

## Exercise sheet 8: Suffix-Trees

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### Exercise 1

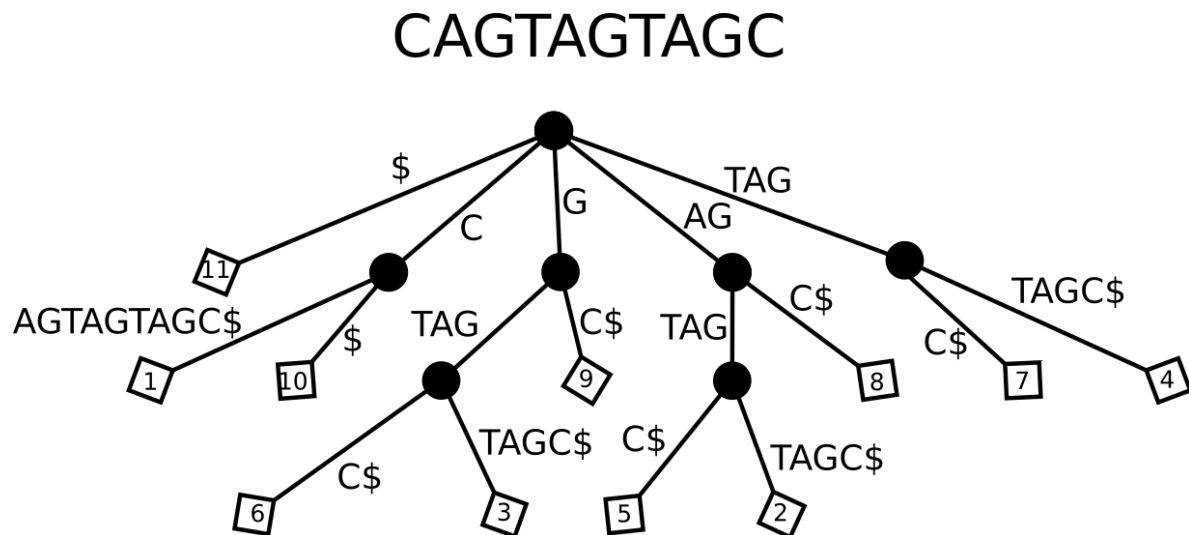
You are given the text  $T = \text{CAGTAGTAGC}$

1a)

Draw the corresponding suffix tree

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Solution



1b)

Describe the steps of a counting query for  $P = \text{TAG}$

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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**  $sl(v) = w$

$v = \overline{cb}$

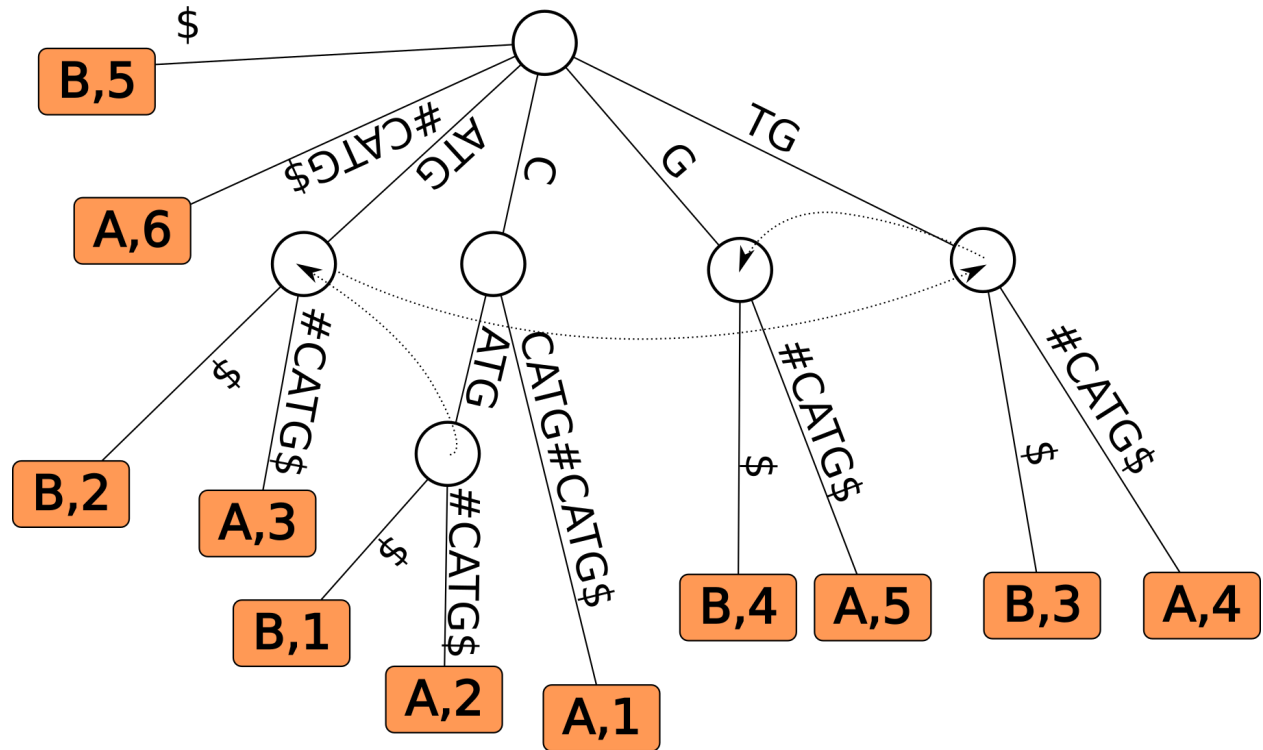
$w = \overline{b}$

$c : character, b : string$

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

### Solution

CCATG#CATG\$



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  $A = ACGCACGCG$ .

### Solution



Find all maximal pairs of length at least 2

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

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

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

4

**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.