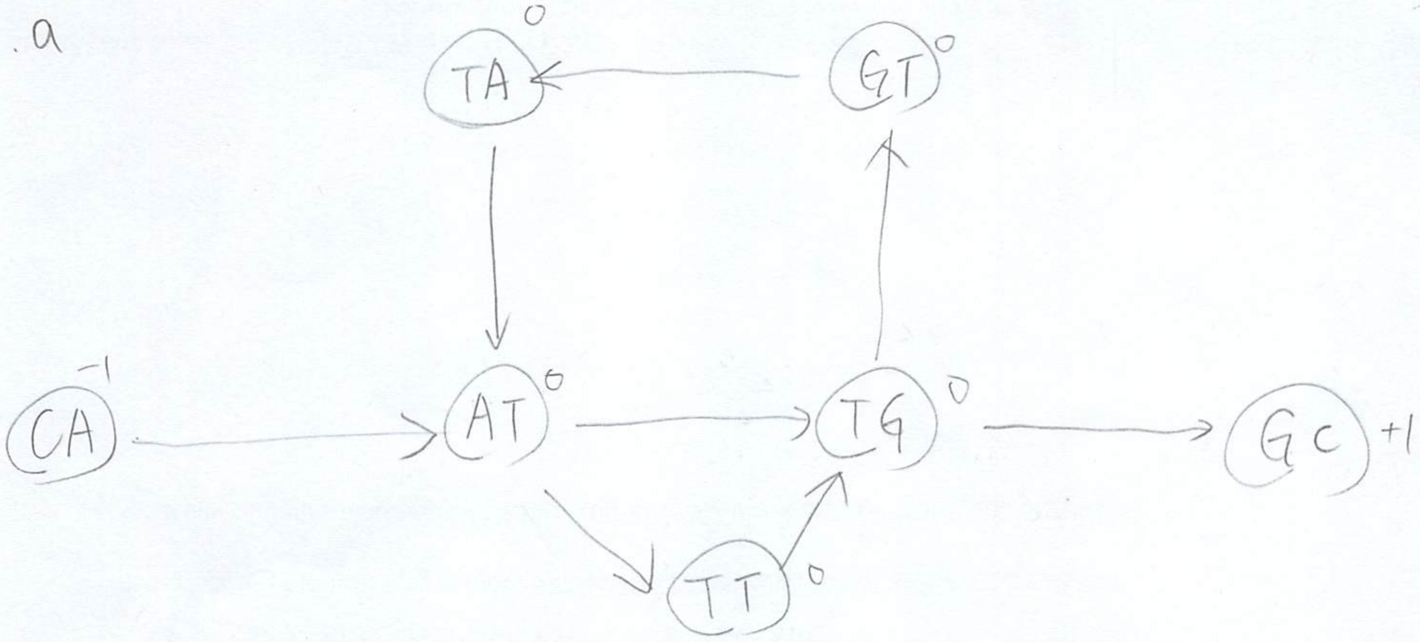
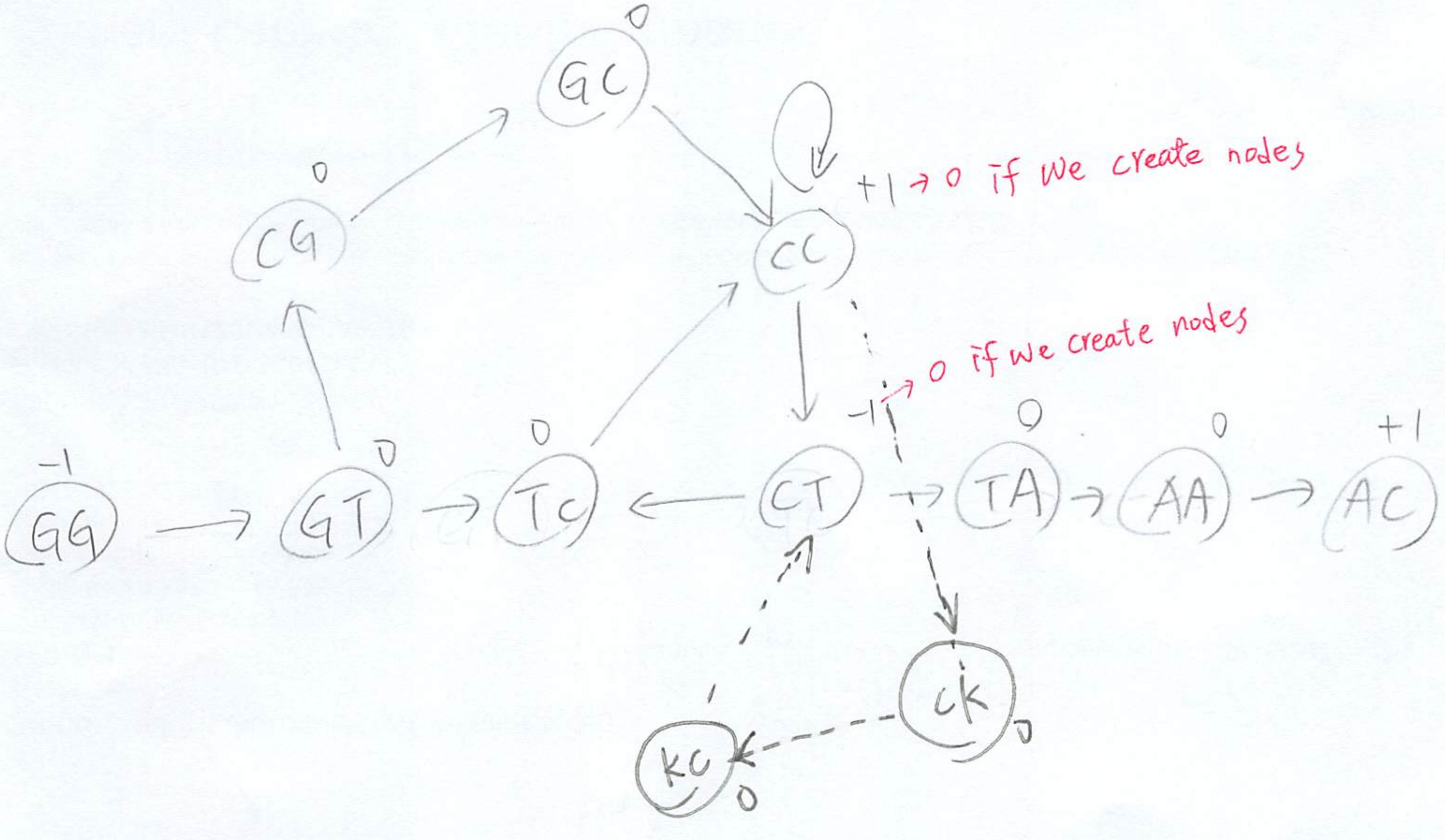
1.a



