

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.*

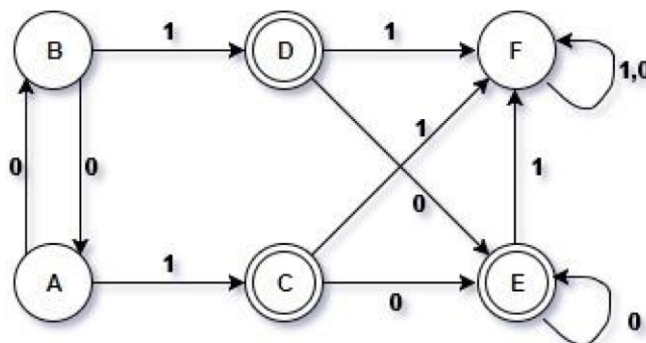
Marks

- |   |  |     |
|---|--|-----|
| 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, $\epsilon$ -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 :<br>$L = (a + b)^*(aa + bb)(a + b)^*$  | (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.  $L = \{0^{i^2} \mid \text{such that } i \geq 1\}$  is not regular
  - ii.  $L = \{a^p \mid \text{such that } p \text{ is a prime number}\}$

**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)

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