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 $\rightarrow \ldots$

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

Question 1C

$$S_1 = AGTCCT \tag{5}$$
$$S_2 = CGCTCA \tag{6}$$

Hint AGTCCT → AGCTCA → ...

Correct Answer AGTCCT → CGTCCT → CGCCCT → CGCTCA = 4

Question 1D

$$S_1 = TGCATAT \tag{7}$$
$$S_2 = ATCCGAT \tag{8}$$

Hint TGCATAT → AGCATAT → ...

Correct Answer TGCATAT → AGCATAT → ATCATAT → ATCCGAT = 4

Question 1E

$$S_1 = ACGTATATAGCCCCGCG \tag{9}$$
$$S_2 = ACGTTATATAGCCGCGC \tag{10}$$

Hint You need to use all the possible operations

ACGTATATAGCCCCGCG → ACGTTATATAGCCCCGCG → ...

Correct Answer ACGTATATAGCCCCGCG → ACGTTATATAGCCCCGCG → ACGTTATATAGCCGCGCG → ACGTTATATAGCCGCGC = 4

Exercise 2 - Metric function

Check if the corresponding functions are metric.

Question 2A

$$w(x, y) = x - y \tag{11}$$

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

Correct Answer Not metric

Question 2B

$$w(x, y) = |x - y| \tag{12}$$

Hint You need to check all the properties.

Correct Answer Metric

Question 2C

$$w(x, y) = x + y \tag{13}$$

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

Correct Answer Not metric

Question 2D

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

Hint You need to check all the properties.

Correct Answer Metric

Exercise 3 - DNA and RNA