⇒ CATTG TATGC

(b)



2.(a) Because we want to find the maximum rooks which can be put on the chessboard. So, define the position that can put rooks to be 1, holes to be x

	a	b	c	d	e	
5	1	1	x	x	1	3
4	x	1	1	1	1	4
3	x	1	x	x	1	2
2	x	①	x	x	x	1
1	1	x	1	1	x	3
	2	3	2	2		

★ in this row, how many positions can put rooks

★ in this column, how many positions can put rooks?

① find the most important position : 2.b

because it only has one site to put a rook.

⇒ Remove the row 2 and the column b.

	a	b	c	d	e	
5	1		x	x	1	2
4	x		1	1	1	3
3	x		x	x	①	1
2						
1	1		1	1	x	
	2		2	2	3	

② follow the same way, We can find 3.e. is the important site to put a rook, we choose it

⇒ remove the row 3 and the column e

	a	b	c	d	e	
5	①		x	x		1
4	x		1	1		2
3						
2						
1	1		1	1		2
	2		2	2		

③ We find 5.a is the most important site, we choose it and remove { row 5, column a

	a	b	c	d	e	
5						
4			1	1		2
3						
2						
1			1	1		2
			2	2		

④ All the remaining Sites have the same chances to be put in, So we will have two choices:
{ 4c, 1d
or
4d, 1c.

∴ The answer is we can put 5 rooks in this chessboard, and the result is

	a	b	c	d	e
5	①	1	x	x	1
4	x	1	1	①	1
3	x	1	x	x	①
2	x	①	x	x	x
1	1	x	①	1	x

or

	a	b	c	d	e
5	①	1	x	x	1
4	x	1	①	1	1
3	x	1	x	x	①
2	x	①	x	x	x
1	1	x	1	①	x

3.1(b) Let: A(m) contains m-pivot and the length is L. and it is the running time of m-pivots/m-many candy-bars

$$A_m(n) = c(n-1) + A\left(\frac{m+2}{2(m+1)}n\right)$$

of (n-1) many candy-bars

$A\left(\frac{m+2}{2(m+1)}\right)$ means when we split to m pivots, it creates m+1 portions. therefore the average length of the larger pieces of candy-bars will be $\frac{L}{2}\left(\frac{m+2}{m+1}\right)$. because when we complete the n-1 times comparison. the worse situation is if we can not find the kth number in the shorter pieces of candy-bars we would need to do the recursion that choosing the longer one. and the average of the longer one is $\frac{L(m+2)}{2(m+1)}$,

$$\Rightarrow A_m(n) = c(n-1) + \left(\frac{(m+2)}{2(m+1)} + \left(\frac{m+2}{2(m+1)}\right)^2 + \cdots\right)\cdot cn$$

