

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: CS301

Course Name: THEORY OF COMPUTATION (CS)

Max. Marks: 100

Duration: 3 Hours

PART A

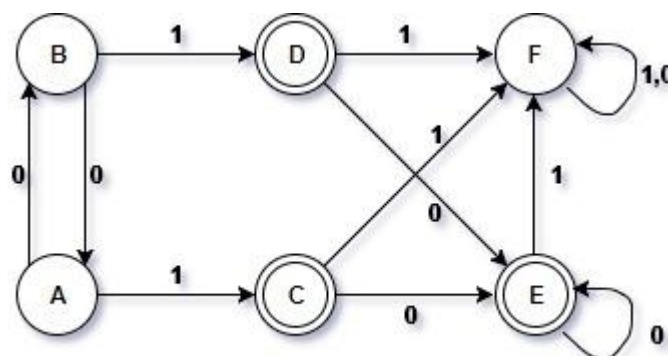
Answer all questions, each carries 3 marks.

- | | | Marks |
|---|--|-------|
| 1 | Define Non Deterministic Finite Automata? Compare its ability with Deterministic Finite Automata in accepting languages. | (3) |
| 2 | Write the notations for the language accepted by DFA, NFA, ϵ -NFA | (3) |
| 3 | Can we use finite state automata to evaluate 1's complement of a binary number? Design a machine to perform the same. | (3) |
| 4 | Define Two-way finite automata | (3) |

PART B

Answer any two full questions, each carries 9 marks.

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|---|---|-----|
| 5 | a) Design a Finite state automata which accepts all strings over $\{0,1\}$ with odd number of 1's and even number of 0's. | (5) |
| | b) Show the changes needed to convert the above designed automata to accept even number of 1's and odd number of 0's | (4) |
| 6 | a) Construct Regular grammar for the regular expression :
$L = (a + b)^*(aa + bb)(a + b)^*$ | (5) |
| | b) List the closure properties of Regular sets. | (4) |
| 7 | State Myhill-Nerode theorem. Minimize the following DFA by table filling method using Myhill-Nerode theorem describing the steps in detail. | (9) |



PART C

Answer all questions, each carries 3 marks.

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|---|---|-----|
| 8 | Which Normal Form representation of CFG will you prefer in converting CFG to NPDA? Why? | (3) |
|---|---|-----|

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- 9 What do you mean by useless symbol in a grammar? Show the elimination of useless symbols with an example. (3)
- 10 Explain the different methods by which a PDA accepts a language. (3)
- 11 Can we construct a Deterministic PDA for the language ww^R ? Justify your answer. Otherwise how can we modify this language to make it accepted by DPDA. (3)

PART D

Answer any two full questions, each carries 9 marks.

- 12 Define CFG for the following languages over the alphabets $\{a,b\}$ (9)
- i. $L = \{ a^{m+n}b^m c^n, m>0 \}$
 - ii. L contains all odd length strings only
 - iii. $L = \{ 0^n 1^n 2^n \mid n>0 \}$
- 13 Design a Push Down Automata for the language $L = \{ a^n b^{2n} \mid n>0 \}$ (9)
Trace your PDA with $n=3$.
- 14 Prove that the following languages are not regular (9)
- i. $L = \{ 0^{i^2} \text{ such that } i \geq 1 \}$ is not regular
 - ii. $L = \{ a^p \text{ such that } p \text{ is a prime number} \}$

PART E

Answer any four full questions, each carries 10 marks.

- 15 State and prove pumping lemma for Context Free Languages. (10)
- 16 Construct a Turing machine that recognizes the language $L = \{ a^n b^n c^n \mid n>0 \}$ (10)
- 17 a) What is a Context sensitive grammar(CSG). Design a CSG to accept the language $L = \{ 0^n 1^n 2^n \mid n>0 \}$ (6)
- b) Define Linear Bound Automata (4)
- 18 a) Write a note on Recursive Enumerable Languages (5)
- b) Discuss about Universal Turing Machines (5)
- 19 a) Explain Chomsky's Hierarchy of Languages (6)
- b) Let $L = \{ x \mid x \in (a + b + c)^* \text{ and } |x|_a = |x|_b = |x|_c \}$. What class of language does L belong to? Why? What modification will you suggest in the grammar to accept this language? (4)
- 20 Discuss the Undecidable Problems About Turing Machines (10)
