KENYA METHODIST UNIVERSITY
END OF TRIMESTER ONE EXAMINATIONS, JANUARY 2009

FACULTY	:	ARTS AND SCIENCES.
DEPARTMENT	:	COMPUTE.R INFORMATION SYSTEMS.
COURSE CODE	:	CISY 305
COURSE TITLE	:	AUTOMATA AND FORMAL LANGUAGES.
TIME	:	2 HOURS

INSTRUCTIONS: Answer Question 1 and any other two questions

SECTION A: (Compulsory)

Question 1

(a)

(i) Differentiate Existential and Universal quantifiers giving examples

(2 marks)

(ii) Explain the three main classes or areas of study in automata theory

(6 marks)

(iii) Define a set; describe the cardinality of a set giving an example.

(3 marks)

(b) Create a logical formula that captures the following English statement:
Everybody loves my baby, but my baby don't love nobody but me.

(4 marks)

(c) Define the following terms used in automata theory :

(iv) Empty string
(v) Alphabet.
(vi) String.
(vii) Language.

(4 marks)

(d) Regular languages over an alphabet Σ are defined recursively by three rules, outline the rules.

(3 marks)

(e) Distinguish between formal and regular languages.

(2 marks)

(f) Discuss the Church-Turing thesis.

(2 marks)

(g) Define the halting problem.

(2 marks)

(b) Differentiate between recognizable and decidable languages.

(2 marks)

SECTION B: (Attempt any two questions from this section)

Question 2

(a) Briefly explain the following terms used in automata theory :

(i) Proof.
(ii) Conjecture.
(iii) Preposition.
(iv) Theorem.
(v) Lemma.
(vi) Corollary.

(6 marks)

(b) Define formally a deterministic finite Automaton (FA).

(6 marks)

(c) Given A Deterministic Finite Automaton (DFA) M such that M = (Q, Σ, δ, q0, F).
Where:

Q = {q0, q1, q2, q3}

δ, is defined by the following table:

	0	1
q_0	q_1	q_3
q_1	q_2	q_3
q_2	q_3	q_2
q_3	q_3	q_4
q_4	q_4	q_4

(vii) Determine the alphabet set Σ. (2 marks)
(viii) The set of acceptable states F. (2 marks)
(ix) Represent the above table as a transition network. (4 marks)

Question 3

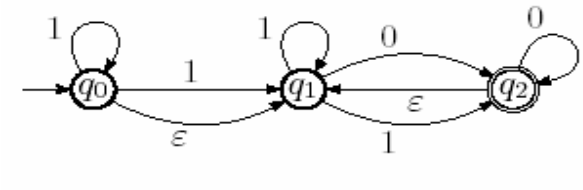
(a) Differentiate regular expressions and languages from context free grammars and languages giving two examples of application areas for each.

(4 marks)

(b) Give a DFA for recognizing the language of all binary strings ending in 0110

(4 marks)

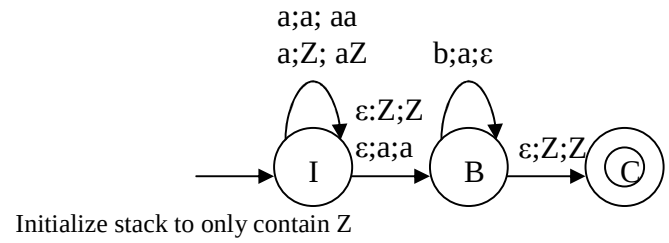
(c) Let δ below, the transition network for an NFA.



(i) Determine the alphabet set Σ. (3 marks)
(ii) The set of acceptable states F. (2 marks)
(iii) Represent the above Network as a transition function table. (7 marks)

Question 4

(a) Below is a PDA diagram, indicate the values of Q, Σ, Γ, q0, F then draw a transition table to represent the PDA. .



(8 marks)

(b) Define Formally Context Free-grammar.

(6marks)

(c) Write a logical formula in predicate calculus (First Order Logic) that will represent the following English statement written in natural language.

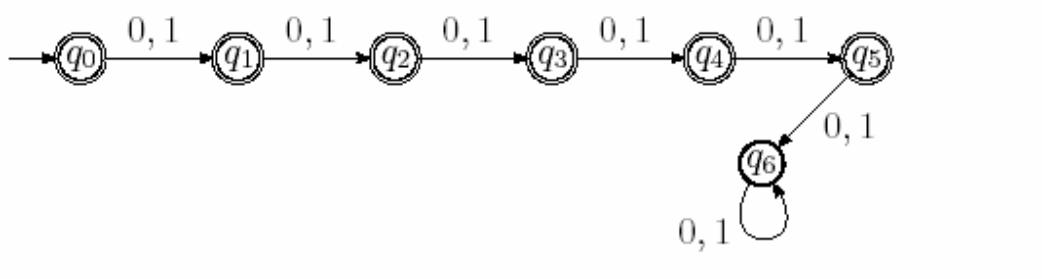
You can fool all of the people some of the time, and you can fool some of the people all of the time, but you can't fool all of the people all of the time. *(6 marks)*

Question 5

(a) Discuss four important properties of regular languages.

(4 marks)

(b) Let Σ= {0, 1} and L = {w | Len (w) is at most 5}. Show that L is a regular DFA by use of a transition network then draw a transition table to represent the network.



(5 marks)

(c) Describe the formal definition of Push-Down Automata.

(6 marks)

(d) Give a formal definition of a Turing machine

(5 marks)