$$= cn\left(1 + \left(\frac{m+2}{2(m+1)}\right) + \left(\frac{m+2}{2(m+1)}\right)^2 + \cdots\right) - 1$$

$$= cn\left(\frac{1}{1 - \frac{(m+2)}{2(m+1)}}\right) - 1$$

$$= cn\left(\frac{1}{\frac{(2m+2)-(m+2)}{2(m+1)}}\right) - 1$$

$$= cn\left(\frac{1}{\frac{m}{2(m+1)}}\right) - 1$$

$$= cn\left(\frac{2(m+1)}{m}\right) - 1$$

$$\le cn\,\frac{2(m+1)}{m} \quad \#$$

100

4.(b) calculate the class 0 area means we want to choose the first, third, fourth quadrant.

	$z<0$	$z>0$
$y>0$	1	0
$y<0$	1	1

↑ $\mathbb{1}_{R^2 \setminus (R_+ \times R_+)}(z,y)$

① we add $\mathbb{1}_{R-}(z)$ + $\mathbb{1}_{R-}(y)$

	$z<0$	$z>0$
$y>0$	1	0
$y<0$	1	0

	$z<0$	$z>0$
$y>0$	0	0
$y<0$	1	1

‖

	$z<0$	$z>0$
$y>0$	1	0
$y<0$	2	1

$$\left(\begin{array}{l} \mathbb{1}_{R^-}(z) = S_\varepsilon(-x) \\ \mathbb{1}_{R}^{-}(y) = S_\varepsilon(-y) \end{array} \right.$$

if we reduced the truth table by 1/2

we get

	$z<0$	$z>0$
$y>0$	1/2	-1/2
$y<0$	3/2	1/2

$$= S_\varepsilon(-z) + S_\varepsilon(-y) - \frac{1}{2}$$

$$= 1 - S_\varepsilon(z) + 1 - S_\varepsilon(y) - \frac{1}{2}$$

$$= -S_\varepsilon(z) - S_\varepsilon(y) + \frac{3}{2}$$

then we use the sigmoid to calculate it again, we can get the result

$$\therefore \mathbb{1}_{R^2 \setminus R_+ \times R_+}(z,y) \approx S_\varepsilon\left(-S_\varepsilon(z) - S_\varepsilon(y) + \frac{3}{2}\right)$$

$$\approx S_\varepsilon(-S_\varepsilon(>x-y+3) - S_\varepsilon(y) + \frac{3}{2}$$

4. (a) Based on the equation, we can rewrite the inequity formula to

$$\begin{cases} 2x+3 > y \\ y > 0 \end{cases} \Rightarrow \begin{cases} 2x-y+3 > 0 \\ y > 0 \end{cases} \quad \text{we define } 2x-y+3 = z \Rightarrow \begin{cases} z > 0 \\ y > 0 \end{cases}$$

$$\left(\overset{1_{R+}(z)}{\begin{array}{|cc} 0 & 1 \\ 0 & 1 \end{array}} + \overset{1_{R+}(y)}{\begin{array}{|cc} 1 & 1 \\ 0 & 0 \end{array}} \right)$$

follow the true table:

we want to find

$$\begin{array}{c|cc} & z<0 & z>0 \\ \hline y>0 & 0 & 1 \\ y<0 & 0 & 0 \end{array} \;=\; \begin{array}{c|cc} & z<0 & z>0 \\ \hline y>0 & 1 & 2 \\ y<0 & 0 & 1 \end{array}$$

if we reduce $\frac{3}{2}$

there

$$1_{R+R+}(z,y) = 1_{R^+}(z) + 1_{R^+}(y) = S_\varepsilon(z) + S_\varepsilon(y)$$

it will be

$$\begin{array}{c|cc} & z<0 & z>0 \\ \hline y>0 & -1/2 & 1/2 \\ y<0 & -3/2 & -\frac{1}{2} \end{array}$$

$$\parallel$$

$$S_\varepsilon(z) + S_\varepsilon(y) - \frac{3}{2}$$

$$S_\varepsilon(S_\varepsilon(z) + S_\varepsilon(y) - \frac{3}{2})$$

$$\parallel$$

if we sigmoid it again, it will be

$$\begin{array}{c|cc} & z<0 & z>0 \\ \hline y>0 & 0 & 1 \\ y<0 & 0 & 0 \end{array}$$

$$\Rightarrow 1_{R+\times R+}(z,y) \approx S_\varepsilon(S_\varepsilon(z) + S_\varepsilon(y) - \frac{3}{2})$$

$$\Rightarrow 1_{R+\times R+}(2x-y+3, y) \approx S_\varepsilon(S_\varepsilon(2x-y+3) + S_\varepsilon(y) - \frac{3}{2})$$