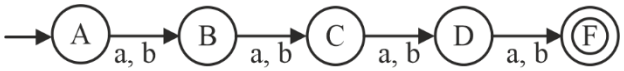
(d) It decrements the input number

Answer Key

1. **(b)**
2. **(3)**
3. **(2)**
4. **(0)**
5. **(b)**
6. **(d)**
7. **(a, b, d)**
8. **(d)**
9. **(a, d)**
10. **(b)**

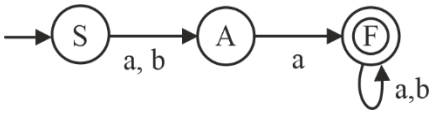
Hints and solutions

1. (b)



Number of states = 5

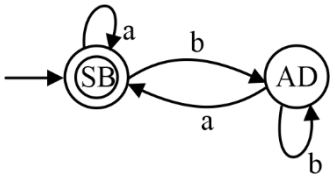
2. (3)



Number of states = 3

The above NFA represents the language where 2nd symbol is 'a'.

3. (2)



Number of states = 2

4. (0)

$L_1 \cap L_2 = a^* + b^*$

$L_3 \cap L_4 = a^* b^* a^*$

$L = (a^* + b^*) - a^*b^*a^*$

$= \phi$

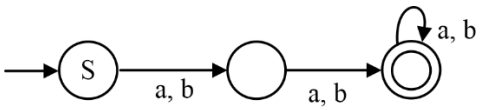
Number of strings = 0

5. (b)

$R = (a + b)^* (a + b)^2 (a + b)^*$

Number of equivalence classes in my hill Nerode = Number of states in minimal DFA

DFA for R:



Number of states = 3

Number of equivalence classes = 3

6. (d)

$L = (a + b)^* ab (a + b)^*$

L = {containing 'ab' as a substring}

$\bar{L} = \{(a + b)^* (ba + bb + aa) (a + b)^* + \in\}$

7. (a, b, d)

(a) $n + 2 = 5 + 2 = 7$ states DFA

(b) $n + 1 = 5 + 1 = 6$ states NFA

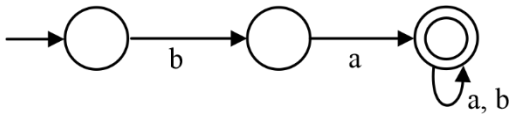
(c) $n + 2 = 6 + 2 = 8$ states DFA

(d) $2^n = 2^{10} = 10^{24}$ states DFA

Hence, (a, b, d) are correct.

8. (d)

S_1 True:



n = 3

(w) ≥ 3

For 3 length there must be a loop an any state. **S_2 False:**

$|w| < n$

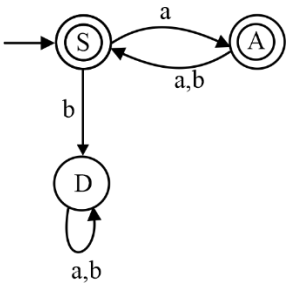
$2 < 3$

S2 will be true If and only if all the strings where | w | <n .

S_3 False:

Minimum pumping length is unique.

9. (a, d)



FA:

Regular expression = $(a(a + b))^* a + (a (a + b))^* a$

$= (a(a + b))^* (\in + a) : (aa + ab)^*(\in + a)$

Hence, (a, d) are correct.

10. (b)

It computes 2's complement of the input number