MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

SECOND/THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

BACHELOR OF SCIENCE (MATHEMATICS)

SCO211/SMA394: AUTOMATA THEORY/THEORY OF COMPUTATION

DATE: 17/12/2021 **TIME: 11.00-1.00 PM**

INSTRUCTIONS: Answer Question ONE and other TWO Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Describe the THREE main branches of Theory of Computation. (3 marks)

b) Differentiate between NFA and DFA. (4 marks)

c) Describe the applications of pumping lemma. (3 marks)

d) Obtain a DFA to accept strings of a's and b's starting with the string ab. (6 marks)

e) Convert the below automation to DFA. (6 marks)

δ	0	1
□	{p,r}	{q}
p	{r,s}	{p}
q	{p,s}	{r}
*	{q,r}	I

f) Obtain a grammar to generate the following language L = {WWR Where W {a, b}*}. (4 marks)

g) Prove that L= {w|w is a palindrome on {a,b}*} is not regular. i.e., L= {aabaa, aba, abbbba,…} (4 marks)

QUESTION TWO (20 MARKS)

a) Define Turing Machine. (4 marks)

b) Describe FOUR applications of Finite Automata. (4 marks)

c) Obtain grammar to generate string consisting of any number of a's and b's with at least one b. (4 marks)

d) Construct PDA: For the language. (4 marks)

$$L = \{wcw^R \mid w \quad \{a, b\}^*, c \quad \Sigma \}$$

e) Eliminate non-reachable symbols from G= ({S, A}, {a}, {S -> a, A ->a}, S). (4 marks)

QUESTION THREE (20 MARKS)

a) Describe deductive proof. (2 marks)

b) Discuss THREE uses of Context free Grammars. (6 marks)

c) Construct a state transition diagram for a DFA that recognizes the following language over the alphabet $\Sigma = \{a, b\}$: (6 marks)

$$L_1 = \{w | w \neq ba, \text{and } w \text{ does not contain } bab\}$$

d) Design a TM to recognize a string of the form $a^n b^{2n}$ (6 marks)

QUESTION FOUR (20 MARKS)

a) Give FOUR applications of automata theory. (4 marks)

b) Construct a state transition diagram for 5-state NFA that recognizes the language given by the regular expression $a(cb)^* \cup c(ba)^*$. (6 marks)

c) Discuss the language accepted by the following FA. (6 marks)

d) Explain CGF with an example. (4 marks)

QUESTION FIVE (20 MARKS)

a) Obtain DFAs to accept strings of a's and b's having exactly one a. (5 marks)

b) Explain the ground rules of finite automata. (5 marks)

c) Let R be a regular expression. Then there exists a finite automaton M = (Q,¦, G, q0,A) which accepts L(R). (6 marks)

d) Prove pumping lemma. (4 marks)