



Kasarani Campus
Off Thika Road
Tel. 2042692 / 3
P. O. Box 49274, 00100
NAIROBI
Westlands Campus
Pamstech House
Woodvale Grove
Tel. 4442212

KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
THIRD YEAR, SECOND SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE

KCS 308 – FORMAL LANGUAGES AND AUTOMATA THEORY

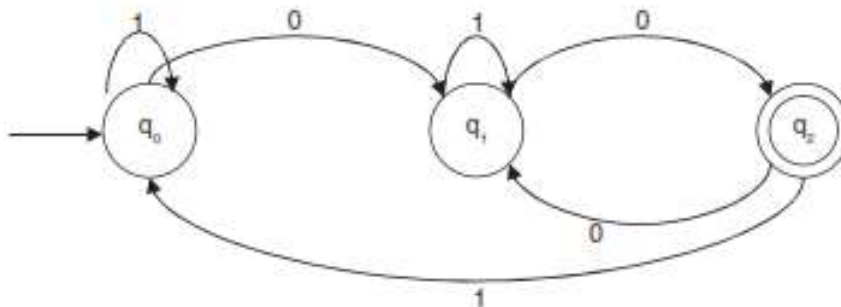
Date: 6TH December, 2022
Time: 11:30AM – 1:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

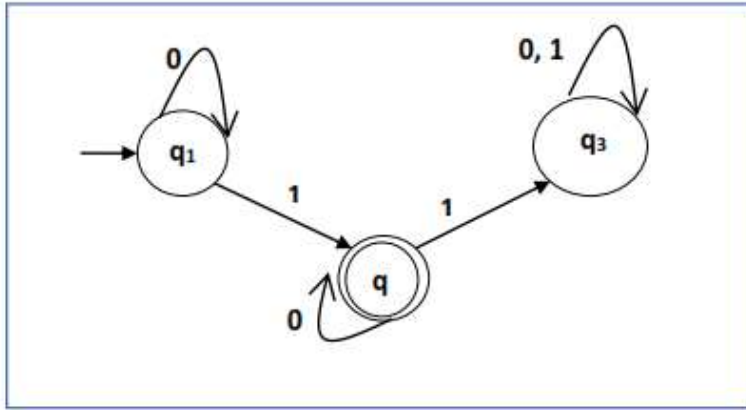
QUESTION ONE (30 MARKS)

- a) Test whether the strings 010010 and 01010 are accepted by the finite automata given in Figure below or not. (3 Marks)



- b) Define the following terms as used in Automata Theory (6 Marks)
- i) Alphabet
 - ii) String
 - iii) Kleene Star
- c) Construct a grammar for the language $a^n b^{n+1}$, $n > 0$ (4 Marks)

- d) Construct a regular expression corresponding to the automata given below: (6 Marks)



- e) Contrast between Non-determinism and Determinism. (2 Marks)
- f) Differentiate between (a,b) and (a+b)? (2 Marks)
- g) Finite Automata can be represented by three parts in a mechanical diagram, list the three parts. (3 Marks)
- h) Construct the language generated from the given grammar: (4 Marks)
- $$S \rightarrow aSb/\epsilon$$

QUESTION TWO (20 MARKS)

- a) The grammar is basically defined as a set of 4-tuple, discuss them with their symbols (8 Marks)
- b) What is the difference between FA and NFA? (4 Marks)
- c) Consider the following machine M1

Present State	Next State, z			
	I ₁	I ₂	I ₃	I ₄
A	–	C, 1	E, 1	B, 1
B	E, 0	F, 1	–	–
C	F, 0	F, 1	–	–
D	–	–	B, 1	–
E	–	F, 0	A, 0	D, 1
F	C, 0	–	B, 0	C, 1

- i) Construct a merger table for M1 (4 Marks)
- ii) Find the set of compatibles. (4 Marks)

QUESTION THREE (20 MARKS)

- a) Discuss the types of grammars according to Chomsky's Hierarchy (12 Marks)
- b) Convert the following NFA to an equivalent DFA. (8 Marks)
- (q_0 is the initial state and q_1 is the final state)

Σ		
States	0	1
q_0	q_0	q_0, q_1
q_1	q_2	q_2
q_2	-	q_2

QUESTION FOUR (20 MARKS)

- a) With the use of a well labeled illustration, Discuss the components of the mechanical diagram of the PDA (8 Marks)
- b) Find the languages generated by the following grammar (4 Marks)
- $S \rightarrow aSa/aba$**
- c) Test whether the following strings are accepted by the following finite automata or not: (8 Marks)
- i) 0001101
- ii) 00000

Present State	Next State	
	0	1
$\rightarrow q_0$	q_2	q_3
q_1	q_0	q_2
q_2	q_1	q_3
q_0	q_1	q_1

QUESTION FIVE (20 MARKS)

- a) Finite automata with output can be divided into two types, describe the two types. (8 Marks)
- b) Draw the state transition of a deterministic finite state automaton which accepts all strings from the alphabet (a, b), such that no string has three consecutive occurrences of the letter b. (6 Marks)
- c) State the two types of Finite Automata (2 Marks)
- d) Show the derivation tree for the string 'aabbbb' with the following grammar. (4 Marks)
- $S \rightarrow AB/\epsilon$
 $A \rightarrow aB$
 $B \rightarrow Sb$