Exercise sheet 8: Suffix-Trees

Exercise 1

You are given the text $T = CAGTAGTAGC$

1a)

Draw the corresponding suffix tree

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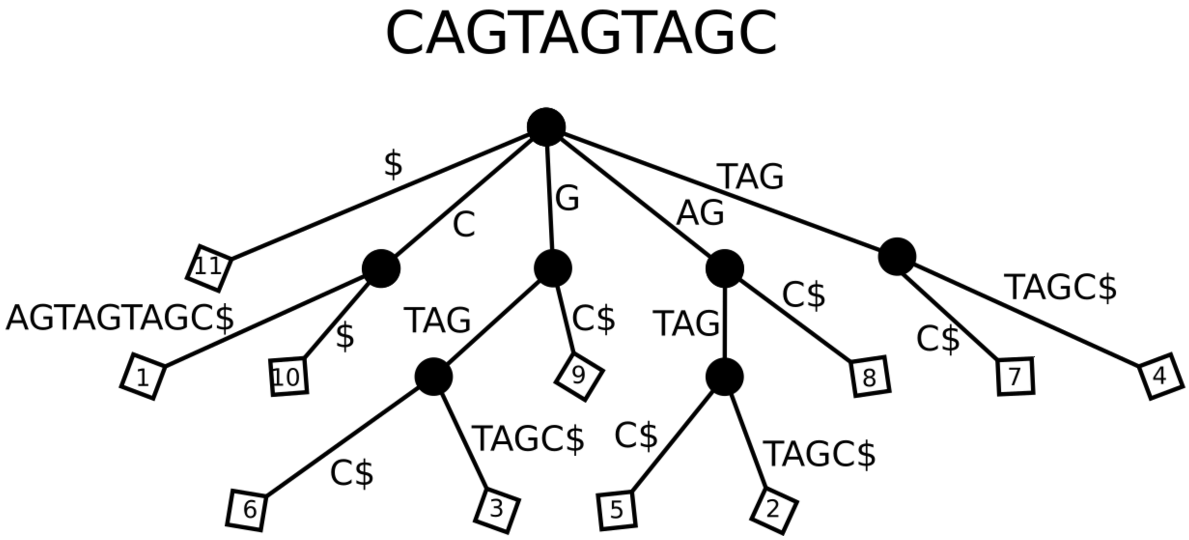
Solution



1b)

Describe the steps of a counting query for $P = TAG$

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Solution

- start at root node
- locate outgoing edge that starts with T
- match subsequent characters of the pattern
- in the subtree rooted at $\overline{TAG}$ count the number of leaves $\Rightarrow 2$

1c)

Describe the steps of a reporting query for $P = AG$

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Solution

- start at root node
- locate outgoing edge that start with A
- match subsequent characters of the pattern
- in the subtree rooted at $\overline{AG}$ report the labels of all leaves $\Rightarrow \{2, 5, 8\}$

Exercise 2

2a)

Draw a generalized suffix tree for the sequences $A = CCATG$ and $B = CATG$.

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Hint 1 Concatenate the two sequences using a unique character for splitting. e.g. $CCATG\#CATG\$$.

