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. (10x2=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 \( \Sigma = \{a, b\} \) for the language accepting string of exactly length 2.

5. State pumping Lemma for regular languages.


7. Define grammar. Give one example.
8. Mention any two applications of context free grammar.


10. Define GNF.

11. Define turing machine.

12. Define recursively enumerable language.

SECTION – B

Answer any five questions. Each question carries five marks. (5x5=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 \( L = \{w \in \{0,1\}^* \mid w \text{ is a palindrome} \} \).

15. Using pumping Lemma prove the language \( L = \{yy \in \{0,1\}^* \mid y \geq 1 \} \) is not regular.

16. Convert the DFA to Regular Expression.

17. Define context free grammar.

Consider a grammar \( G = (V, T, P, S) \) where \( V = \{S \} \), \( T = \{a, b\} \), \( S \in P = \{S \to aS | b\} \).

Find the language accepted by \( G \).

18. Explain Chomsky hierarchy of grammar.
19. Eliminate useless symbols from the following grammar.
   
   \[
   \begin{align*}
   S & \rightarrow aAa \\
   A & \rightarrow Sb \\
   A & \rightarrow bcc \\
   A & \rightarrow DaA \\
   C & \rightarrow abb \\
   C & \rightarrow DD \\
   E & \rightarrow ac \\
   D & \rightarrow aDa
   \end{align*}
   \]

20. What are the different types of turing machine?

SECTION - C

Answer any three questions. Each question carries fifteen marks. (15x3=45)

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

![NFA to DFA diagram]

22. Minimize the following DFA using table filling algorithm.

<table>
<thead>
<tr>
<th>( \delta )</th>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>B</td>
<td>G</td>
<td>C</td>
</tr>
<tr>
<td>C</td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>D</td>
<td>C</td>
<td>G</td>
</tr>
<tr>
<td>E</td>
<td>H</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>C</td>
<td>G</td>
</tr>
<tr>
<td>G</td>
<td>G</td>
<td>E</td>
</tr>
<tr>
<td>H</td>
<td>G</td>
<td>C</td>
</tr>
</tbody>
</table>
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 \( b \).

b) For the following production
   \[ S \rightarrow AB \]
   \[ A \rightarrow aaA | \epsilon \]
   \[ B \rightarrow Bb | \epsilon \]
   Write the left most and right most derivation for the string \( aab \).

c) For the grammar \( G \) with production rules
   \[ E \rightarrow E + E \]
   \[ E \rightarrow E \times E \]
   \[ E \rightarrow \text{id} \]
   Where \( V = \{E\} \), \( T = \{\text{id}\} \), \( S = \{E\} \), obtain the right most derivation and the parse tree for the string \( W = \text{id} + \text{id} \times \text{id} \).

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

**SECTION – D**

Answer any one question.

26. Convert the RE \( (a + b)^* \text{abb} \) to DFA.

27. Write short notes on halting problem of turing machine and post correspondence problem.
VI Semester B.C.A. Examination, May 2017
(2016 – 17 & Onwards) (CBCS)
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.
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’.

P.T.O.
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

\[ P = \{ S \to AB \\
A \to 01 \mid 0A1 \\
B \to \epsilon \mid 2B \} \]

17. Prove that \( S \to aSbS/bSaS/\epsilon \) is ambiguous.

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

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


SECTION – C

Answer any three questions. Each question carries fifteen marks. (15x3=45)

21. Convert the following NFA to its equivalent DFA.

22. Construct a NFA with \( \epsilon \) 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

\[ S \to AB \\
A \to BS \mid 1 \\
B \to SA \mid 0 \]
25. a) Explain Post's Correspondence Problem (PCP).
   
b) Explain intersection and homomorphism property of Regular languages.

SECTION - D

Answer any one question.

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

<table>
<thead>
<tr>
<th>δ</th>
<th>a</th>
<th>b</th>
</tr>
</thead>
<tbody>
<tr>
<td>→</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>B</td>
</tr>
<tr>
<td>*D</td>
<td>D</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>G</td>
</tr>
<tr>
<td>H</td>
<td>G</td>
<td>D</td>
</tr>
</tbody>
</table>

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


