BLG311E – FORMAL LANGUAGES AND AUTOMATA

2017 SPRING

RECITEMENT 1

1) Transform the given Moore machine into the Mealy model and reduce the states of the transformed machine.

	0	**1**	**Output**
S_0	S_4	S_2	1
S_1	S_4	S_2	1
S_2	S_5	S_0	0
S_3	S_7	S_6	0
S_4	S_1	S_4	0
S_5	S_0	S_4	0
S_6	S_3	S_2	1
S_7	S_1	S_5	0

Solution:

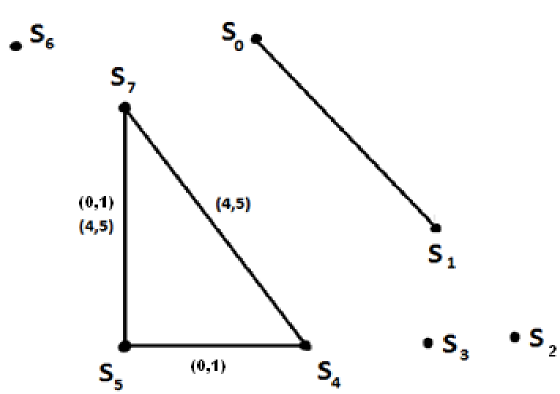
	0	**1**	**Output**
S_0	S_4	S_2	1
S_1	S_4	S_2	1
S_2	S_5	S_0	0
S_3	S_7	S_6	0
S_4	S_1	S_4	0
S_5	S_0	S_4	0
S_6	S_3	S_2	1
S_7	S_1	S_5	0

Moore

	0	**1**
S_0	$S_4/0$	$S_2/0$
S_1	$S_4/0$	$S_2/0$
S_2	$S_5/0$	$S_0/1$
S_3	$S_7/0$	$S_6/1$
S_4	$S_1/1$	$S_4/0$
S_5	$S_0/1$	$S_4/0$
S_6	$S_3/0$	$S_2/0$
S_7	$S_1/1$	$S_5/0$

Mealy

	S_0	**S_1**	**S_2**	**S_3**	**S_4**	**S_5**	**S_6**
S_1	OK						
S_2	X	X					
S_3	X	X	(5,7), (0,6) X				
S_4	X	X	X	X			
S_5	X	X	X	X	(0,1) OK		
S_6	(3,4) X	(3,4) X	X	X	X	X	
S_7	X	X	X	X	(4,5) OK	(0,1), (4,5) OK	X



	0	**1**	
A	D/0	B/0	A={S_0,S_1}
B	D/0	A/1	B={S_2}
C	D/0	E/1	C={S_3}
D	A/1	D/0	D={S_4,S_5,S_7}
E	C/0	B/0	E={S_6}

2) Consider the given state transition table on the right which belongs to an incompletely specified Mealy machine

- **a)** Reduce the states of this machine
- **b)** Find the complete cover and the minimal closed cover for this machine
- **c)** Give the state transition table for the minimal closed cover in Mealy model
- **d)** Transform the resulting state transition table (in **c**) into the Moore model

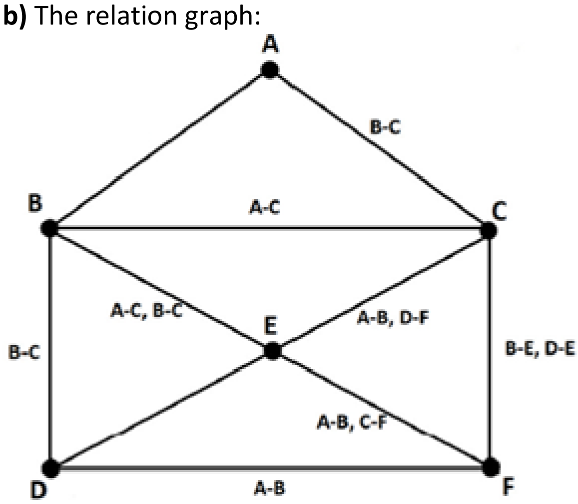
	I1	**I2**	**I3**	**I4**
A	B/0	-/-	-/-	E/1
B	A/0	C/-	-/-	-/-
C	C/-	A/1	D/1	E/-
D	-/-	B/-	-/-	A/-
E	C/-	B/1	F/-	-/0
F	F/1	A/-	E/-	B/-

Solution:

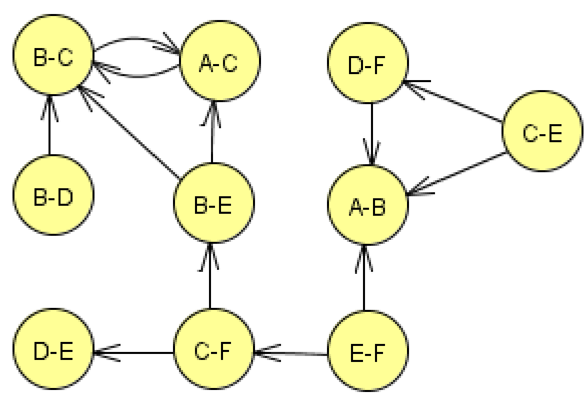
a) Dependency table for the given model:

	A	B	C	D	E
B	√				
C	B-C √	A-C √			
D	E-A **X**	B-C √	A-B A-E **X**		
E	**X**	A-C B-C √	A-B D-F √	√	
F	**X**	**X**	D-E E-B √	A-B √	A-B C-F √

b) The relation graph:



The dependency graph:



Complete cover = {A,B,C}, {B,D,E}, {C,E,F}, {B,C,E}, {D,E,F}   (all the maximal compatibility classes)

Minimal Closed Cover

A set of k compatibles forming the set $\mathbb{S}$ is called a minimal closed cover if and only if $\mathbb{S}$ satisfies

1. Covering condition: $\mathbb{S}$ covers the machine $\mathbb{M}$
2. Closure condition: $\mathbb{S}$ is closed
3. Minimal condition: A set of $k-1$ or less compatibles does not satisfy both covering condition and closure condition.

Maximal compatibility classes can be considered to satisfy the minimal condition. In this example, there is only one set of these maximal compatibility classes that also satisfies the covering condition by involving all the states defined in the machine, {A,B,C} and {D,E,F}. However, this set does not satisfy the closure condition as the relation C-F is not involved which is required for compatibility of the states E-F. Thus, we need at least three compatibility classes for the minimal closed cover. When the dependency graph is examined, it is seen that all the compatible state pairs except D-E require the relations involved in the maximal compatibility class {A,B,C}. Thus, it makes sense to select {A,B,C} first. Then, compatibility classes involving the states D, E and F are needed to be involved in the cover to satisfy the covering condition. D-E is a good candidate as it does not require any other relations. It is possible to select D-F as it only requires A-B that is contained in {A,B,C}. Then the minimal closed cover becomes {A,B,C}, {D,E} and {D,F}.

Note: Alternative solutions can be found for the minimal closed cover such as {A,B,C}, {B,E} and {D,F}

c)

α={A,B,C}
β={D,E}
γ={D,F}

	I1	**I2**	**I3**	**I4**
α	α/0	α/1	β, γ/1	β/1
β	α/-	α/1	γ/-	α/0
γ	γ/1	α/-	β/-	α/-

d)

		I1	**I2**	**I3**	**I4**	**Output**
K	**α/0**	K	L	M,N	M	0
L	**α/1**	K	L	M,N	M	1
M	**β/1**	K,L	L	N	K	1
N	**γ/1**	N	K,L	M	K,L	1