

SVKM's NMIMS
MUKESH PATEL SCHOOL OF TECHNOLOGY MANAGEMENT & ENGINEERING

Programme: B. Tech (COMPUTER)

Year: III

Semester: V

Academic Year: 2016-2017

Subject : Theoretical Computer Science

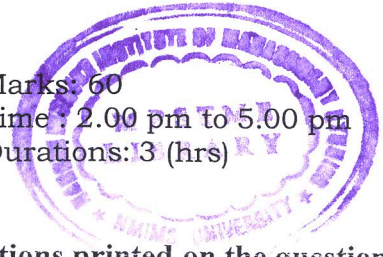
Date : 24 November 2016

Marks: 60

Time : 2.00 pm to 5.00 pm

Durations: 3 (hrs)

Final-Examination



Instructions: Candidates should read carefully the instructions printed on the question paper and on the cover of the Answer Book, which is provided for their use.

- 1) Question No. 01 is compulsory.
- 2) Out of remaining questions, attempt any 04 questions.
- 3) In all 05 questions to be attempted.
- 4) All questions carry equal marks.
- 5) Answer to each new question to be started on a fresh page.
- 6) Figures in brackets on the right hand side indicate full marks.
- 7) Assume Suitable data if necessary.

Q.1 a) Which of the following regular expression does not correspond to the DFA given below? [2]



- a) $(0^* 1^* 0 + (1^* 10)^* 1^*)^*$
- b) $((1^* 0 + 0^*)^* + 1 1^*)^*$
- c) $(1^* 0 + 0^*)^*$
- d) $((0^* + (1 0)^* 1^*)^* + (0^* 11 + 10)^*)^*$

b) If L_1 is context free language and L_2 is a regular language which of the following is/are false? [2]

- a) $L_1 - L_2$ is not context free
- b) $L_1 \cap L_2$ is context free
- c) $\sim L_2$ is context free
- d) $L_1 \cap L_2$ is regular

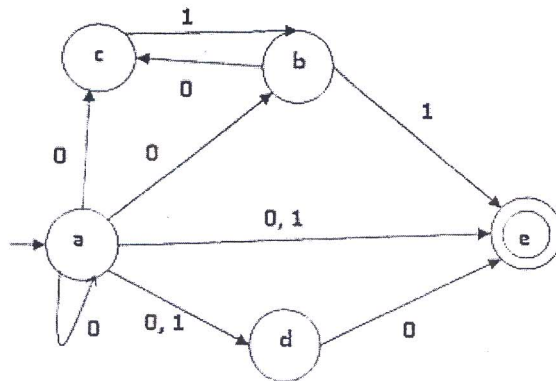
c) Explain ambiguity of grammar with an example. [2]

d) Compare NFA and DFA. [2]

e) Explain Rice's theorem and its properties with an example. [4]

- Q.2 a) Write algorithm to convert CFG into CNF. [8]
 Convert the given CFG into Chomsky Normal Form:
 $S \rightarrow ASA \mid aB$
 $A \rightarrow B \mid S$
 $B \rightarrow b \mid \epsilon$

- b) Convert following NFA into DFA. [4]



- Q.3 a) Explain PDA and with an example. Write algorithm to find PDA corresponding to a given CFG. [8]

Construct PDA from the following CFG:

$G = (\{S, X\}, \{a, b\}, P, S)$

where the productions are –

$S \rightarrow XS \mid \epsilon, A \rightarrow aXb \mid Ab \mid ab$

- b) Prove using pumping lemma [4]

$L = \{a^i b^i c^i \mid i \geq 1\}$

Is not CFL.

- Q.4 a) Design Moore and Mealy machine to find, [4]

- 1's complement of binary number.
- 2's complement of binary number.

- b) Construct NFA and minimum DFA for given regular expression [4]
 $(0 + 1)^* (00 + 11)$.

- c) Explain following terms in relation with Turing Machine. [4]

- Solvability
- Semi-Solvability
- Unsolvability

- Q.5 a) Consider the following language and convert it into a grammar [4]

- $L(G) = \{a^m b^n \mid m \geq 0 \text{ and } n > 0\}$
- $L(G) = \{a^m b^n \mid m > 0 \text{ and } n \geq 0\}$

- b) State and explain any 4 closure properties of regular expression. [4]
- c) Compare Moore and mealy machine. [4]

- Q.6 a) Using Arden's theorem obtain a regular expression for following DFA: [6]
 $Q = \{q_1, q_2, q_3\}$, $\Sigma = \{0, 1\}$
 δ is as follows:

| | 0 | 1 |
|-------------------|----|----|
| $\rightarrow q_1$ | Q1 | Q2 |
| q2 | Q3 | Q2 |
| q3* | Q1 | Q2 |

- b) Consider following CFG: [6]
 $S \rightarrow iCtS \mid iCtSeS \mid a$
 $C \rightarrow b$

Derive the string "ibtibtaea" using leftmost derivation and rightmost derivation. Draw syntax tree for the same.

- Q.7 a) Explain multi-tape Turing machine. [4]
- b) Prove using pumping lemma [4]
 $L = \{a^i b^{2i} \mid i > 0\}$
 is not regular.
- c) What is Chomsky hierarchy? Explain with an example. [4]