Machakos University College

(A Constituent College of Kenyatta University)
UNIVERSITY EXAMINATIONS 2013/2014
SCHOOL OF BUSINESS
SECOND YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 211: AUTOMATA THEORY

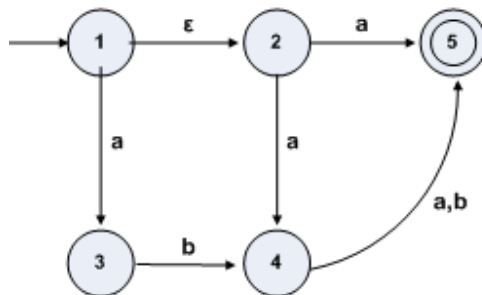**DATE**: 1/4/2014   **TIME:** 8.30 a.m. – 10.30 a.m.

Instructions: Answer Question 1 and Any Other Two.

Question 1: Compulsory (30 Marks)
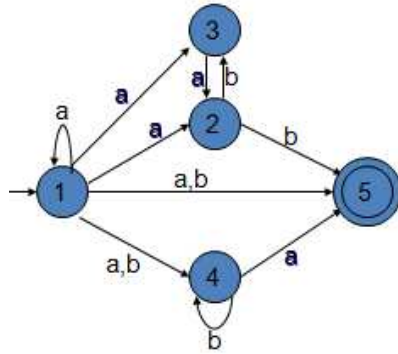
a)   Explain what you understand by the term Finite State Machine   **(3 Marks)**

b)   Give a brief justification as to why *Automata* and *Languages* are necessary for computing

(4 Marks)

c)   Convert the following NFAs to their equivalent DFAs

   i.

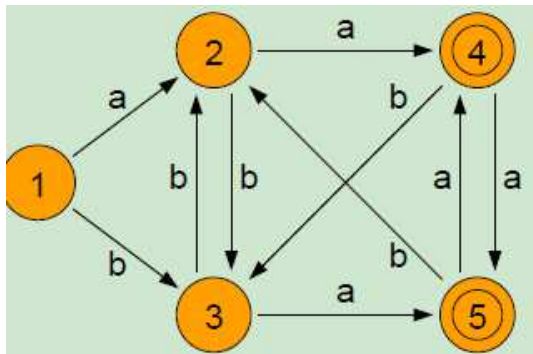**(6 Marks)**

ii.

(5 Marks)

d)

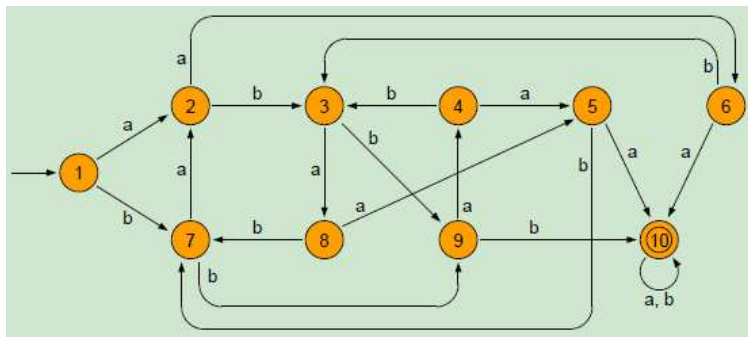i.   Outline the Minimization algorithm learnt in class   **(5 Marks)**

ii.   Applying the algorithm in Qst. 1)(d)(i) above, minimize the below Automata:

a)

(3 Marks)

b)

(4 Marks)

Question 2: (20 Marks)

a)   Given the sets S1 and S2 described as S1= {I : I>0 and I is even} and S2 = {I : I>0 and I

is a multiple of 5}, perform the following operations:

i.   S1 ∩ S2   **(3 Marks)**

ii.   S1 U S2   **(3 Marks)**

iii.   S1 – S2   **(4 Marks)**

b)   Using an example, differentiate between Deterministic Finite Automata (DFA) and Non-deterministic Automata (NFA).   **(6 Marks)**

c)   Compare and contrast regular languages and regular expressions.   **(4 Marks)**