Dont forget to include suffix links

Formulae $sl(v) = w$

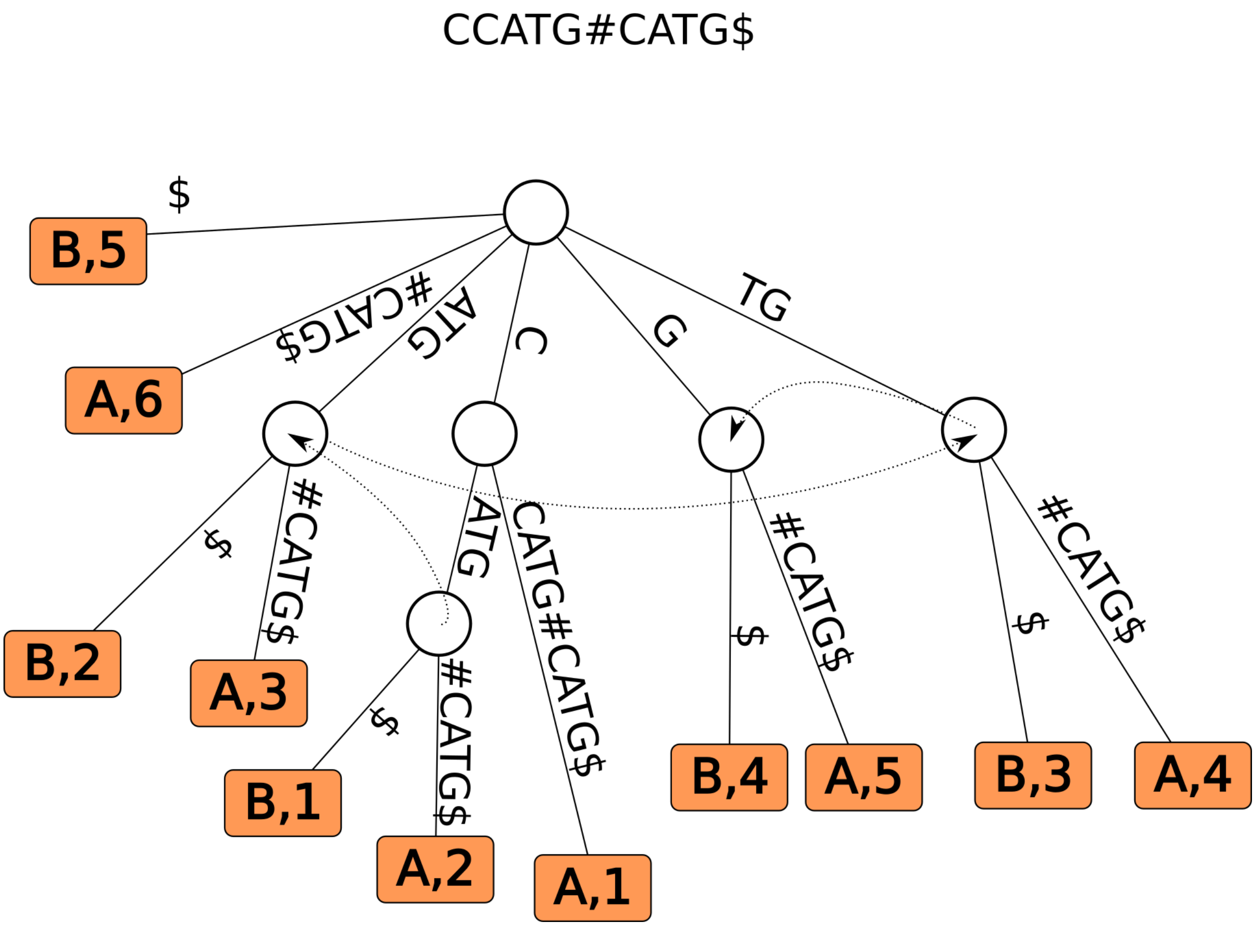
$v = \overline{cb}$

$w = \overline{b}$

$c : character, b : string$

remember: over lined strings are a representation for the node at that string

Solution



2b)

Find the Maximal Unique Matches of the sequences $A = CCATG$ and $B = CATG$ using the tree from A)

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Solution $CATG$ is the only MUM as $v = \overline{CATG}$ has no suffix links pointing to it

Exercise 3

3a)

Draw a generalized suffix tree for the sequence $A = ACGCACGCG$.

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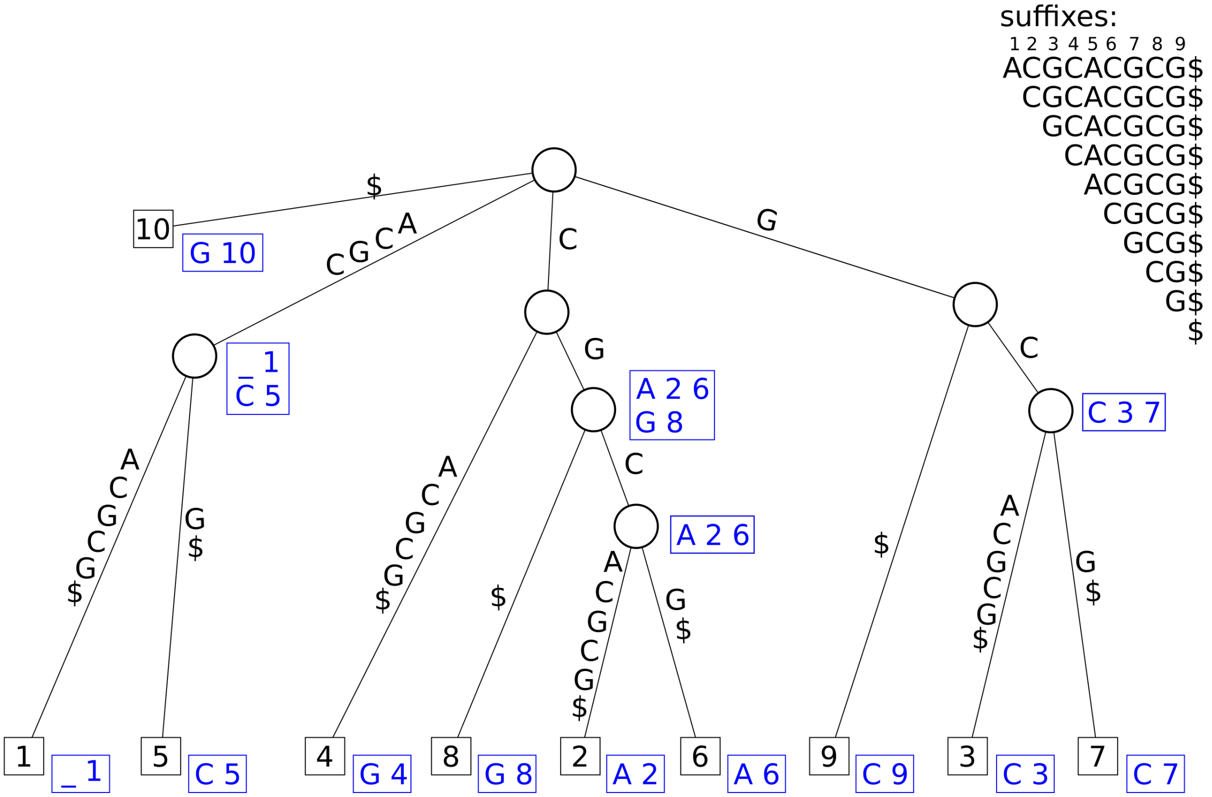
Solution



3b)

Find all maximal pairs of length at least 2

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Solution $ACGC : (1, 5, 4)$

$CG : (2, 8, 2), (6, 8, 2)$

3c)

Why is $C : (2, 8, 1)$ not a maximal pair?

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Solution It is not right maximal. This can be seen since $CG : (2, 8, 2)$ already includes the indices 2 and 8 with a longer match.