UG – 420

VI Semester B.C.A. Examination, September/October 2022
(CBCS) (F+R) (2016-17 and Onwards)
COMPUTER SCIENCE
BCA 601 : Theory of Computation

Time : 3 Hours Max. Marks : 100

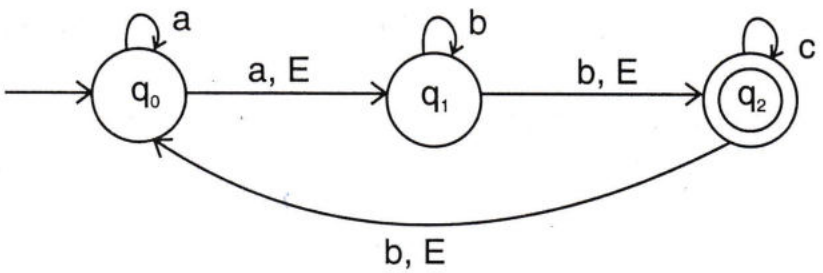
Instruction : *Answer* ***all*** *Sections.*

SECTION – A

Answer **any ten** questions. **Each** question carries **two** marks. **(10×2=20)**

1. Define finite automata. Give the mathematical representation of finite automata.

2. Find the E-closure of all states for the given E-NFA.



3. Define Kleen closure with an example.

4. Construct a regular expression for the language consisting of all strings of a's and b's beginning with 'a' and ending with 'ab'.

5. Define left most derivation with an example.

6. Obtain a grammar to generate the set of all strings with exactly one a, over $\Sigma = \{a, b\}$.

7. What is an unit production ?

P.T.O.

8. Draw a parse tree for the following string w = id + id * id having production rules

   $E \rightarrow E + E$

   $E \rightarrow E * E$

   $E \rightarrow id$

   Where V = {E}, T = {id}, S = {E}.

9. Define push down automata.

10. Explain ID (Instantaneous Description) of turing machine.

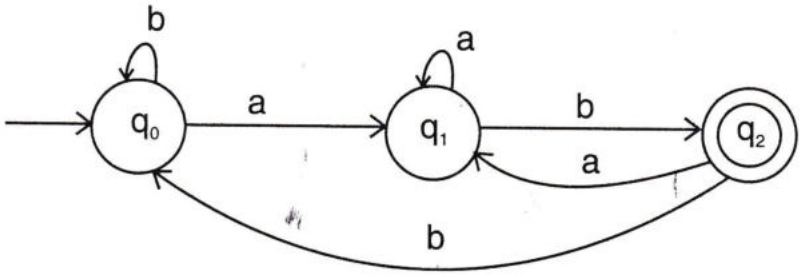
11. Define post correspondence problem.

12. Write the meaning of the regular expression 0* 1* 2*.

SECTION – B

Answer **any five** questions. **Each** question carries **5** marks. **(5×5=25)**

13. Check whether the strings "a a bab" and "baba" are accepted by the following DFA (Deterministic Finite Automata).



14. Design a DFA that accepts strings of a's and b's having a substring "aa".

15. Differentiate between DFA, NFA and E-NFA.

16. Construct an E-NFA for (0*0) + (1*0).

17. Design a grammar to generate the language $L = \{a^n b^n | n \geq 0, m > n\}$.

18. Eliminate the useless symbols in the following grammar :

    $S \rightarrow AB$

    $A \rightarrow a$

    $B \rightarrow b|C$

    $E \rightarrow d$

19. Explain the types of turing machines.

20. Construct the PDA for the grammar $S \rightarrow aSbb|a$.

    (PDA : Push Down Automata).

SECTION – C

Answer **any three** questions. **Each** question carries **15** marks. **(15×3=45)**

21. Construct a DFA for the regular expression $(a|b)^* abb$. **15**

22. Find a DFA equivalent to the following NFA $N = (\{q_0, q_1, q_2\}, \{a, b\}, \delta, q_0, \{q_2\})$ where δ is defined as

δ_D	a	b
$\rightarrow q_0$	$\{q_0, q_1\}$	$\{q_2\}$
q_1	$\{q_0\}$	$\{q_1\}$
$^* q_2$	–	$\{q_0, q_1\}$

    DFA : Deterministic Finite Automata

    NFA : Non-deterministic Finite Automata. **15**

23. a) Verify if the following grammar is ambiguous. **7**

    $S \rightarrow aB|bA$

    $A \rightarrow aS|bAA|a$

    $B \rightarrow bS|aBB|b$

    b) Remove E-productions from the following CFG (Context Free Grammar). **8**

    $S \rightarrow XYX$

    $X \rightarrow 0X|E$

    $Y \rightarrow 1X|E$

24. a) Obtain a TM to accept a string w of a's and b's such that $N_a(w)$ is equal to $N_b(w)$. **7**

(TM : Turing Machine)

b) State and prove pumping lemma for regular language. **8**

25. Convert the given grammar to Chomsky Normal Form (CNF). **15**

$S \rightarrow AB|CA$

$B \rightarrow BC|AB$

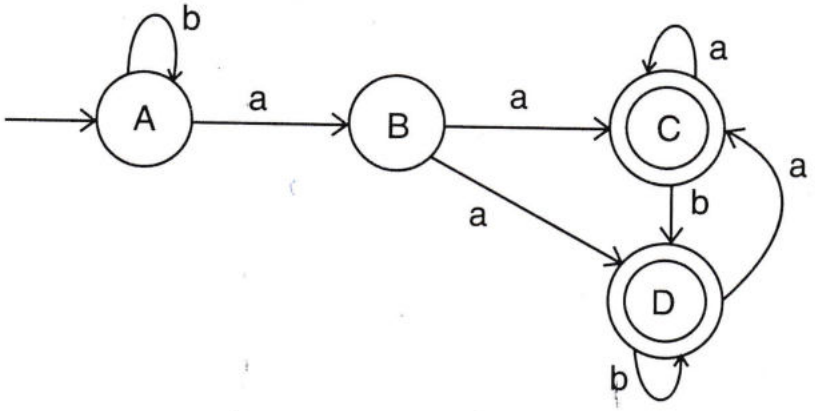
$A \rightarrow a$

$C \rightarrow aB|b$

SECTION – D

Answer **any one** of the following questions. **Each** carries **10** marks. **(1×10=10)**

26. Minimize the following Deterministic Finite Automata (DFA). **10**



27. Construct a Push Down Automata (PDA) to accept the language **10**

$L(m) = \{w \subset w^R | w \in (a + b)^*\}$ where w^R is the reverse of w.