

$$\log_2 R = \log_2 \frac{\text{observed. CN (or RD)}}{\text{mean. CN (or RD)}}$$

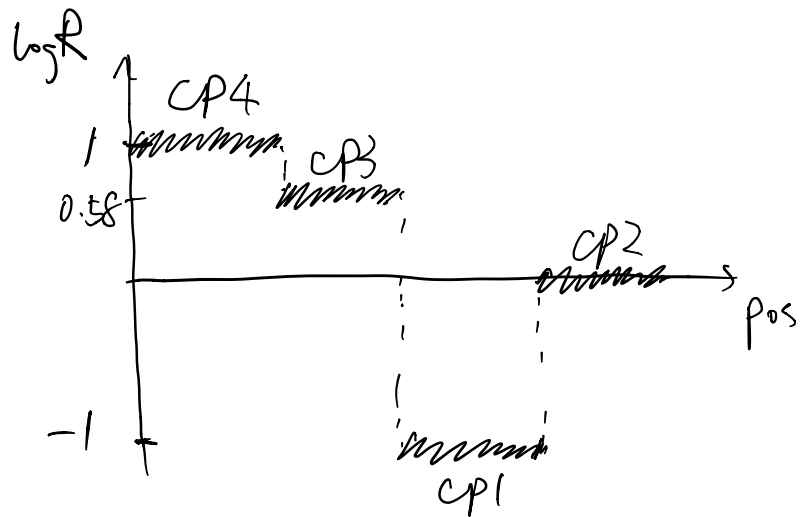
for diploid organism: mean. CN = 2.

$$\begin{aligned} \text{thus, } \log_2 R &= \log_2 \frac{\text{ob. CN}}{2} \\ &= \log_2 \text{ob. CN} - \log_2 2 \\ &= \log_2 \text{ob. CN} - 1 \end{aligned}$$

$$\text{ob. CN} = 2^{\log R + 1}$$

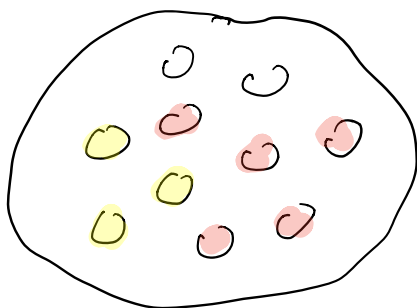
Quick Reference:

ob. CN	$\log_2 R$
1	-1
2	0
3	0.58
4	1



purity: proportion of cancer cells in the admixture

clonality: proportion of clonal cells in the admixture

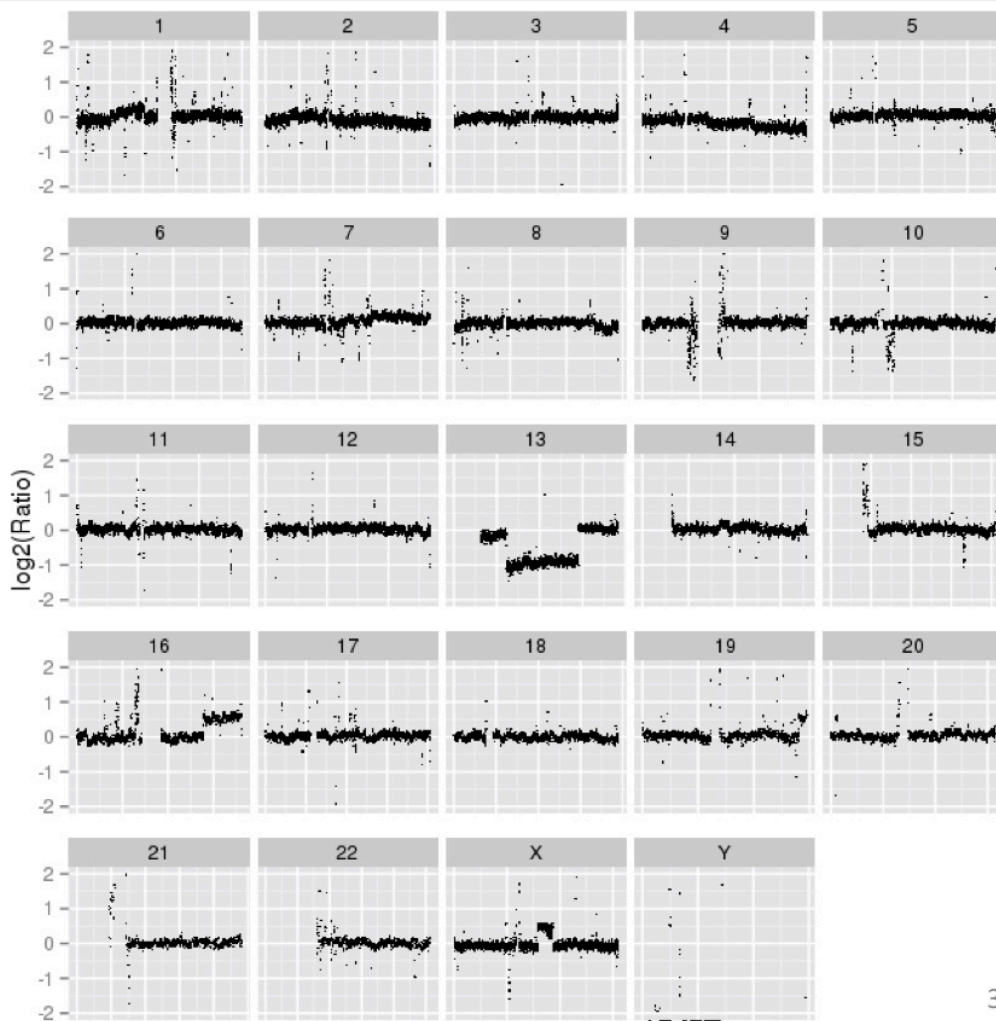


- 2 normal cells
- 3 yellow subclonal cells
- 5 red subclonal cells

$$\text{purity: } \frac{3+5}{10} = 80\%$$

$$\text{clonality}_Y : \frac{3}{10} = 30\%$$

$$\text{clonality}_R : \frac{5}{10} = 50\%$$



discuss the
CNV for :

