MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

SCHOOL OF SCIENCE

COURSE CODE: COM 2206

COURSE TITLE: AUTOMATA THEORY

DATE: 2ND MAY 2018 **TIME: 11:00AM – 13:00PM**

INSTRUCTIONS TO CANDIDATES

i. *Answer question ONE (compulsory) and any other TWO questions.*
ii. *Question one carries 30 marks*
iii. *All other questions carry 20marks*
iv. *Mobile Phone is not allowed in the exam room*

SECTION A (COMPULSORY –30 MARKS)

QUESTION ONE

a) Give NFAs with the specified number of states recognizing each of the following languages. In all cases, the alphabet is $\Sigma = \{0, 1\}$. The language $\{ w \in \Sigma^* \mid w \text{ ends with } 00 \}$ with three states. **(5 Marks)**

b) Exain Pattern Matching and Regular Expressions. **(10marks)**

c) Consider the following non-deterministic finite automaton (NFA) over the alphabet $\Sigma = \{0, 1\}$.

Give a one-sentence description of the language recognized by the NFA. Write a regular expression for this language. **(10 Marks)**

d) Explain Universal Turing Machine. **(5 marks)**

SECTION B: ANSWER TWO QUESTION 40 MARKS

QUESTION TWO

a) Simplify $(\varnothing b + \epsilon a)^+ + \varnothing^*$ **(5 Marks)**

b) Explain Chomsky Normal Form. **(5 marks)**

c) State and Prove Parikh's theorem. **(5 marks)**

d) Show by giving an example that, if M is an NFA that recognizes language C, swapping the accept and non-accept states in M doesn't necessarily yield a new NFA that recognizes $\overline{C}$. **(5 Marks)**

QUESTION THREE

a) Explain Regular Expressions and Finite Automata. **(10 marks)**

b) Write regular expressions for the following languages over the alphabet $\Sigma = \{a, b\}$: **(5 Marks)**

c) Draw DFAs for each of the languages from question 1. None of your DFAs may contain more than 4 states. **(5 Marks)**

QUESTION FOUR

a) Differentiate NFA and DFA with respect to transition and acceptance. **(10 marks)**

b) Draw DFA which accepts even number of a's over the alphabet {a, b}. **(5 marks)**

c) Explain Myhill-Nerode Theorem. **(5 marks)**

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