2.1

a. $c^* \cdot a \cdot c^* \cdot b \cdot (a|b|c)^*$

b. $(aa|b|c)^*$

c. $(0|1)^* \cdot 100$

d. $(0|1)^* \cdot 0 \cdot (11 \cdot (0|1)^4 \,|\, 1011 \cdot (0|1)^2 \,|\, 1010 \cdot (0|1)) \,|\, (0|1)^* \cdot 1 \cdot (0|1)^6$

e. $(a|c|b^+c|b^+ab^+c)^* \,|\, b^*$

f. $0 \cdot [0-7]^* \,|\, [1-9]^+$

g. $-10 \,|\, -1 \,|\, 0 \,|\, 1 \,|\, 10$

2.2 a. To confirm if a string $\in L$, the memory space we need must be finite, but for this language, we can never know if it satisfy the requirement before we finish reading it. And it cannot be repsented by simple loops, neither. It can also be proved by the pumping lemma.

b. Similar to a.

c. Similar to a.

2.3

a.

S	a	$\delta(S,a)$
(1,2,3,4)	x	(5,6,7)
(1,2,3,4)	y	(6,7)
5	z	(1,2,3,4)
(5,6,7)	ϵ	(6,7)
(6,7)	ϵ	7

b.

S	a	$\delta(S,a)$
1	a	(1,2)
1	b	1
(1,2)	a	(1,2,3)
(1,2)	b	(1,3)
(1,3)	a	(1,2,4)
(1,3)	b	(1,4)
(1,4)	a	(1,2,5)
(1,4)	b	(1,5)
(1,5)	a	(1,2,6)
(1,5)	b	(1,6)
(1,6)	a	(1,2,6)
(1,6)	b	(1,6)

(1,2,3)	a	(1,2,3,4)
(1,2,3)	b	(1,2,4)
(1,2,4)	a	(1,2,3,5)
(1,2,4)	b	(1,3,5)
(1,2,5)	a	(1,2,3,6)
(1,2,5)	b	(1,3,6)
(1,2,6)	a	(1,2,3,6)
(1,2,6)	b	(1,3,6)
(1,3,4)	a	(1,2,4,5)
(1,3,4)	b	(1,4,5)
(1,3,5)	a	(1,2,4,6)
(1,3,5)	b	(1,4,6)
(1,3,6)	a	(1,2,4,6)
(1,3,6)	b	(1,4,6)
(1,4,5)	a	(1,2,5,6)
(1,4,5)	b	(1,5,6)
(1,4,6)	a	(1,2,5,6)
(1,4,6)	b	(1,5,6)
(1,5,6)	a	(1,2,6)
(1,5,6)	b	(1,6)
(1,2,3,4)	a	(1,2,3,4,5)
(1,2,3,4)	b	(1,3,4,5)

(1, 2, 3, 5) a (1, 2, 3, 4, 5, 6)
(1, 2, 3, 5) b (1, 3, 4, 6)
(1, 3, 4, 5) a (1, 2, 3, 4, 5, 6)

⋮

2.6 (2, 8) (4, 6) (1, 5)