



B.E DEGREE EXAMINATIONS: MAY 2015

(Regulation 2013)

Fourth Semester

COMPUTER SCIENCE AND ENGINEERING

U13CST405: Theory of Computation

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

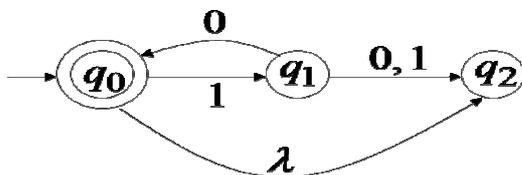
1. Given an arbitrary NFA with N states, the maximum number of states in equivalent minimized DFA is atleast
 - a) N^2
 - b) 2^N
 - c) N
 - d) $N!$
2. For the DFA $M=(S, \Sigma, \delta, q_0, F)$; δ is
3. If R_1 and R_2 are regular sets defined over alphabet Σ , the
 - a) $R_1 \cup R_2$ is regular
 - b) $R_1 \cap R_2$ is not regular
 - c) $\Sigma \cap R_2$ is not regular
 - d) R_2^* is not regular
4. Regular expression for all strings of 0's and 1's with no two consecutive zeros is
5. CFG is not closed under
 - a) Union
 - b) Kleene
 - c) Complementation
 - d) Product
6. CFG which generates $\{a^l b^m c^n \mid l+m = n\}$ has its production rules given by
7. Match the language with the corresponding machine
 - i) Regular language
 - ii) DCFL
 - iii) CFL
 - iv) Context sensitive language
 - v) Recursive language
 - vi) Recursively enumerable language
 - A) NDPDA
 - B) Turing machine
 - C) DPDA
 - D) Non deterministic finite automata
 - E) TM that halts
 - F) Linear-bounded automaton
 - a) DCFEAB
 - b) DCABEF
 - c) DCAFEB
 - d) DACFEB

8. A Finite state machine can be considered to be a of finite tape length without rewinding capability and unidirectional tape movement
9. The problem of determining that a turing machine would halt after giving Yes/No output is
 - a) unsolvable
 - b) Solvable
 - c) Decidable
 - d) Intractable
10. In _____ problems if there is solution for one decision problem from that family, then there will be solution for every decision problem from that family

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Give the regular expression for language accepted by the NFA



12. Draw Finite automaton to add 2 n-bit binary numbers
13. Prove that $L = \{vv^R : v \in \Sigma^*\}$ $\Sigma = \{a,b\}$ is not regular
14. Pictorially depict how a PDA works?
15. Is the following grammar ambiguous? Give reason.
 $S \rightarrow i C t S e S \mid i C t S \mid a$
 $C \rightarrow b$
16. State Church-Turing thesis
17. Give primitive recursive function for

$$x \dot{-} y = \begin{cases} x - y & \text{if } x \geq y, \\ 0 & \text{otherwise.} \end{cases}$$

18. Differentiate between recursive and recursively enumerable languages
19. Identify whether the following problems are tractable / intractable / partially tractable. Give reason.
 - i) Searching an unordered list
 - ii) Towers of Hanoi
20. Define NP-complete with an example

PART C (5 x 14 = 70 Marks)

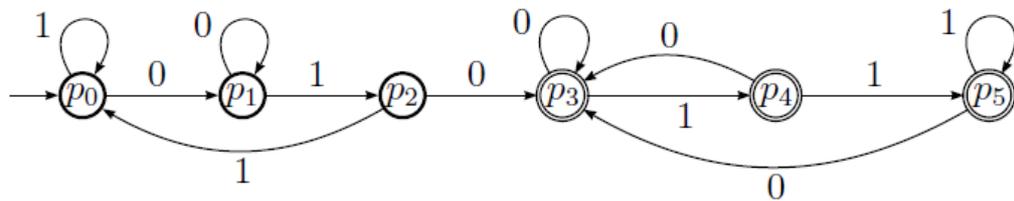
(Not more than 400 words)

Q.No. 21 is Compulsory

21. Construct NFA and DFA for the following regular expression $(a/b)^*abb$. Show transitions for a string of acceptance. Compare NFA and DFA

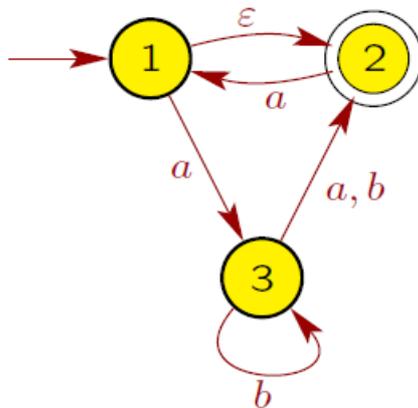
22. a) (i) Give rules for Construction of ϵ -NFA from regular expression. Demonstrate (7) with an example.

(ii) Construct a minimized DFA for the following DFA. Illustrate the transitions for (7) a string of acceptance and non-acceptance



(OR)

b)



Explain subset construction algorithm. Use subset construction algorithm to convert the NFA given to DFA

23. a) Construct PDA to accept palindromes and explain

(OR)

b) (i) Define Chomsky Normal form and GNF (4)

(ii) Write the steps to convert a CFG to CNF. Illustrate with the following example (10)

$S \rightarrow ASA|aB$

$A \rightarrow B|S$

$B \rightarrow b|\epsilon$

24. a) Design a Turing machine to copy strings.

(OR)

b) (i) Discuss Chomsky hierarchy of languages with one example. (7)

(ii) Write notes on multitape Turing machine. (7)

25 a) (i) What is Universal Turing machine? Explain (7)

(ii) Explain P, NP hard and NP completeness of problems. Give one example for each. (7)

(OR)

b) (i) What is halting problem? Prove that it is undecidable. (7)

(ii) What is linear bounded automaton? Discuss its working. How does it differ from a Turing machine? (7)
