Printed Pages : 3 **Roll No.** | | | | | | | | | | | **NCS402**

B.TECH.

THEORY EXAMINATION (SEM–IV) 2016-17

THEORY OF AUTOMATA AND FORMAL LANGUAGES

Time : 3 Hours ***Max. Marks : 100***

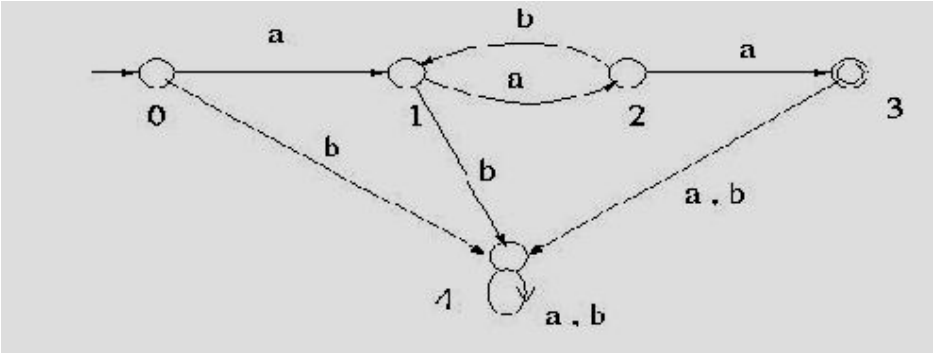
Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. Explain the following: **10 x 2 = 20**

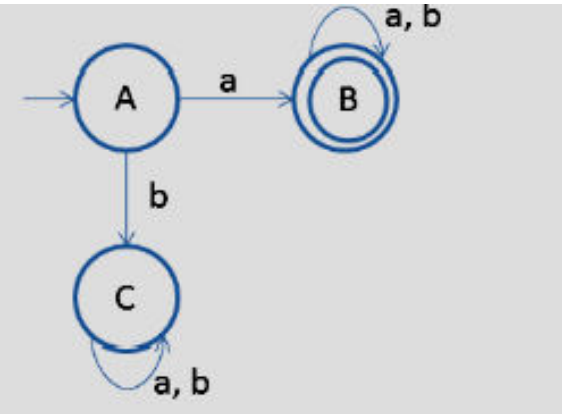
(a) Design the DFA that accepts an even number of a's and even number of b's.

(b) Consider the DFA given below and identify the L accepted by the machine.



(c) State the pumping lemma theorem for regular languages.

(d) Convert the FA given below to left linear grammar.



(e) Check whether the grammar is ambiguous or not.
R-> R+R/ RR/ R*/ a / b / c. Obtain the string w = a+b*c

(f) S->aB/bA A->a/aS/bAA B-> b/bS/aBB. Identify the strings obtained from this grammar.

(g) Define PDA. Draw the graphical representation for PDA.

(h) Design a PDA which accepts set of balanced paranthesis ({ { } }).

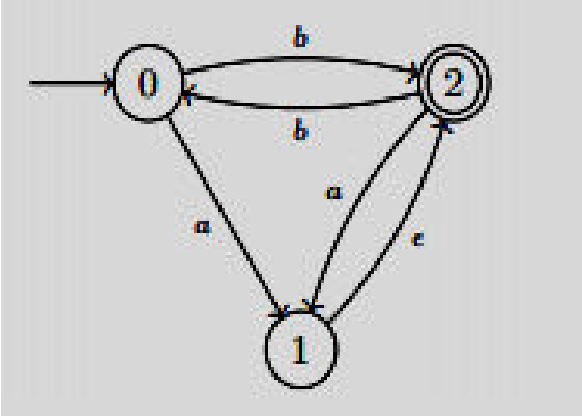
(i) Eliminate unit productions in the grammar. S->A/bb A->B/b B->S/a

(j) What are checking off symbols?

