

# Automates d'arbre

TD n°1 : Recognizable Tree Languages and Finite Tree Automata\*

September 12, 2017

## Exercise 1: First constructions of Tree Automatas

Let  $\mathcal{F} = \{f(2), g(1), a(0)\}$ . Give a DFTA and a top-down DFTA for the set  $G(t)$  of ground instances of the term  $t = f(f(a, x), g(y))$  which is defined by :

$$G(t) = \left\{ f(f(a, u), g(v)) \mid u, v \in T(\mathcal{F}) \right\}$$

## Exercise 2: What is recognizable by an FTA ?

Are the following tree languages recognizable (by a bottom-up FTA) ?

- $\mathcal{F} = \{g(1), a(0)\}$  and  $L$  the set of ground terms of even height.
- $\mathcal{F} = \{f(2), g(1), a(0)\}$  and  $L$  the set of ground terms of even height.

## Exercise 3: Bottom-up vs Top-down

- 1) Recall why bottom-up NFTAs, bottom-up DTAs and top-down NFTAs have the same expressiveness.
- 2) Let  $\mathcal{F} = \{f(2), g(1), a(0)\}$ . Give a DFTA and a top-down NFTA for the set  $M(t)$  of terms which have a ground instance of the term  $t = f(a, g(x))$  as a subterm, ie.  $M(t) = \left\{ C[f(a, g(u))] \mid C \in \mathcal{C}(\mathcal{F}), u \in T(\mathcal{F}) \right\}$ .
- 3) Show that NFTAs and top-down DFTAs do not have the same expressiveness.

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\*taken from *Tree Automata Techniques and Applications*. Thanks to Jeremy Dubut for previous years TDs.