

Find the **global alignment** between GATCGTT and TCTGAT with the δ values from the table below. As a reminder the recursive formula for global alignment is given.

δ	A	C	T	G	-
A	1.5	-1	-0.75	-1	-0.5
C	-1	1.5	-1	-0.75	-0.5
T	-0.75	-1	1.5	-1	-0.5
G	-1	-0.75	-1	1.5	-0.5
-	-0.5	-0.5	-0.5	-0.5	$-\infty$

$$V(i, j) = \max \begin{cases} V(i-1, j-1) + \delta(S[i], T[j]) & \text{match/mismatch} \\ V(i-1, j) + \delta(S[i], -) & \text{delete} \\ V(i, j-1) + \delta(-, T[j]) & \text{insert} \end{cases}$$

Best score: _____
 Best alignment:

(0,0)	(1,0)	...	(n,0)
(0,1)	(1,1)	...	(n,1)
:	:		:
(0,m)	(1,m)	...	(n,m)

Find the **local alignment** between CACTUS and REACTSBAD with the σ values that follow the rules below. As a reminder the recursive formula for global alignment is given.

$$V(i, j) = \max \begin{cases} 0 & \text{align empty strings} \\ V(i-1, j-1) + \delta(S[i], T[j]) & \text{match/mismatch} \\ V(i-1, j) + \delta(S[i], -) & \text{delete} \\ V(i, j-1) + \delta(-, T[j]) & \text{insert} \end{cases}$$

$$\begin{aligned} \delta(-, x) &= -1 \text{ for } x \in \Sigma \\ \delta(x, -) &= -1 \text{ for } x \in \Sigma \\ \delta(x, y) &= 2 \text{ for } y = x \\ \delta(x, y) &= -1 \text{ for } y \neq x \end{aligned}$$

Best score: _____
 Best alignment:

(0,0)	(1,0)	...	(n,0)
(0,1)	(1,1)	...	(n,1)
:	:		:
(0,m)	(1,m)	...	(n,m)

Find the **global alignment with affine gap costs** between AGGC and ATTGGGC with the scores. As a reminder the recursive formula for global alignment is given.

$$F(i, j) = \max \begin{cases} F(i-1, j) - b \\ G(i-1, j) - f_{a,b}(1) \end{cases}$$

$$f_{a,b}(i) = \alpha + \beta \cdot i$$

$$E(i, j) = \max \begin{cases} E(i, j-1) - b \\ G(i, j-1) - f_{a,b}(1) \end{cases}$$

$$G(i, j) = \max \begin{cases} G(i-1, j-1) + \delta(S[i], T[j]) \\ E(i, j) \\ F(i, j) \end{cases}$$

F

$$\delta(x, y) = 5 \text{ for } y = x$$

$$\delta(x, y) = -1 \text{ for } y \neq x$$

$$\alpha = 2$$

$$\beta = 0.5$$

Best score: _____
Best alignment: _____

G

E

(0,0)	(1,0)	...	(n,0)
(0,1)	(1,1)	...	(n,1)
:	:		:
(0,m)	(1,m)	...	(n,m)