Question 3: (20 Marks)

a) Using examples, briefly explain the following terms as they relate to Automata Theory:
   i.   Alphabet   **(3 Marks)**
   ii.   String   **(2 Marks)**
   iii.   Language   **(3 Marks)**

b) Construct complete *deterministic automata* recognizing each of the following languages. Justify your answers.
   i. $a^2 + (a^3 + a^6 + a^8)(a^6)^*$ **(5 Marks)**
   ii. $\{x \in (a + b)^* : |x| >= 4\}$ **(4 Marks)**
   iii. $abab(a+b)^*$ **(3 Marks)**

Question 4: (20 Marks)

a)   In the automaton diagram below the state labels are below each state (i.e. S, P, Q,...). Do not use the names q0, q1,...to refer to the states. Also note that the loop on state M (the one with both a and b on it) means that there are two loops at M, one labeled a and the other labeled b
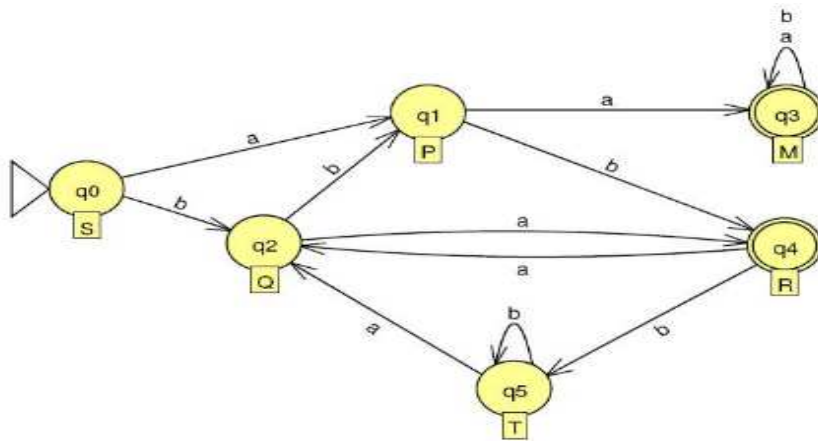
For each of the following display the sequence of configurations and state if the word is accepted by the language of the automaton, or not.

   i.   abaa   **(4 Marks)**

   ii.   abbbaaaba   **(4 Marks)**

   iii.   bbbbb   **(4 Marks)**

b) Find a regular expression for the language L below:

L= {W∈{0,1}*| W has no pair of consecutive zeros}   **(4 Marks)**

c) Find a regular expression for the set $\{a^n b^m: (n+m) \text{ is even}\}$ **(4 Marks)**

Question 5: (20 Marks)

a) List and explain any TWO application areas of regular expressions.   **(4 Marks)**

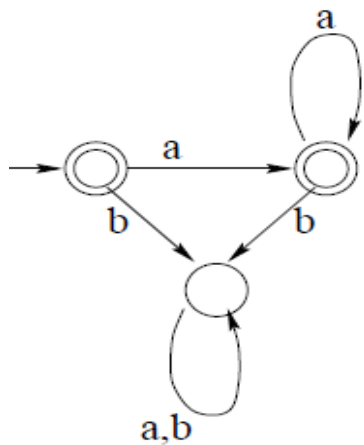b) A Deterministic Finite Automata B, is described by the following 5 items

$$B = (Q, \Sigma, \delta, q_0, F)$$

Required: Using an example, explain what each of the five items above stands for.
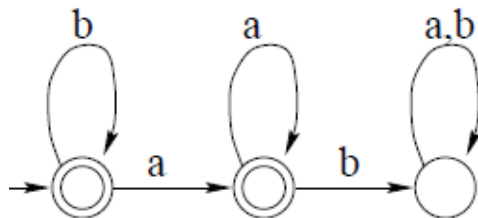
(10 Marks)

c) Determine (and describe in English) the languages recognized by the following DFA:

i.

(3 Marks)

ii.

(3 Marks)

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