

B.E. DEGREE EXAMINATIONS: NOV/DEC 2012

Fifth Semester

COMPUTER SCIENCE AND ENGINEERING

CSE111: Theory of Computation

Time: Three Hours

Maximum Marks: 100

Answer All Questions:-

PART A (10 x 1 = 10 Marks)

1. $R \cup S = S \cup R$ denotes
 - a) associative law
 - b) commutative law
 - c) mutual induction
 - d) general induction
2. A _____ automaton has multiple states for certain transitions.
 - a) deterministic finite
 - b) nondeterministic finite
 - c) pushdown automate
 - d) epsilon DFA
3. If $L = L(A)$ for some DFA A, then there is a regular expression R such that
 - a) $L = L(R)$
 - b) $L = L^*$
 - c) $L = L \cup R$
 - d) $L = R^*$
4. A function on strings that works by substituting a particular string for each symbol is called
 - a) inverse homomorphism
 - b) Laplace
 - c) isomorphism
 - d) homomorphism
5. The string of terminals and nonterminals that we get during the derivation process is called
 - a) right most derivation
 - b) normal form
 - c) sentential form.
 - d) left most derivation
6. The DPDA languages lie strictly between the regular languages and the _____.
 - a) nonregular languages
 - b) high-level languages
 - c) context-free languages
 - d) NFA languages
7. A variable A is nullable if
 - a) $A \Rightarrow \alpha$
 - b) $A \Rightarrow \epsilon$
 - c) $A \Rightarrow \beta$
 - d) $A \Rightarrow \gamma$
8. If all the productions in the grammar G are in the form $A \rightarrow a\alpha$ and, where α is set of nm terminals then the grammar is said to be
 - a) Chomsky normal form
 - b) ambiguous
 - c) unambiguous
 - d) Greibach normal form
9. Modified Post Correspondence Problem reduces to
 - a) decidable
 - b) undecidable
 - c) post correspondence
 - d) non-recursive

10. The _____ language consists of all those strings w such that the TM represented by w halt in the input w .
- a) recursive b) enumerable c) diagonalization d) programming

PART B (10x 2 = 20 Marks)

11. Define DFA.
12. Draw a transition diagram for an NFA to accept the regular expression $(x+y)^*x$.
13. State regular expression.
14. Give the RE for a language accepting all combinations of 'a' and 'b'.
15. Write the 4 important components in a grammatical description of a language.
16. Give the formal definition of push down automata.
17. What are ϵ productions and unit productions?
18. Differentiate Finite state machine and Turing machine.
19. Define undecidable problem.
20. What is diagonalization language?

PART C (5 x 14 = 70 Marks)

21. a) (i) Construct a NFA that accept the set of strings in $(0 + 1)^*$ such that some two 0's are separated by string whose length is $4i$, for some $i \geq 0$. (7)
- (ii) Prove the equivalence of NFA and DFA. (7)
- (OR)
- b) (i) Construct a DFA that will accept strings on $\{a,b\}$ where the number of b's divisible by 3. (7)
- (ii) Explain in detail with an example the conversion of NFA to DFA (7)
22. a) (i) State and prove pumping lemma for regular sets. (7)
- (ii) State and prove the properties that are closed under regular languages (7)
- (OR)
- b) (i) Prove that a balanced parenthesis is not a regular language. (7)
- (ii) Construct a minimized DFA for the regular expression $(0+1)(0+1)^*11$ (7)

23. a) Construct a context free grammar for the given language

$L = \{a^n b^n / n \geq 1\} \cup \{a^m b^{2m} / m \geq 1\}$ and hence a PDA accepting L by empty stack.

(OR)

b) (i) Prove that the DPDA languages include all the regular languages. Give example. (7)

(ii) Describe the components to form a context-free grammar. Give example. (7)

24. a) Construct a Turing machine to do the proper subtraction.

(OR)

b) (i) State and prove pumping lemma for context-free languages. (6)

(ii) Convert the following grammar to Greibach normal form

$S \rightarrow AS / a$

$A \rightarrow SAA / b$

25. a) (i) Prove that the union and intersection of two recursive languages are also recursive. (7)

(ii) Prove that there exists a recursively enumerable language whose complement is not recursively enumerable. (7)

(OR)

b) State and prove Rice's theorem for recursive index sets.
