



# MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SCO 211: AUTOMATA THEORY

DATE: 1/12/2020

TIME: 2:00 – 4:00 PM

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## INSTRUCTIONS

Answer question ONE and any other TWO questions.

### QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Define the following
  - i. Alphabet (1 mark)
  - ii. Automaton (1 mark)
  - iii. Regular Language (1 mark)
  - iv. Kleen Star (1 mark)
- b) In theory of computation, what is the meaning of the following
  - i. Turing machine (2 marks)
  - ii. Recognizer (2 marks)
  - iii. Transducer (2 marks)
  - iv. Classifier (2 marks)
- c) List down components of a DFA (5 marks)
- d) Name any THREE operators associated with Language Processing in Automata theory (3 marks)
- e) Given  $\Sigma = \{0, 1\}$  Construct a NFA that recognizes ALL
  - i. strings in which every 1 is immediately followed by 00; (3 marks)
  - ii. strings that contain both 010 and 101 as substrings; (4 marks)
  - iii. Strings that end with 00. (3 marks)

## QUESTION TWO (20 MARKS)

- a) Provide a formal definition of a Grammar (4 marks)
- b) Suppose,  $L(G) = \{a^m b^n \mid m > 0 \text{ and } n \geq 0\}$ . Find out the Grammar G which produces L(G) (6 marks)
- c) Given  $\Sigma = \{a, b\}$
- i) Construct automaton for the Language in which every “a” is either immediately preceded by or immediately followed by “b” (5 marks)
- ii) List any 2 Strings in the Language (2 marks)
- iii) Construct a transition table for the problem above (3 marks)

## QUESTION THREE (20 MARKS)

- a) Describe applications of AUTOMATA (5 marks)
- b) Answer the following questions about Moore Machines
- i. Provide a formal definition if a Moore Machine (5 marks)
- ii. Draw the transition table of the machine (5 marks)
- iii. Sketch a diagram to represent the machine (5 marks)

## QUESTION FOUR (20 MARKS)

Answer the following questions about Mealy Machines

- a) Provide a formal definition of a Mealy Machine (5 marks)
- b) Draw the transition table of the machine (5 marks)
- c) Sketch a diagram to represent the machine (5 marks)
- d) Compare Mealy with Moore Machine (5 marks)

## QUESTION FIVE (20 MARKS)

- a) What is a deterministic finite automata machine? (4 marks)
- b) The following is the transition table of a Moore Machine. Convert it to a Mealy Machine by providing the equivalent transitions table (8 marks)

| Present State | Next State |       | Output |
|---------------|------------|-------|--------|
|               | a = 0      | a = 1 |        |
| a             | d          | b     | 1      |
| b             | a          | d     | 0      |
| c             | c          | c     | 0      |
| d             | b          | a     | 1      |

- c) Construct a machine for ALL strings over {a, b} That begin and end with the same symbol (8 marks)