CISC-471 WINTER 2015

ALIGNMENT WITH GAP PENALTIES

As in the text gaps of length x incur a penalty of $\rho + \sigma x$. We maintain 3 $n \times m$ tables S, $\rightarrow$, and $\uparrow$.

The tables are initialized as follows:

$S_{i,0} = -\infty$ for $1 \leq i \leq n$; $S_{0,j} = -\infty$ for $1 \leq j \leq m$; $S_{0,0} = 0$.-

$\uparrow_{0,j} = -\infty$ for $1 \leq j \leq n$; $\uparrow_{i,0} = -\rho - i\sigma$ for $0 \leq i \leq m$.

$\rightarrow_{0,j} = -\rho - j\sigma$ for $0 \leq j \leq n$; $\rightarrow_{i,0} = -\infty$ for $1 \leq i \leq m$.

And the recurrence relations are given as

$$\uparrow_{i,j} = \max \begin{cases} \uparrow_{i-1,j} - \sigma & \text{extend gap in } w \\ S_{i-1,j} - (\rho + \sigma) & \text{open gap in } w \end{cases}$$

$$\rightarrow_{i,j} = \max \begin{cases} \rightarrow_{i,j-1} - \sigma & \text{extend gap in } v \\ S_{i,j-1} - (\rho + \sigma) & \text{open gap in } v \end{cases}$$

$$S_{i,j} = \max \begin{cases} S_{i-1,j-1} + \delta(v_i, w_j) & \text{match or mismatch in } v_i w_j \\ \uparrow_{i,j} & \text{gap in } w \\ \rightarrow_{i,j} & \text{gap in } v \end{cases}$$

Using $v =$ AAT and $w =$ ACACT with values $\rho = 1, \sigma = 3$ and 1 and -1 respectively for a match and mismatch, I obtained the following results.

$$S = \begin{bmatrix} & & A & C & A & C & T \\ & 0 & -\infty & -\infty & -\infty & -\infty & -\infty \\ A & -\infty & 1 & -3 & -4 & -5 & -6 \\ A & -\infty & -3 & 0 & -2 & -5 & -6 \\ T & -\infty & -4 & -4 & -1 & -3 & -4 \end{bmatrix}$$

$$\uparrow = \begin{bmatrix} & & A & C & A & C & T \\ & -3 & -\infty & -\infty & -\infty & -\infty & -\infty \\ A & -4 & -\infty & -\infty & -\infty & -\infty & -\infty \\ A & -5 & -3 & -7 & -8 & -9 & -10 \\ T & -6 & -4 & -4 & -6 & -9 & -10 \end{bmatrix}$$

$$\rightarrow = \begin{bmatrix} & & A & C & A & C & T \\ & -3 & -4 & -5 & -6 & -7 & -8 \\ A & -\infty & -\infty & -3 & -4 & -5 & -6 \\ A & -\infty & -\infty & -7 & -4 & -5 & -6 \\ T & -\infty & -\infty & -8 & -8 & -5 & -6 \end{bmatrix}$$