



B.TECH. SEMESTER VI [Information Technology]
SUBJECT: Theory of Automata and Formal Language

Examination : Block -repeater Seat No. :
Date : 09 /11/2017 Day :
Time : 11:00 to 12:15 Max. Marks : 36

INSTRUCTIONS:

1. Figures to the right indicate maximum marks for that question.
2. The symbols used carry their usual meanings.
3. Assume suitable data, if required & mention them clearly.
4. Draw neat sketches wherever necessary.

Q.1

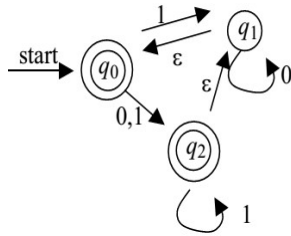
Do as directed.

- (a) Find a possible alphabet Σ for the following languages. [02]
1) The language $L = \{ \text{'this', 'that', 'at'} \}$
2) The language of all decimal strings
- (b) Myhill Nerode theorem is consisting of the following statements - [01]
1) L partitions Σ into distinct classes.
2) If L is regular then, L generates finite number of classes.
3) If L generates finite number of classes then L is regular.
4) All of the above
- (c) Which of the following statements is true? Why? [02]
1) If a language is context free it can always be accepted by a deterministic push-down automaton
2) The union of two context free languages is context free
3) The intersection of two context free languages is context free
4) The complement of a context free language is context free
- (d) If relation is reflexive, symmetric and transitive, it is called _____ [01]
[equivalence relation / equal relation/ matching relations]
- (e) Identify if following languages are regular or not. If they are regular, give the corresponding regular expression. [04]
1) Binary strings with five times as many 0s as 1s
2) Binary strings of the form uvu ; where u and v are nonempty strings
3) Strings over the decimal alphabet $\{0; 1; 2; \dots; 9\}$ with characters in sorted order
4) Strings in which the number of 0s is even.
- (f) Let L be any infinite regular language, defined over an alphabet Σ then there exist three strings x, y and z belonging to Σ such that all the strings of the form $XY^n Z$ for $n=1,2,3, \dots$ are the words in L . is called. _____ (Complement of L / pumping lemma / Kleene's theorem / None in given) [01]
- (g) The following problem(s) ----- is/are called decidable problem(s). [01]
1) The two regular expressions define the same language
2) The two FAs are equivalent 3) Both (1) and (2) 4) None of given

Q.2 Attempt following questions.(any two)

- (a) Explain all components of Chomsky hierarchy for languages and automata. [06]
(b) State and explain Kleene's theorem part 1. [06]
(c) What is undecidable problem? Explain halting undecidable problem or post correspondence problem with example. [06]

Q.3 (a) Convert the NFA shown below into a DFA, using the subset construction. [08]



- (b) Consider the CFG $S \rightarrow aS \mid aSbS \mid \epsilon$. [04]
Give two different parse trees for “aaba”

OR

- Q.3 (a) Consider following PDA is given
 $P = \{\{p, q, r\}, \{0, 1\}, \{0, Z_0\}, \delta, q, Z_0\}$ Let r be the accepting state. The transition function is described as follows-

1. $\delta(q, 0, Z_0) = \{(q, 0Z_0)\}$
2. $\delta(q, 0, 0) = \{(q, 00)\}$
3. $\delta(q, 1, 0) = \{(p, \epsilon)\}$
4. $\delta(p, 1, 0) = \{(p, \epsilon)\}$
5. $\delta(p, 1, Z_0) = \{(r, Z_0)\}$
6. $\delta(r, 1, Z_0) = \{(r, Z_0)\}$

Now answer the following questions:-

- 1) Is PDA deterministic? Justify. [1]
 - 2) Give the transition diagram corresponding to given PDA. [2]
 - 3) What is language of PDA? Explain. [2]
 - 4) Give trace of any one string in the language and one string not in the language on above PDA. [3]
- (b) Write short note on :- Turing machine variations . [04]