2.1

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

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

c. $(0|1)^*\,00$

d. $(10|01\,(0|1))\,|$
$(10\,||(0|1)(0|1))\,|$
$(\,||(0|1)(0|1)(0|1)(0|1))\,|$
$(\,|(0|1)^*(0|1)(0|1)(0|1)(0|1)(0|1)(0|1))$

e. $a^*\,(b|ba|ca^*)^*$

f. $(0[0-7]^*)\,|\,([1-9][0-9]^*)$

g. $1|10$

2.2

a. Regular expression is not capable of counting numbers of characters.

b. Regular expression is not capable of "remembering" the content of a certain position.

c. Regular expression can't represent syntactic grammar.

2.5

a. input x: 1 $state[1]=\{1,2,3,4\}$

    input y: 2 $state[1]\xrightarrow{x}state[2]=\{5,6,\underline{1}\}$

    input z: 5 $state[1]\xrightarrow{y}state[3]=\{6,\underline{1}\}$

               $state[2]\xrightarrow{z}state[4]=\{2,3,4,\underline{1}\}$

                            $=state[1]$

x z

2   5,6,7

6,7   3
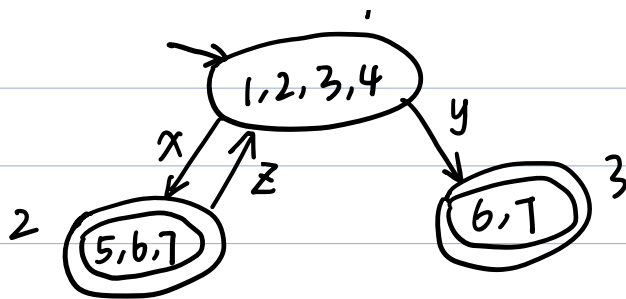
b. input a: 1, 2, 3, 4, 5

    input b: 1, 2, 3, 4, 5

state[1] = {1}

state[1] $\xrightarrow{a}$ state[2] = {1,2} , state[1] $\xrightarrow{b}$ state[1]

state[2] $\xrightarrow{a}$ state[3] = {1,2,3} , state[2] $\xrightarrow{b}$ state[4] = {1,3}

state[3] $\xrightarrow{a}$ state[5] = {1,2,3,4} , state[3] $\xrightarrow{b}$ state[6] = {1,3,4}

state[4] $\xrightarrow{a}$ state[7] = {1,2,4} , state[4] $\xrightarrow{b}$ state[8] = {1,4}

state[5] $\xrightarrow{a}$ state[9] = {1,2,3,4,5} , state[5] $\xrightarrow{b}$ state[10] = {1,3,4,5}

[6] $\xrightarrow{a}$ [11] = {1,2,4,5} , [6] $\xrightarrow{b}$ [12] = {1,4,5}

[7] $\xrightarrow{a}$ [13] = {1,2,3,5} , [7] $\xrightarrow{b}$ [14] = {1,3,5}

[8] $\xrightarrow{a}$ [15] = {1,2,5} , [8] $\xrightarrow{b}$ [16] = {1,5}

[9] $\xrightarrow{a}$ [17] = {1,2,3,4,5,6} , [9] $\xrightarrow{b}$ [18] = {1,3,4,5,6}

[10] $\xrightarrow{a}$ [19] = {1,2,4,5,6} , [10] $\xrightarrow{b}$ [20] = {1,4,5,6}

[11] $\xrightarrow{a}$ [21] = {1,2,3,5,6} , [11] $\xrightarrow{b}$ [22] = {1,3,5,6}

[12] $\xrightarrow{a}$ [23] = {1,2,5,6} , [12] $\xrightarrow{b}$ [24] = {1,5,6}

[13] $\xrightarrow{a}$ [25] = {1,2,3,4,6} , [13] $\xrightarrow{b}$ [26] = {1,3,4,6}

[14] $\xrightarrow{a}$ [27] = {1,2,4,6} , [14] $\xrightarrow{b}$ [28] = {1,4,6}

[15] $\xrightarrow{a}$ [29] = {1,2,3,6} , [15] $\xrightarrow{b}$ [30] = {1,3,6}

$[16] \xrightarrow{a} [31] = \{1,2,6\}$, $[16] \xrightarrow{b} [32] = \{1,6\}$

$[17] \xrightarrow{a} [17]$, $[17] \xrightarrow{b} [18]$; $[18] \xrightarrow{a} [19]$, $[18] \xrightarrow{b} [20]$

$[19] \xrightarrow{a} [21]$, $[19] \xrightarrow{b} [22]$; $[20] \xrightarrow{a} [23]$, $[20] \xrightarrow{b} [24]$

