VI Semester B.C.A. Examination, May/June 2018
(CBCS) (F +R)
(2016 – 17 & 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. What is finite automata ? Explain with block diagram.

2. What is trap state ? Explain with a simple example.

3. What are the moves made by the following DFA while processing the string abaab ? Find if the string is accepted or rejected by DFA.
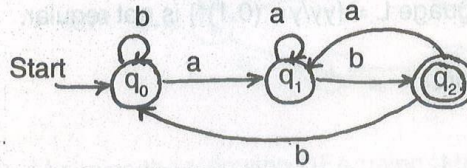
4. Design a regular expression over Σ ={a, b} for the language accepting string of exactly length 2.

5. State pumping Lemma for regular languages.

6. State Arden's theorem.

7. Define grammar. Give one example.

P.T.O.

8. Mention any two applications of context free grammar.

9. Define Nullable variable.

10. Define GNF.

11. Define turing machine.

12. Define recursively enumerable language.

SECTION – B

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

13. Construct a DFA to accept string of 0's and 1's representing zero modulo five.

14. Define NFA. Obtain a NFA to accept the language L = {w/w∈ abab^n or aba^n where n ≥ 0}.

15. Using pumping Lemma prove the language L = {yy/y∈ (0.1)*} is not regular.

16. Convert the DFA to Regular Expression.
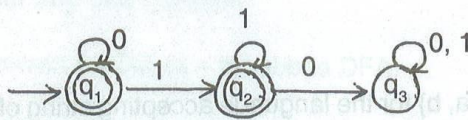
17. Define context free grammar.

    Consider a grammar G = (V, T, P, S) where V = {S} T = {a, b} S = S P = {S→aS|b}. Find the language accepted by G.

18. Explain Chomsky hierarchy of grammar.

19. Eliminate useless symbols from the following grammar

    S → aAa

    A → Sb

    A → bcc

    A → DaA

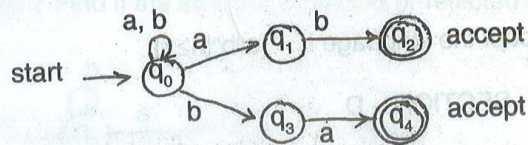   C → abb

    C → DD

    E → ac

    D → aDa

20. What are the different types of turing machine ?

<div align="center">SECTION – C</div>

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

21. Convert the following NFA to DFA using lazy evaluation method.

22. Minimize the following DFA using table filling algorithm.

δ	a	b
→ A	B	C
B	G	C
* C	A	C
D	C	G
E	H	F
F	C	G
G	G	E
H	G	C

23. Define pushdown automata. Obtain a PDA to accept the language L = {$a^n b^n | n \geq 1$}.

24. a) Obtain a grammar to generate string consisting of any number of a's and b's with atleast one a or atleast one b.

(5+5+5)

 b) For the following production

   S → AB

   A → aaA|∈

   B → Bb|∈

   Write the left most and right most derivation for the string aab.

 c) For the grammar G with production rules

   E → E + E

   E → E * E

   E → id

   Where V = {E} T = {id} S = {E}, obtain the right most derivation and the parse tree for the string W = id + id * id.

25. Obtain a turing machine to accept the language L = {$a^n b^n | n \geq 1$}.

SECTION – D

Answer **any one** question.

(10×1=10)

26. Convert the RE (a + b)* abb to DFA.

27. Write short notes on halting problem of turing machine and post correspondence problem.

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SECTION – A

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

1. Define Finite Automata.

2. Define DFA. Mention the types of Finite Automata.

3. Build an regular expression that generates a string with even number of 0's followed by odd number of 1's.

4. What is Pumping Lemma ?

5. What are terminal and non-terminal symbols in grammar ?

6. What is left most derivation in CFG ?

7. What are the different types of grammar ?

8. Mention the 7 types of PDA.

9. Define GNF.

10. What are useful and useless symbols in grammar ?

11. What is Turing Machine ?

12. What are the different types of Turing Machine ?

SECTION – B

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

13. Mention five differences between DFA and NFA.

14. Construct a DFA to accept the string 'abba'.

15. Explain the various applications of Regular expressions.

16. Obtain the left most and right most derivations for the string 00112. The production rules are given by

    $P = \{S \rightarrow AB$

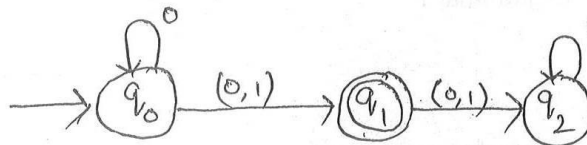 $\quad A \rightarrow 01 \mid 0A1$

    $\quad B \rightarrow \in \mid 2B$

17. Prove that $S \rightarrow aSbS/bSaS/\in$ is ambiguous.

18. Write a short note on Chomsky hierarchy of languages.

19. Write down the steps for conversion of DFA to CFG.

20. Explain halting problem of Turing Machine.

SECTION – C

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

21. Convert the following NFA to its equivalent DFA.

22. Construct a NFA with $\in$ for $(0 + 1)^* 1 (0 + 1)$.

23. Explain the block diagram of Pushdown automata with its components, specification, language and transition table.

24. Transform the CFG into GNF

    $S \rightarrow AB$

    $A \rightarrow BS \mid 1$

    $B \rightarrow SA \mid 0$

25. a) Explain Post's Correspondence Problem (PCP).   8

b) Explain intersection and homomorphism property of Regular languages.   7

SECTION – D

Answer **any one** question.

26. Find the minimized DFA for the following transition table :   10

δ	a	b
→ A	B	A
B	A	C
C	D	B
*D	D	A
E	D	F
F	G	E
G	F	G
H	G	D

27. Design a Turing Machine that accepts the language of all strings over the alphabet $\Sigma = \{a, b\}$ whose second letter is 'b'.   10

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