# Exercise sheet 2: Edit operations and alignments

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## 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 $\rightarrow$ ...

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

**Question 1C**

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

**Hint** AGTCCT $\rightarrow$ AGCTCA $\rightarrow$ ...

**Correct Answer** AGTCCT $\rightarrow$ CGTCCT $\rightarrow$ CGCCCT $\rightarrow$ 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 → ACGTTATATAGC-CGCGCG → 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