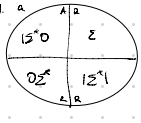
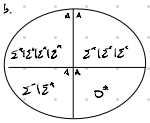
1. a.



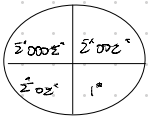
	ε	0	10	11
ε				
0	10			
10	ε	ε		
11	10	0	ε	

b.



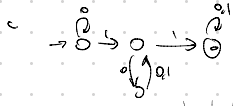
	0	1	11	111
0				
1	11			
11	1	1		
111	ε	ε	ε	

c.



	1	0	00	00
1				
0	00			
00	0	0		
000	ε	ε	ε	

c



pure $\exists$ 3 strgs in diff classes

	0	1	11	10
0				
1	00			
11	ε	ε		
10	ε	00	11	ε

≥ 4 equiv classes.

$\Rightarrow$ min size of DFA ≥ 4

$\rightarrow$ DFA optimal

2a) $L \equiv$ string = string^R

w as i≠j s.t. $0^i10^i \in L$
$0^j10^j \notin L$

$\{0, 010, 00100 \ldots\}$ this can be done for any power of string $\Leftrightarrow$ every palindrome = own equiv class

2b. i≠j $0^i1^i \in L$
$0^j1^j \notin L$ $\rightarrow$ $\{01, 0011, 000111, \ldots\}$ are all in own equiv class

$0^i \equiv_L 0^j$

$\downarrow$

so # of strings in equiv classes all by themselves.

3. i≠j $0^i1^i2^i \in L$
$0^j1^j2^j \notin L$ } diff suffix
a) $0^i1^i \not\equiv_L 0^j1^j$

$\downarrow$

$\{\varepsilon, 01, 0011, 000111 \ldots\}$ are in diff equiv classes.

$\rightarrow$ ∞ many equiv classes.

$\rightarrow$ L non-reg. ▫

b) i≠j $0^i10^i1 \in L$
$0^j10^j1 \notin L$
$0^i10^i1 \not\equiv_L 0^j10^j1$

$\rightarrow$ 11, 0101, 001001, 00010001 ... in diff equiv classes.

$\rightarrow$ ∞ many equiv classes.

L is non-reg. ▫

c. i≠j $0^i0^i \in L$
$0^j0^j \notin L$
$0^i \not\equiv_L 0^j$

$0^i \cdot 0^i = 0^{2i+1} \in L$
$0^j \cdot 0^j = 0^{2j+1} \cdot 0^i$
$= 0^i(1) \notin L$

$\hookrightarrow$ 00, 0000 ... diff equiv classes.

$\hookrightarrow$ ∞ many equiv classes

$\hookrightarrow$ L non-reg.

4.

pure $\exists$ 2 strings in diff classes

a)

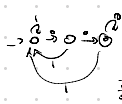
	ε	1
ε		
1	ε	

$\rightarrow$ ≥ 2 equiv classes

$\rightarrow$ min size of DFA ≥ 2

DFA optimal

b)



pure $\exists$ 3 strings in diff classes.

	1	0	00
1			
0	0		
00	ε	ε	

$\rightarrow$ ≥ 3 equiv classes.

$\rightarrow$ min size of DFA ≥ 3 $\rightarrow$ DFA optimal