MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (MATHEMATICS AND COMPUTER SCIENCE)

SCO 211/SMA 394:AUTOMATA THEORY/THEORY OF COMPUTATION

DATE: 11/4/2023 **TIME: 11:00 – 1:00 PM**

INSTRUCTIONS

i) Answer question ONE and other TWO questions

ii) Write on both sides of the answer sheet

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Define the following

i) Turing machine (2 marks)

ii) Automaton (2 marks)

iii) Kleen Star (2 marks)

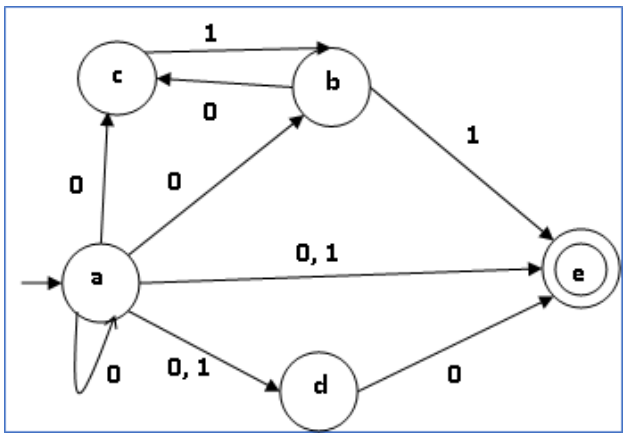
b) Distinguish between a Recognizer and a Transducer (4 marks)

c) Describe applications of AUTOMATA (5 marks)

d) Write down the formal definition of a Deterministic Finite Automaton (DFA) (5 marks)

e) Compare Deterministic Finite Automaton (DFA) with Non-Deterministic Finite Automaton NFA(NDFA) (5 marks)

f) Construct a transition table for the following Automaton (5 marks)



QUESTION TWO (20 MARKS)

a) Provide a formal definition of a Mealy Machine (5 marks)

b) Suppose we have the following grammar: G: N={S, A, B} T= {a, b} P= {S →AB, A →aA|a, B →bB|b}, Find the language generated by this grammar (5 marks)

c) Suppose the language generated by a grammar is L (G) = {am b n | m ≥ 0 and n > 0}. Find the grammar (4 marks)

d) Given that the Regular Set for Regular Expression (0+10*) is L= { 0, 1, 10, 100, 1000, 10000, … }, Find the Regular Set (L) for the following Regular Expressions:

i. (a+b)* (3 marks)

ii. (a+b)*abb (3 marks)

QUESTION THREE (20 MARKS)

a) Given that the Regular Set for Regular Expression (0+10*) is L= { 0, 1, 10, 100, 1000, 10000, … }, Find the Regular Set (L) for the following Regular Expressions:

i. (a+b)* (4 marks)

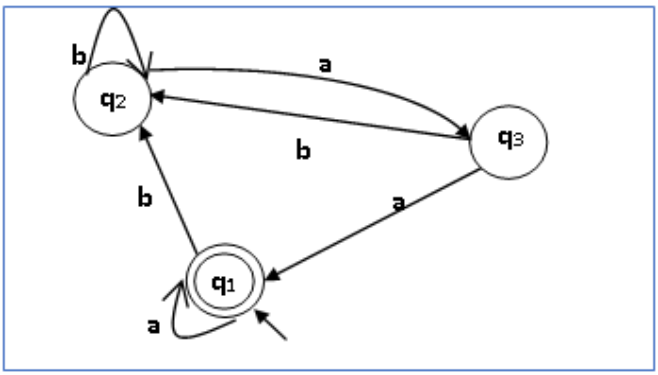
ii. (a+b)*abb (4 marks)

b) Proof the following properties of Regular Sets:

i. The union of two regular sets is regular. (4 marks)

ii. The intersection of two regular sets is regular. (4 marks)

c) Construct a regular expression corresponding to the automata given below: (4 marks)



QUESTION FOUR (20 MARKS)

a) Provide a formal definition if a Moore Machine (5 marks)

b) Construct a Fimite Automaton (FA) for the following Regular Expressions(RE):

i. (a+b)*, (3 marks)

ii. (a+b) (3 marks)

c) Construct a PDA that accepts L= {0n 1n | n ≥ 0} (4 marks)

d) Design a top-down parser for the expression "x+y*z" for the grammar G with the following production rules:

P: S → S+X | X, X → X*Y | Y, Y → (S) | id (5 marks)

QUESTION FIVE (20 MARKS)

a) Design a TM to recognize all strings consisting of an odd number of α's (5 marks)

b) Design a Turing Machine that reads a string representing a binary number and erases all leading 0's in the string. However, if the string comprises of only 0's, it keeps one 0. (5 marks)

c) Construct a PDA that accepts L= { wwR | w = (a+b)* } (5 marks)

d) Design a top-down parser for the expression "x+y*z" for the grammar G with the following production rules:

P: S → S+X | X, X → X*Y | Y, Y → (S) | id (5 marks)