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University Examinations 2020/2021

SECOND YEAR SECOND SEMESTER EXAMINATIONS FOR BACHELOR OF SCIENCE IN COMPUTER SCIENCE AND BACHELOR OF SCIENCE IN COMPUTER TECHNOLOGY

CCS 3253: AUTOMATA THEORY

DATE: JULY 2021 **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other Two questions.

QUESTION ONE (30 MARKS)

a) Give a reason why studying automata theory is important. (2 Marks)

b) Using a suitable diagram name and explain the main components of a push down Automata and show how it works (5 Marks)

c) Discuss context sensitive grammars and context free grammars (4 marks)

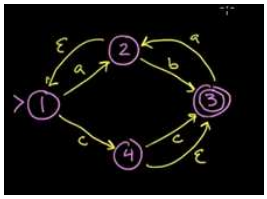
d) Give an application of context free grammars (4 marks)

e) Give the explanation of this Turing Machine transition function $\delta(q,x)=(r,Y,D)$ (5 Marks)

f) Explain the concept behind finite state machine (2 marks)

g) Differentiate between Finite State machine and Turing Machine (4 Marks)

h) Convert the NFA to DFA showing all the steps (8 Marks)



QUESTION TWO (20 MARKS)

a) Write a regular expression for the following (6 Marks)

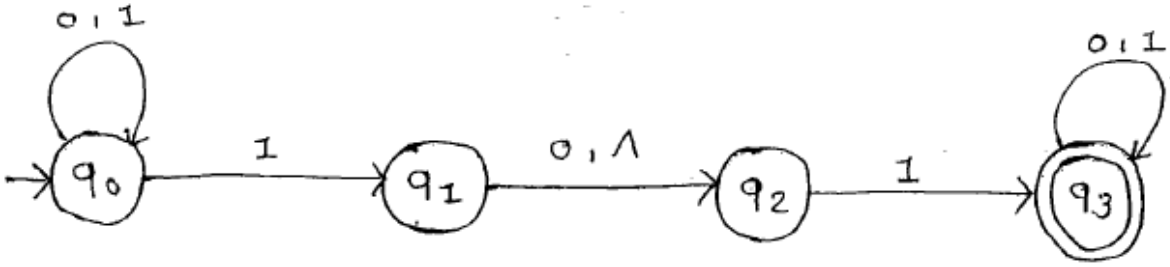
i) The set of strings over {0,1} that end in 3 consecutive 1's.

ii) The set of strings over {0,1} that have at least one 1.

iii) The set of strings over {0,1} that have at most one 1.

b) Explain what is meant by a regular language (2 Marks)

Let N1 be a Nondeterministic Finite automaton. Give its formal description including its transition function. (10 Marks)



c) What an accepting or rejecting state of a finite automata (2 marks)

QUESTION THREE (20 MARKS)

a) Define the following terms and give an example of each (6 marks)

i. Alphabets
ii. Strings
iii. Words

b) Give a regular expression for the machine shown below (4 marks)

i) Given the following $\sum=\{a\}$

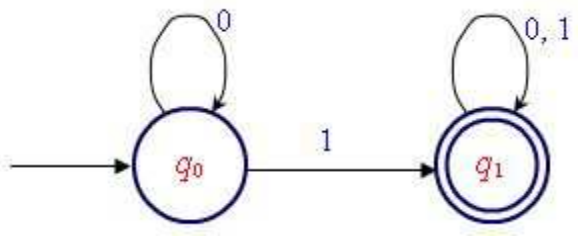
Productions:

$S \longrightarrow aS$

$S \longrightarrow \wedge$

Trace the execution of applying rule 1 three times and rule 2 once (5 Marks)

a) Draw a Transition table of the DFA below (5 marks)



QUESTION FOUR (20 MARKS)

a) Compare Deterministic finite automata with Non Deterministic finite automata (6 marks)

b) Discuss two ways of accepting an input string by pushdown automata (4 marks)

c) Giving suitable examples, describe the following four classifications of grammar introduced by Chomsky.

i. Type 0 gramma (2Marks)

ii. Type one gramma (2Marks)

iii. Type 2 gramma (2Marks)

iv. Type 3 gramma (2Marks)

d) What is meant by an NP Complete problem? (2 marks)

QUESTION FIVE (20 MARKS)

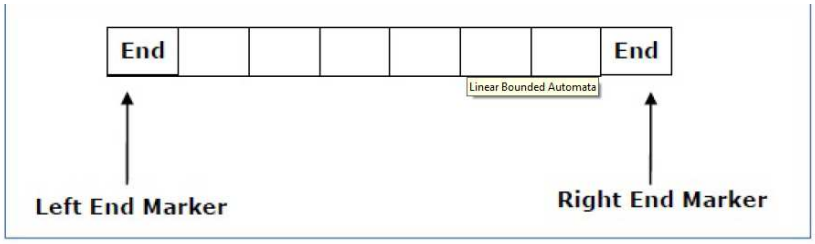
a) Find a PDA for each of the following languages.

i) $\{abncdn \mid n \in N\}$ (5 marks)

b) Describe what is pumpimg lemma and its use (5 Marks)

c) What makes PDA be superior than FSA and show the kind of languages accepted by the PDA (2marks)

d) Given the unboumded linear automa below discuss how it differs with turing machine and give a formal defination of the machine (4 marks)



e) Given the program

i. Int main()

//2 variable

Int a; b;

A=10;

Return 0;

}

Use Lexical analyzer to generate all the valid tokens in the program above (4 Marks)