$[21] \xrightarrow{a} [25]$, $[21] \xrightarrow{b} [26]$; $[22] \xrightarrow{a} [27]$, $[22] \xrightarrow{b} [28]$
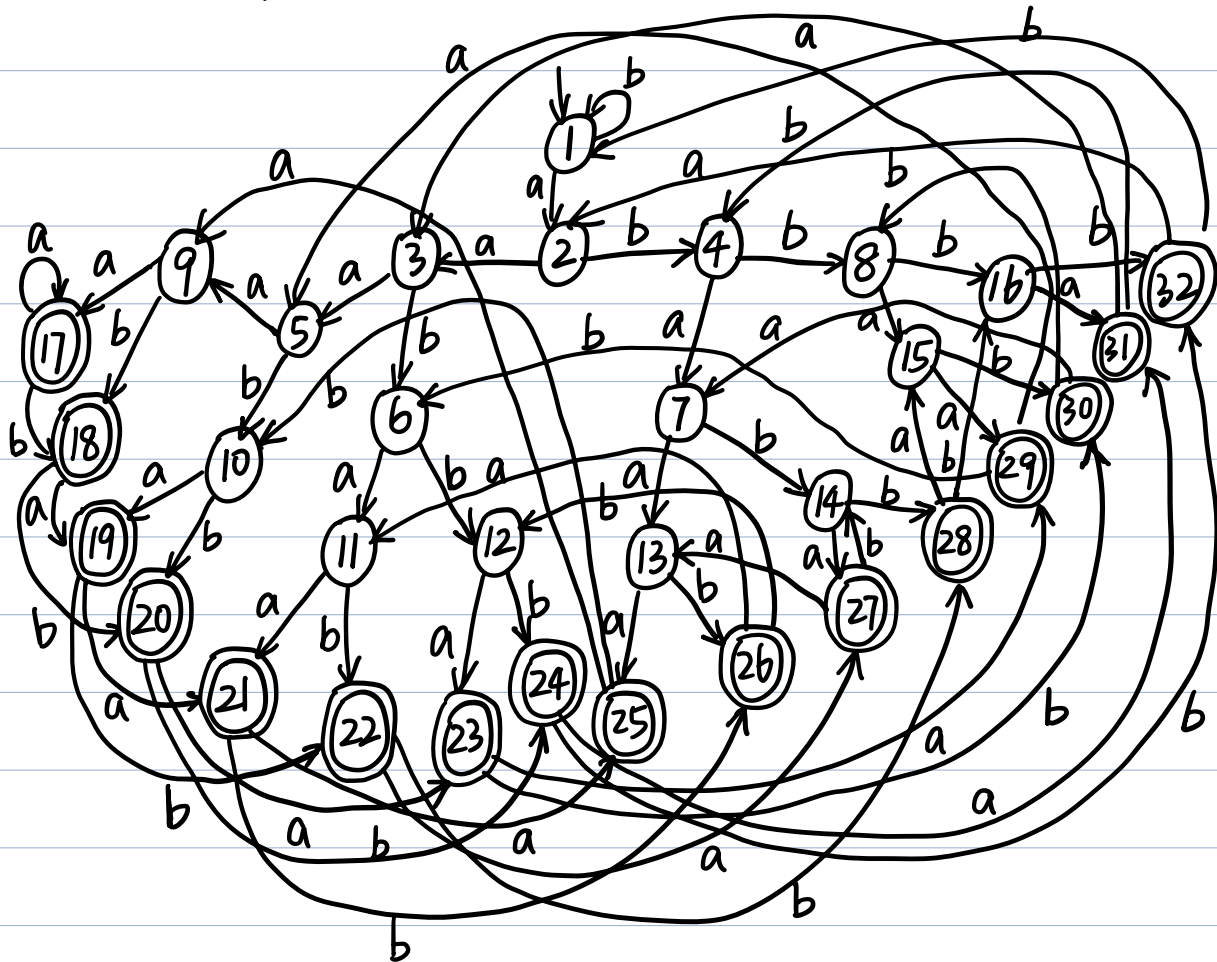
$[23] \xrightarrow{a} [29]$, $[23] \xrightarrow{b} [30]$; $[24] \xrightarrow{a} [31]$, $[24] \xrightarrow{b} [32]$

$[25] \xrightarrow{a} [9]$, $[25] \xrightarrow{b} [10]$; $[26] \xrightarrow{a} [11]$, $[26] \xrightarrow{b} [12]$

$[27] \xrightarrow{a} [13]$, $[27] \xrightarrow{b} [14]$; $[28] \xrightarrow{a} [15]$, $[28] \xrightarrow{b} [16]$

$[29] \xrightarrow{a} [5]$, $[29] \xrightarrow{b} [6]$; $[30] \xrightarrow{a} [7]$, $[30] \xrightarrow{b} [8]$

$[31] \xrightarrow{a} [3]$, $[31] \xrightarrow{b} [4]$; $[32] \xrightarrow{a} [2]$, $[32] \xrightarrow{b} [1]$

2.6   {1,2,4,5,6,7,8}   {3}

$\xrightarrow{0}$ {1,2,5,7,8} {4,6} {3}

$\xrightarrow{1}$ {1,5,7} {2,8} {4,6} {3}

$\xrightarrow{0}$ {1,5} {7} {2,8} {4,6} {3}