2002 SCHEME

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CS44

Fourth Semester B.E. Degree Examination, December 2010
Finite Automata and Formal Languages

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions.*
2. Any missing data may be suitably assumed

1 a. Define symbols, alphabets, strings and languages. **(04 Marks)**

b. Define a DFA. Design a DFA to accept language with even number of a's and odd number of b's over $\Sigma = \{a, b\}$, and process the string U = aaaabbb. **(08 Marks)**

c. If $D = (Q_D, \Sigma, \delta_D, \{q_0\}, F_D)$ is a DFA constructed by $N = (Q_N, \Sigma, \delta_N, q_0, F_N)$ by the subset construction, then prove that L(D) = L(N). **(08 Marks)**

2 a. Convert the following $\in$ - NFA to DFA. **(06 Marks)**

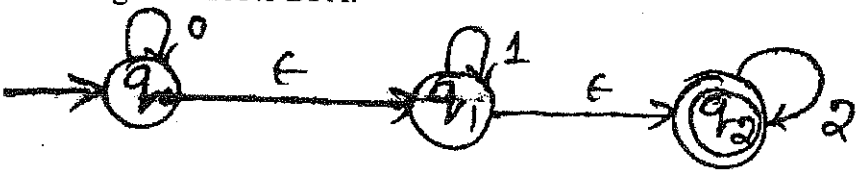

Fig. Q2(a)

b. Define regular expression. Write a regular expression to accept following languages.
i) Combination of a's and b's of even length.
ii) 2nd symbol is 'a' and 3rd symbol is 'b' from right end.
iii) $L = \{a^n b^m \mid \text{where } n \geq 3, b \leq 2\}$. **(07 Marks)**

c. Convert the following regular expressions to its equivalent NFA.
(a + ab)* a b*. **(07 Marks)**

3 a. Define and prove the pumping lemma for regular expression. **(06 Marks)**

b. If L and M are regular languages, then so is $L \cap M$. **(04 Marks)**

c. Convert the following DFA to a minimized DFA. **(06 Marks)**

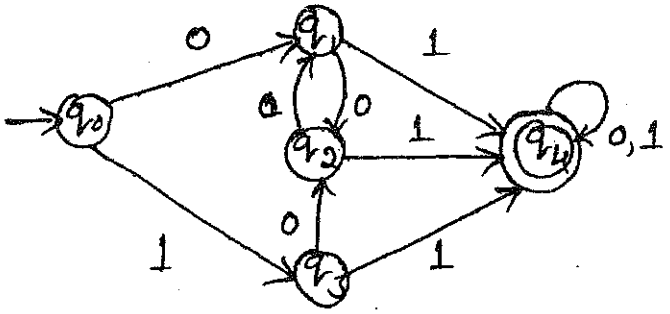

Fig. Q3(c)

d. Explain the applications of regular expressions. **(04 Marks)**

4 a. Define grammar. Write a grammar for the following languages.
i) $L = \{a^n b^m \mid m > n, n \geq 0\}$
ii) $L = \{0^n 1^{2n} \mid n \geq 0\}$
iii) $L = \{a^n b^m c^k \mid k = n + m\}$. **(06 Marks)**

b. Consider the following grammar, write the LMD and RMD for the string U = – + ∞ xyxy. Check given grammar is ambiguous or not.
$E \rightarrow * EE \mid - EE \mid + EE \mid x \mid y$. **(12 Marks)**

c. List the applications of parser. **(02 Marks)**

5 a. What are the different kinds of languages accepted by PDA? Design a PDA for language $L = \{a^n b^m c^n \mid n \geq 0, m \geq 0\}$ and traverse the string w = aabcc. **(12 Marks)**

b. Convert the given CFG to its equivalent PDA.
$I \rightarrow a \mid b \mid Ia \mid Ib \mid I0 \mid I1$.
$E \rightarrow I \mid E * E \mid E + E \mid (E)$. **(08 Marks)**

6 a. Remove the useless symbols from the given grammar :
$S \rightarrow aAa$
$A \rightarrow ab \mid bcC \mid DaA$
$C \rightarrow abb \mid DD$
$D \rightarrow aDA$
$E \rightarrow aC$. **(05 Marks)**

b. Define CNF and GNF. Convert the following grammar into CNF.
$E \rightarrow E + T \mid T$
$T \rightarrow T * F \mid F$
$F \rightarrow (E) / I$
$I \rightarrow a/b$. **(10 Marks)**

c. Prove that the following grammar is not regular
$L = \{0^n 1^n 2^n \mid n \geq 1\}$. **(05 Marks)**

7 a. Design a Turing machine to accept a language
$L = \{a^n b^n \mid n \geq 1\}$.
Write transition diagram and table, process the string U = aaabbb. **(12 Marks)**

b. Explain in detail,
i) Multitape turing machine
ii) Non – deterministic turing machine
iii) Restricted turing machine. **(08 Marks)**

8 Write short notes on :
a. Variants of FA
b. DPDA
c. Turing machine and computers
d. Post's correspondence problem. **(20 Marks)**

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