① chr X

② chr 7

③ chr 4

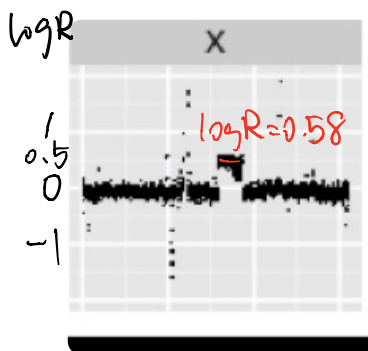
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Example in slides :

① chr X :

the region with CNV has :

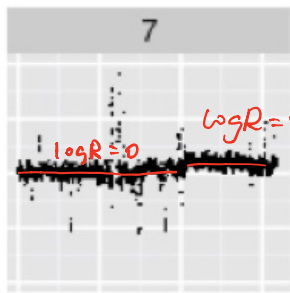
$$\log R \approx 0.58$$



$$\text{ob. CN} = 2^{0.58+1} \approx 3$$

the region has CP3 . clonality = 100%

② chr 7 :



$$\log R \approx 0.32$$

$$\text{ob. CN} = 2^{0.32+1} \approx 2.5$$

clonality can't be 100% since CN is not an integer.

Assume clonality = C , with $\text{CN} = x$, there is :

$$C \in (0, 1)$$

$$x \in \{0, 1, 2, 3, \dots\}$$

$$x \cdot C + 2 \cdot (1 - C) = 2.5$$

$$(x - 2) C = 0.5$$

possible x, C pairs :

$$x = 3, C = 0.5$$

$$x = 4, C = 0.25$$

$$x = 5, C = 0.17$$

...

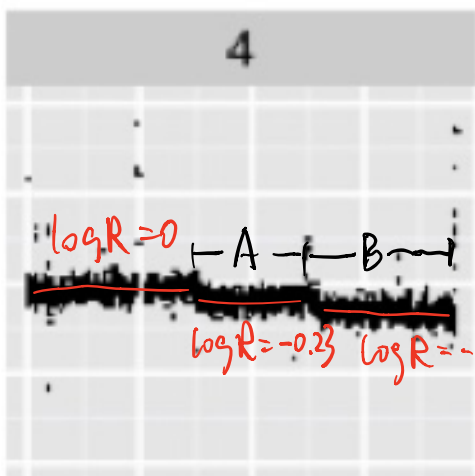
$$\log R_A = -0.23 \Rightarrow \text{ob. CN}_A = 2^{1-0.23} = 1.7$$

$$\log R_B = -0.49 \Rightarrow \text{ob. CN}_B = 2^{1-0.49} = 1.4$$

Similarly,

for region A & B :

$$\begin{cases} (x_A - 2) C_A = -0.3 \\ (x_B - 2) C_B = -0.6 \end{cases}$$



assume CN_A and CN_B both happen on the same clone :

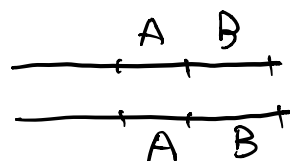
$$C_A = C_B, x_A, x_B < 2$$

$$\text{thus, } x_A = 1, x_B = 0, C_A = C_B = 0.3$$

if there is no interger X_A, X_B found,
 then it can be assumed that CNV_A and CNV_B
 happens independently on two clones.

Case#	X_A	C_A	X_B	C_B
1	1	0.3	1	0.6
2	0	0.15	1	0.6
3	1	0.3	0	0.3
4	0	0.15	0	0.3

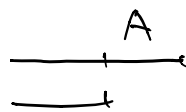
normal chr 4:



$$CN_A = 2$$

$$CN_B = 2$$

CNV_A & CNV_B on one clone:

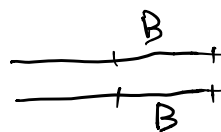


$$\text{clonality} = 0.3$$

$$CN_A = 1$$

$$CN_B = 0$$

CNV_A & CNV_B on two clones:



$$\text{clonality} = 0.15$$

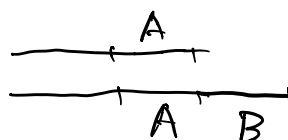
$$CN_A = 0$$

$$CN_B = 2$$

(4 possible cases.

here shows case 2)

AND



$$\text{clonality} = 0.6$$

$$CN_A = 2$$

$$CN_B = 1$$

you can use the CN and clonality to again verify
 the observed CNs:

$$\text{Region A: } 0.15 \times 0 + (0.6 + 0.25) \times 2 = 1.7$$

$$\text{Region B: } 0.6 \times 1 + (0.15 + 0.25) \times 2 = 1.4$$

AND DONT FORGET TO DO THE SURVEY PLEASE! THANK YOU!