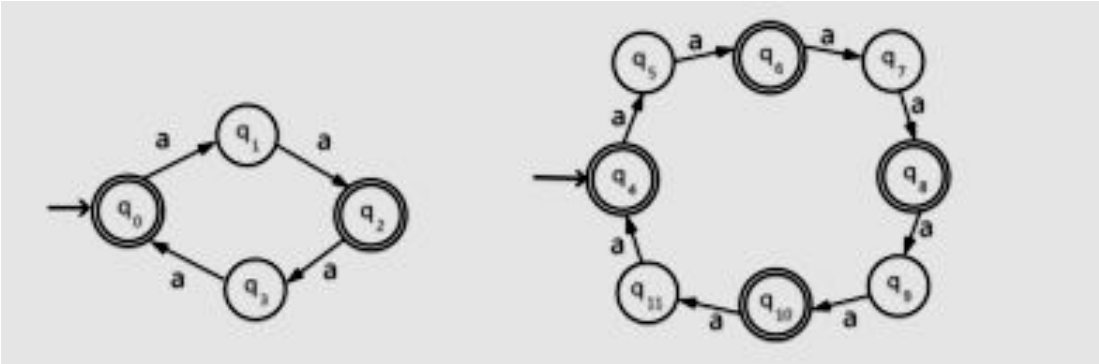
SECTION – B

2. Attempt any five of the following questions: **5 x 10 = 50**

(a) (i) Convert the NFA- ε to DFA.



(ii) Check with the comparison method for testing equivalence of two FA given below.



(b) Prove that the compliment, homomorphism and inverse homomorphism, closure of a regular language is regular.

(c) State and prove kleene's theorem with an example.

(d) Consider the grammar with the production S->aSS A->b. Compute the string aababbb with the left most and right most derivation. Draw the derivation tree.

(e) (i) Find out whether the language $L = \{x^n y^n z^n \mid n \geq 1\}$ is context free or not.

(ii) Construct a PDA that accepts $L = \{ ww^R \mid w = (a+b)^* \}$

(f) (i) Convert the following CFG into CNF

$S \rightarrow XY \mid Xn \mid p$

$X \rightarrow mX \mid m$

$Y \rightarrow Xn \mid o$

(ii) Convert the following CFG into CNF $S \rightarrow ASA \mid aB$, $A \rightarrow B \mid S$, $B \rightarrow b \mid \varepsilon$

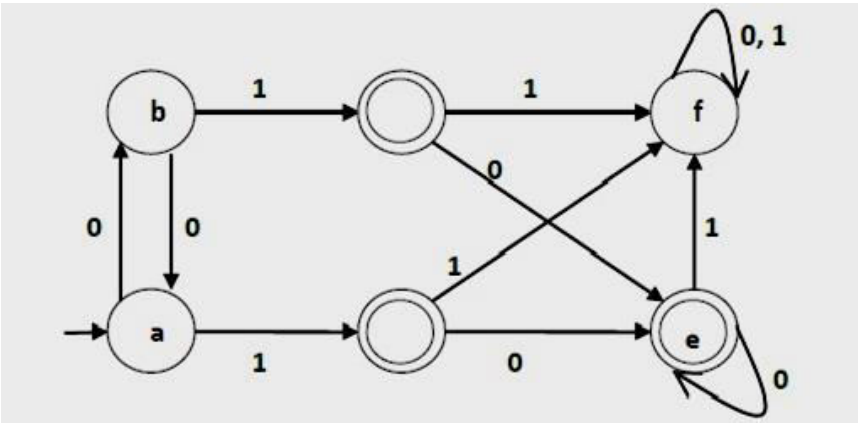
(g) Design a TM to recognize all strings consisting of an odd number of α's.

(h) Prove that the halting problem is undecidable.

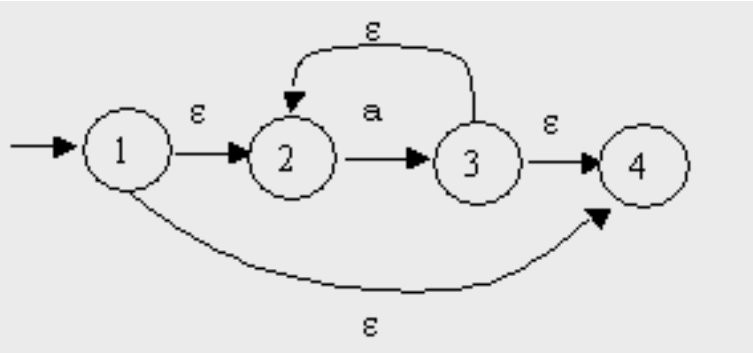
SECTION – C

Attempt any two of the following questions: **2 x 15 = 30**

3. **(a)** Minimize the automata given below



(b) Compute the epsilon- closure for the given NFA. Convert it into DFA.



4. **(a)** Construct PDA to accept $L = \{0^n 1^n \mid n \geq 0\}$

(b) Construct a PDA from the following CFG.

$G = (\{S, X\}, \{a, b\}, P, S)$ where the productions are −

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

5. **(a)** Prove that single tape machines can simulate multi tape machines.

(b) Design a TM to recognize all strings consisting of an odd number of α's.