

AUTOMATA THEORY AND COMPUTABILITY

Question Bank

Module 4

1. If L_1 and L_2 are context free languages then prove that $L_1 \cup L_2$, $L_1 \cdot L_2$ and L_1^* are context free Languages. (4- Marks) (7a) (Dec.2017/Jan.2018)
2. Give a decision procedure to answer each of the following questions:
 - i. Given a regular expression α and a PDA M , the language accepted by M a subset of the language generated by α ?
 - ii. Given a context-free Grammar G and two strings S_1 and S_2 , does G generate $S_1 S_2$?
 - iii. Given a context free Grammar G , does G generate any even. Length strings.
 - iv. Given a Regular Grammar G , is $L(G)$ context-free? (12-Marks) (7b) (Dec.2017/Jan.2018)
3. Explain with neat diagram, the working of a Turing Machine model. (5-Marks) (8a) (Dec.2017/Jan.2018)
4. Design a Turing machine to accept the language $L = \{ a^n b^n c^n \mid n \geq 1 \}$. Draw the transition diagram. Show the moves made by this Turing machine for the string aabbcc. (11-Marks) (8b) (Dec.2017/Jan.2018)
5. Consider the grammar
$$S \rightarrow 0A|IB$$
$$A \rightarrow 0AA|1S|1$$
$$B \rightarrow 1BB|0S|0$$
Obtain the grammar in CNF. (8-Marks) (7a) (June/July 2018)
6. Show that $L = \{ a^n b^n c^n \mid n \geq 0 \}$ is not context free. (8- Marks) (7b) (June/July 2018)
7. With a neat diagram, Explain the working of a basic Turing machine. (4-Marks) (8a) (June/July 2018)
8. Briefly explain the techniques for TM construction. (4-Marks) (8c) (June/July 2018)
9. State and prove pumping lemma for context free languages. Show that $L = \{ a^n b^n c^n \mid n \geq 0 \}$ is not context free. (10-Marks) (7a) (Dec.2018/Jan.2019)
10. Explain Turing machine model. (6-Marks) (7b) (Dec.2018/Jan.2019)
11. Design a Turing machine to accept strings of a's and b's ending with ab or ba. (8-Marks) (8b) (Dec.2018/Jan.2019)
12. Define useless symbols, ϵ -production and unit productions. Simplify the following

grammar:

$S \rightarrow aA|a|Bb|cC$

$A \rightarrow aB$

$B \rightarrow a|Aa \quad C \rightarrow cCD$

$D \rightarrow ddd$ (8-Marks) (6a) (Dec.2018/Jan.2019|10 Scheme)

13. Define CNF. Convert the following Grammar to CNF

$S \rightarrow 0A \mid 1B$

$A \rightarrow 0AA \mid 1S \mid 1$

$B \rightarrow 1BB \mid 0S \mid 0$ (6-Marks)(6b) (Dec.2018/Jan.2019|10 Scheme)

14. Consider the following grammar

$S \rightarrow ASA|aB$

$A \rightarrow B|S$

$B \rightarrow b|E$

i. Eliminate ϵ Production

ii. Eliminate any unit Production in the resulting grammar.

iii. Eliminate any useless symbols in the resulting grammar.

iv. Put the resulting grammar in to CNF. (10-Marks) (6a) (June/July.2017|10 Scheme)

15. Eliminate ϵ , unit and useless production from the following grammar and put the resulting grammar into CNF

$S \rightarrow ABC|BaB$

$A \rightarrow aA|BaC|aaa$

$B \rightarrow bBb|a|D$

$C \rightarrow CA|AC$

$D \rightarrow \epsilon$ (12-Marks) (Dec.2016/Jan.2017|10 Scheme).

16. Eliminate the useless symbols and productions from the following grammar.

$S \rightarrow AB|AC$

$A \rightarrow aA|bAa|a$

$B \rightarrow bbA|aB|AB$

$C \rightarrow aCa|aD$

$D \rightarrow aD|bC$ (7-Marks) (6a) (June/July.2016|10 Scheme)

17. Define CNF and convert the following grammar into GNF.

$S \rightarrow Aba$

$A \rightarrow aab$

$B \rightarrow Ac$ (6-Marks)(6b) (June/July.2016|10 Scheme)

18. Prove that the family of context-free language is closed under union, concatenation and star-closure. (7-Marks) (6c) (June/July.2016|10 Scheme)

19. Consider the following Grammar

$S \rightarrow ASA|aB$

$A \rightarrow B|S$

$B \rightarrow b|E$

- i. Eliminate ϵ Production
 - ii. Eliminate any unit Production in the resulting grammar.
 - iii. Eliminate any useless symbols in the resulting grammar.
 - iv. Put the resulting grammar in to CNF. (10-Marks) (6a)
20. Prove that CFL are closed under union operation.
(4-Marks) (6c) (Dec.2015/Jan.2016|10 Scheme)

Faculty Sign

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