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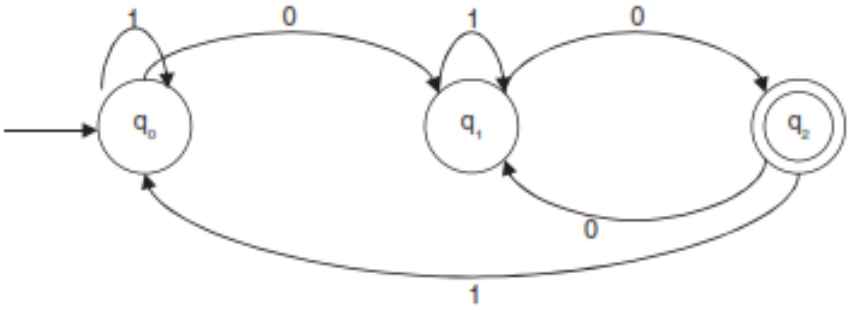
KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
THIRD YEAR, SECOND SEMESTER EXAMINATION
FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE
(SPECIAL EXAMINATION)
KCS 308 FORMAL LANGUAGES AND AUTOMATA THEORY

Date: 13TH AUGUST, 2024
Time: 8:30AM – 10:30MM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS
QUESTION ONE: (30 MARKS)

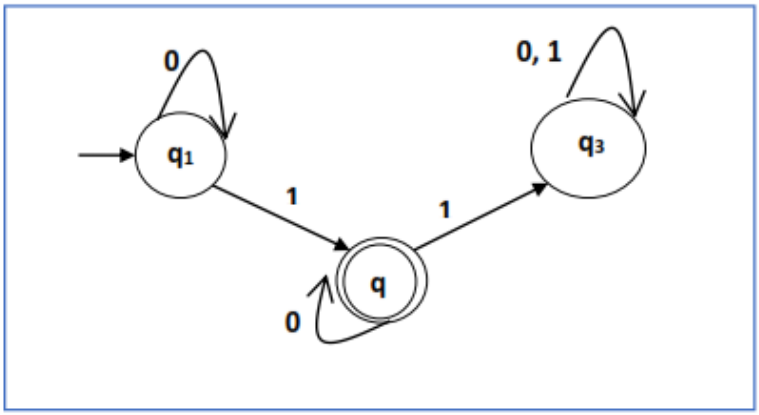
a) Test whether the strings 010010 and 01010 are accepted by the finite automata given in Figure below or not. (3 Marks)



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)

$S \rightarrow aSb/\varepsilon$

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

	Next State, z			
Present State	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)
(q0 is the initial state and q1 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
→ q_0	q_2	q_3
q_1	q_0	q_2
q_2	q_1	q_3
(q_0)	q_3	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)

$S \rightarrow AB/\varepsilon$

$A \rightarrow aB$

$B \rightarrow Sb$