he Open University of Sri Lanka

.Sc. Degree Programme: Level - 05

nal Examination - 2007

SU 3275/PMU3293/PME5293 - Automata Theory -Paper II

uration: Two and Half Hours.

ate: 18.06.2007 1.30 pm - 4.00 pm

nswer Four Questions Only.

i)
a) State the necessary condition for the non-trivial parallel decomposition.

b) What do you mean by the term 'non - trivial' in the above part a)?

c) "Trivial partitions cannot be used for decomposition". Is this statement correct? Justify your answer.

ii) Draw a DFA that acts as a parity checker. [Hint: parity checker's role is to add one (1) to the odd stream to make it even.]

i) Define the SP property of a partition.

ii) Given below is a transition table of a Mealy machine M.

	State Transition					Output Transition				
	1	2	3	4	5	1	2	3	4	5
a	a	c	a	e	b	1	0	1	0	0
b	c	c	a	e	d	1	0	1	0	0
c	b	c	a	e	b	1	0	0	1	0
d	b	a	c	a	b	1	0	0	1	1
e	c	e	a	e	b	0	1	1	0	1

a) Find the SP Partitions of M.

b) Hence, decompose M parallely.

c) If you are to decompose M serially what are the additional features you need to know?

3. i) Prove for any three Mealy machines $M1$, $M2$ and $M3$ where k1: $O_1 \rightarrow I_2$ k2: $O_2 \rightarrow I_3$ are defined. Show that the following are true.

   a) $M1 \oplus_{k1} (M2 \oplus_{k2} M3) \leq (M1 \oplus_{k1} M2) \oplus_{k2} M3$

   b) $M1 \,||\, (M2 \,||\, M3) \leq (M1 \,||\, M2) \,||\, M3$

   ii) Suppose $M1$ and $M2$ are two Mealy machines.

   a) Show that $(M1 \,||\, M2) \approx (M2 \,||\, M1)$.

   b) Is $(M1 \oplus_{k1} M2) \approx (M2 \oplus_{k2} M1)$, where k1: $O_1 \rightarrow I_2$ and k2: $O_2 \rightarrow I_1$? Justify your answer.

4. i) Consider the recursive definition of the language L given below.
   L consists of all stings over {0,1} obtained from the basis step by a finite number of applications of the recursive step.
   Basis: The empty string ε in L.
   Recursive: If $x \in L$ then 1x0 is in L.
   Prove, by induction, that $L = \{1^i\ 0^j \mid i \geq j \geq 0\}$.

   ii) a) Construct a DFA that accepts strings over the alphabet {0,1} that have at least one 1 and an even number of 0s after the last 1.

   b) A DFA has to be constructed for accepting all the words that have $(10101)^n\ 01$ as a string, where n is a positive integer. How would you do this construction if the input alphabet is {0,1}?

i) Compare the differences of states, inputs, outputs and state/output transition of two mealy machines in parallel and serial composition.

ii) The following is a transition table of the Mealy machines M1 and M2.

M1

	1	2	1	2
S1	S2	S3	b	a
S2	S1	S3	b	a
S3	S2	S4	a	b
S4	S1	S4	a	b

M2

	0	1	0	1
00	00	10	0	0
01	00	10	1	1
10	01	11	0	0
11	01	11	1	1

a) If M is to be serially composite with itself, what are the states of the composite machine?

b) Give the state and output transition tables of the composite machine.

5. i) Find all the upper and lower bounds of the SP partitions given below.

$\pi_1 = \{\{1, 2\}, \{3\}, \{4\}, \{5\},\{6\}\}$

$\pi_2 = \{\{1\}, \{2\}, \{3\}, \{4\}, \{5, 6\}\}$

$\pi_3 = \{\{1, 2\}, \{3\}, \{4\}, \{5, 6\}\}$

$\pi_4 = \{\{1, 4\}, \{2, 3, 5, 6\}\}$

ii) Draw the lattice for the above partitions.