TD 14

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Exercise 1.

1. Give a boolean formal ϕ such that any formula ϕ' in disjunctive normal form (DNF) which is equivalent to ϕ has size exponential in ϕ.
2. Show that, for every alternating tree automaton, it is possible to compute in polynomial time an alternating tree automaton which accepts the same language and whose transitions are in disjunctive normal form.

Exercise 2. Show that the membership problem for alternating tree automata can be solved in polynomial time.

Exercise 3. Consider the following deducibility relation on on terms:

$$(\mathsf{E})\quad \frac{x \quad y}{\mathsf{enc}(x,y)} \qquad (\mathsf{D})\quad \frac{\mathsf{enc}(x,y) \quad y}{x}$$

$$(\mathsf{P})\quad \frac{x \quad y}{\mathsf{pair}(x,y)}$$

$$(\pi_1)\quad \frac{\mathsf{pair}(x,y)}{x} \qquad (\pi_2)\quad \frac{\mathsf{pair}(x,y)}{y}$$

Given a finite tree automaton A over the alphabet $\{a, \mathsf{enc}(\_,\_), \mathsf{pair}(\_,\_)\}$, construct an alternating two-way tree automaton which accepts the set of terms t that can be deduced by the rules given above, starting from $L(A)$ as hypotheses.