

Exercise sheet 2: Edit operations and alignments

Exercise sheet 2 - Levenshtein Distance

Compute the minimal Levenshtein edit distance for the following pairs of sequences.

Question 1A

$$S_1 = A \tag{1}$$

$$S_2 = T \tag{2}$$

Hint $A \rightarrow T$

Correct Answer $A \rightarrow T = 1$

Question 1B

$$S_1 = AGATATA \tag{3}$$

$$S_2 = TATATATA \tag{4}$$

Hint $AGATATA \rightarrow ATATATA \rightarrow \dots$

Correct Answer $AGATATA \rightarrow ATATATA \rightarrow TATATATA = 3$

Question 1C

$$S_1 = AGTCCT \tag{5}$$

$$S_2 = CGCTCA \tag{6}$$

Hint $AGTCCT \rightarrow AGCTCA \rightarrow \dots$

Correct Answer $AGTCCT \rightarrow CGTCCT \rightarrow CGCCCT \rightarrow CGCTCA = 4$

Question 1D

$$S_1 = TGCATAT \quad (7)$$

$$S_2 = ATCCGAT \quad (8)$$

Hint $TGCATAT \rightarrow AGCATAT \rightarrow \dots$

Correct Answer $TGCATAT \rightarrow AGCATAT \rightarrow ATCATAT \rightarrow ATCCGAT = 4$

Question 1E

$$S_1 = ACGTATATAGCCCCGCG \quad (9)$$

$$S_2 = ACGTTATATAGCCGCGC \quad (10)$$

Hint You need to use all the possible operations

$ACGTATATAGCCCCGCG \rightarrow ACGTTATATAGCCCCGCG \rightarrow \dots$

Correct Answer $ACGTATATAGCCCCGCG \rightarrow ACGTTATATAGCCCCGCG \rightarrow ACGTTATATAGCCGCGC \rightarrow ACGTTATATAGCCGCGC = 4$

Exercise 2 - Metric function

Check if the corresponding functions are metric.

Question 2A

$$w(x, y) = x - y \quad (11)$$

Hint What if $x = -5$ and $y = -5$?

Correct Answer Not metric

Question 2B

$$w(x, y) = |x - y| \quad (12)$$

Hint You need to check all the properties.

Correct Answer Metric

Question 2C

$$w(x, y) = x + y \quad (13)$$

Hint What if $x = -5$ and $y = -5$?

Correct Answer Not metric

Question 2D

$$w(x, y) = \begin{cases} 1 & \text{if } x \neq y \\ 0 & \text{else} \end{cases} \quad (14)$$

Hint You need to check all the properties.

Correct Answer Metric

Exercise 3 - DNA and RNA