

12.1

1) a) $L \leq 4$

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

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

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

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

$$L = \{\epsilon, x, y, xx, yy, xxx, yyy, xyy, yxy, xxxx, yyyy, xyyx, yxyx\}$$

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

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

$$L_3 = \{xxx, xxy, ~~xyx~~, xyy\}$$

$$L_2 = \{x, xx, xy, xxx, xxy, xyx, xyy\}$$

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

a) 1 b) 0101 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

2a 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) $(x^*y | zy^*)^*$ string = ~~zyx~~xz, zy~~zy~~zy

a) ~~zyx~~xz does not belong to expression
in x^*y after any x it is either x or y
not z

b) zy~~zy~~zy 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

$[a-z] = [a|b|c \dots |z]$

$[a-z]^* (a|e|i|o|u) [a-z]^*$

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

1) a) Quarter, half dollar, quarter

\$1 or more deposited

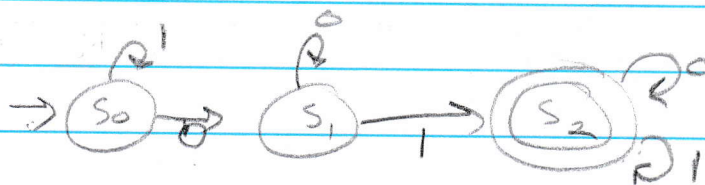
b) Quarter, half dollar, half dollar

\$1 or more deposited

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

\$1.75 deposited - stopped at 75¢

2)



a) states? s_0, s_1, s_2

b) input symbols 0, 1

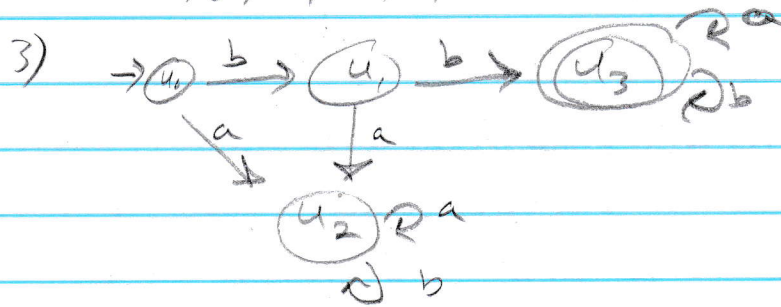
c) initial state s_0

d) accepting states, s_2

e) next state table

	0	1
s_0	s_1	s_0
s_1	s_1	s_2
s_2	s_2	s_2

5, 8, 10, 15, 21



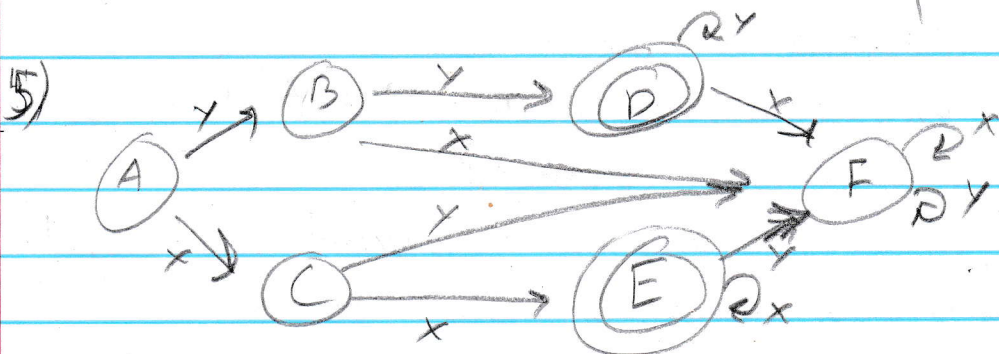
a) u_0, u_1, u_2, u_3 e)

b) a b

c) u_0

d) u_3

	a	b
$\rightarrow u_0$	u_2	u_1
u_1	u_2	u_3
u_2	u_2	u_2
$\odot u_3$	u_3	u_3



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

b) x, y

c) A

d) D, E

e)

	x	y
$\rightarrow A$	C	B
B	F	D
C	E	F
$\odot D$	F	D
$\odot E$	E	F
F	F	F

8) 10, 15, 21

8)

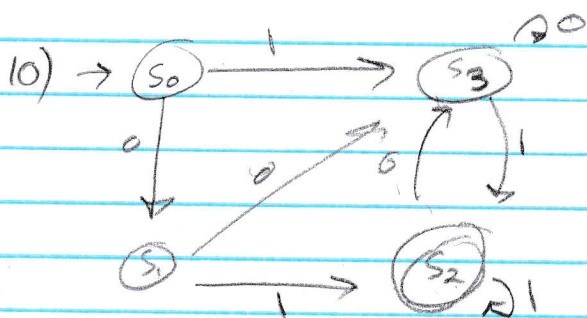
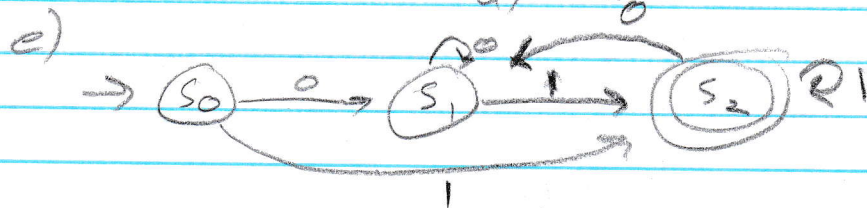
	0	1
$\rightarrow s_0$	s_1	s_2
s_1	s_1	s_2
s_2	s_1	s_2

a) s_0, s_1, s_2

b) 0, 1

c) s_0

d) $s_2, 0$



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) $xyx^* | xxx^*$

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

a)

b) $01(0|1)^*$

