

12.1

1) a)  $L_1 \leq 4$

$$\Sigma = \{x, y\}$$

$$L_0 = \emptyset \quad L_1 = \{x, y\}$$

$$L_2 = \{xx, yy\} \quad L_3 = \{xxx, yyy, xxy, yxy\}$$

$$L_4 = \{xxxx, yyyy, xyyx, \cancel{xyxy}\}$$

$$L_1 = \{\emptyset, x, y, xx, yy, xxx, yyy, xyy, yxy, xxxx, yyyy, xyyx, yxx\}$$

b)  $L_2 \leq 3 \quad \Sigma = \{x, y\}$  begin with  $x$

$$L_0 = \emptyset \quad L_1 = \{x\} \quad L_2 = \{xx, xy\}$$

$$L_3 = \{xxx, xxy, \cancel{xx}, xyy\}$$

$$L_2 = \{x, xx, xy, \cancel{xt}, xxy, yxt, yyy\}$$

16)  $0^* 1 (0^* 1^*)^*$

- a) 1      b) 01      c) 011      d) 0101      e) 10000

17)  $b^* | b^* ab^*$

- a) b      b) bb      c) a      d) bab  
 e) bbb

22)  $(b|\lambda)a(a|b)^*a(b|\lambda)$

string = aaaba, baabb

- a) aaaba belongs to expression  
 1. from  $(b|\lambda)$     a, ab from  $(a|b)$ , then  
 a from  $(b|\lambda)$

b) baabb does not belong to expression  
last two elements can't be bb  
only aa, ab, ba.

23)  $(x^*y \mid zy^*)^*$  string = zyxz, zyyzy

a) zyxz does not belong to expression.  
in  $x^*y$  after any x it is either x or y  
not z

b) zyyzy does not belong to expression  
since zy and zy are part of  
 $zy^*$  and it is closed by concatenation.

34) All words that are written in lower case  
and contain at least one of the vowels a,e,i,o,u

$$[a-z] = [a \mid b \mid c \dots \mid z]$$
$$[a-z]^* (a \mid e \mid i \mid o \mid u) [a-z]^*$$

37) All United States social security #'s  
 (consist of three digits, hyphen, two digits, hyphen, four digits) where the final four digits start with a 3 and end with a 6

$$[0-9] = [0|1|2 \dots |9]$$

$$[0-9][0-9][0-9] - [0-9][0-9] - 3[0-9][0-9]6$$

12.2            1, 2, 3, 5, 8, 10, 15, 21

a) Quarter, half dollar, quarter

\$1 or more deposited

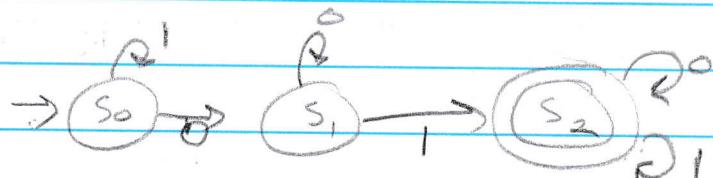
b) Quarter, half dollar, half dollar

\$1 or more deposited

c) Half dollar, quarter, quarter, quarter, half dollar

\$1.75 if deposited stopped at 75¢

2)



a) states?  $s_0, s_1, s_2$

b) input symbols  $0, 1$

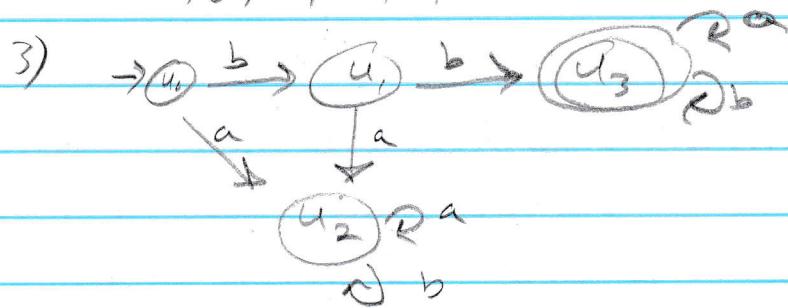
c) initial state  $s_0$

d) accepting states  $s_2$

e) next state table

$s_0$	$s_1$	$s_0$
$s_1$	$s_1$	$s_2$
$s_0$	$s_2$	$s_2$

5, 8, 10, 15, 21



a)  $u_0, u_1, u_2, u_3$     e)

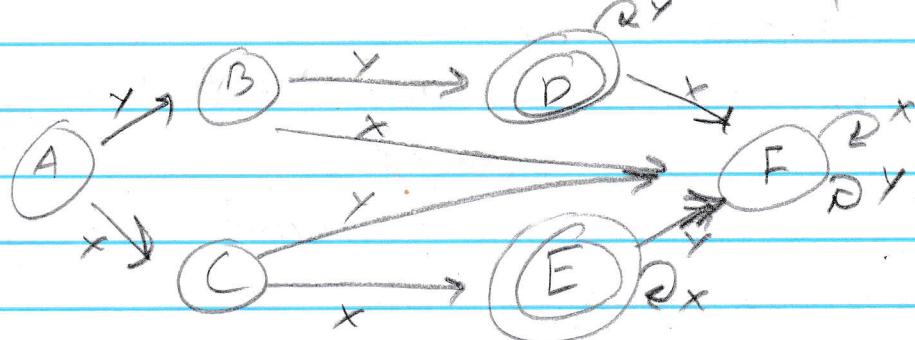
b) a b

c)  $u_0$

d)  $u_3$

a	b
$u_0$	$u_2$
$u_1$	$u_2$
$u_2$	$u_2$
$u_3$	$u_3$

5)



a) A, B, C, D, E, F

b) x, y

c) A

d) D, E

e)

	x	y
A		
B		
C		
D		
E		
F		

8) 10, 15, 21

8)	0	1
$s_0$	$s_1$	$s_2$
$s_1$	$s_1$	$s_2$
$s_2$	$s_1$	$s_2$

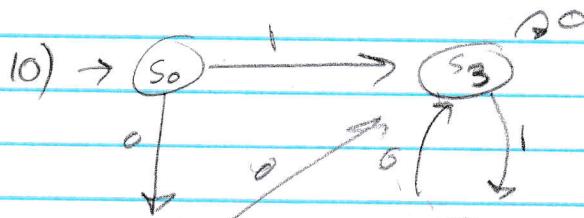
a)  $s_0, s_1, s_2$

b) 0, 1

c)  $s_0$

d)  $s_2$

e)



a)  $N(s_1, 1) = s_2$   
 $N(s_0, 1) = s_3$

b)  $N(s_2, 0) = s_3$   
 $N(s_1, 0) = s_3$

c)  $N^*(s_0, 10011) = s_2$   
 $N^*(s_1, 01001) = s_2$

d)  $N^*(s_2, 11010) = s_3$   
 $N^*(s_0, 01000) = s_3$

15) a) set of only x's or y's with a length of 2.

b)  $yyy^* | xxx^*$

2) Input alphabet = {0, 1}, Accepts set of all strings starting with 01.

a)

b)  $01(011)^*$

