LAIKIPIA UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER 2023/2024 ACADEMIC YEAR

SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (ICT)

COMP 221: AUTOMATA THEORY

STREAM: R ***TIME: 2 HRS***

DAY: WEDNESDAY [8.30 – 10.30 A.M] ***DATE: 17/04/2024***

THIS QUESTION PAPER CONSISTS OF FOUR (4) PAGES

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INSTRUCTIONS: Answer question one and any other two questions

QUESTION ONE (30 MARKS)

a) Briefly describe the following concepts as used with Automata theory **(10 marks)**

   i. Finite state automata

   ii. Regular language

   iii. Set concatenation

   iv. Push down automata

   v. Finite state transition system

b) Outline **three** differences between deterministic finite state automata and non deterministic finite state automata **(3 marks)**

c) Discuss the components of pushdown automata **(6 marks)**

d) What is the basic limitation of finite automata? **(2 marks)**

e) Consider the set of strings in {a,b} that start with ab and end with bba

   i. Give the set former notation for the set **(1 mark)**

   ii. Give a DFA that accepts the set (**4 marks)**

   iii. Define the regular expression for the set (**4 marks)**

QUESTION TWO (20 MARKS)

a) State and briefly explain the five elements of a deterministic finite state automaton(DFA) **(10 marks)**

b) With use of relevant illustrations, show how a DFA processes strings **(10 marks)**

QUESTION THREE (20 MARKS)

a) Consider the deterministic finite state automata represented by the transitions below:

i. Describe the set of strings acceptable by the DFA **(2 marks)**

ii. Give a transition table to represent the DFA (**4 marks)**

iii. Generate a regular expression for the language L of the DFA (**4 marks)**

b) Explain why Turing Machines are more powerful than Finite State Machines **(4 marks)**

c) Using relevant example to illustrate, show that regular sets are closed under union, concatenation and kleene closure **(6 marks)**

QUESTION FOUR (20 MARKS)

a) Describe acceptance for a Push Down Automata, using a relevant example to illustrate (**4 marks)**

b) Given the PDA below, describe the PDA start configuration, and provide the sequence of configurations to show whether the string 010010111 is a string in the language of the PDA or not (**6 marks)**

c) For every NFA, there is a DFA called the equivalent DFA that accepts the same set as the NFA and there is a minimal DFA that accepts the same set. Using the NFA below to illustrate

i. Describe the process of generating an equivalent DFA, and give the resulting DFA **(4 marks)**

ii. Describe the process of generating a minimal DFA and give the minimal DFA **(4 marks)**

iii. Show that the string acceptable by the NFA is acceptable by the other two **(2 marks)**

QUESTION FIVE (20 MARKS)

a) Determine the Number of states require to simulate a computer with memory capable of storing '3' words each of length '8' **(4 marks)**

b) Describe the nine elements of a Turing machine, showing how the Turing machine differs from finite state automata **(11 marks)**

c) Pattern matching is key concept in the definition of finite state automata

i. Define pattern matching (**1 mark)**

ii. Describe how pattern matching applied in the operations of FSA **(2 marks)**

iii. Differentiate between atomic patterns and compound patterns (**2 marks)**