Tree Adjoining Grammars
Mid-term exam

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Exercise 1 *Consider the following sentences:*

(1) *a.* *John likes Mary.*
b. **I likes Mary.*

(2) *a.* *John likes him.*
b. **John likes he.*
c. **Him likes Mary.*

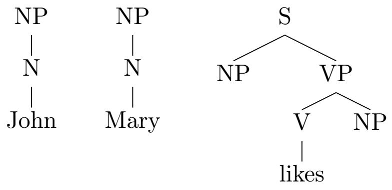
1. *Give the elementary trees and the derived tree (everything without features) for* **??** *according to the XTAG grammar.*

2. *Which features in the XTAG grammar are used to make sure that* **??***,* **??** *and* **??** *are ungrammatical?*[1]

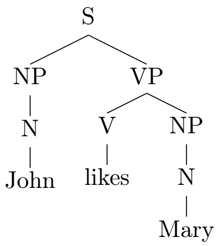
3. *Give the elementary tree for "likes" used in* **??***,* **??** *including these features.*

Solution:

1. Elementary trees:



Derived tree:



4 Punkte

2. For **??**, XTAG uses the AGR feature and, embedded under this, the feature 3RDSING.
The ungrammaticality of **??** and **??** are due to the CASE feature, which gets transported to the subject slot via ASSIGN-CASE.

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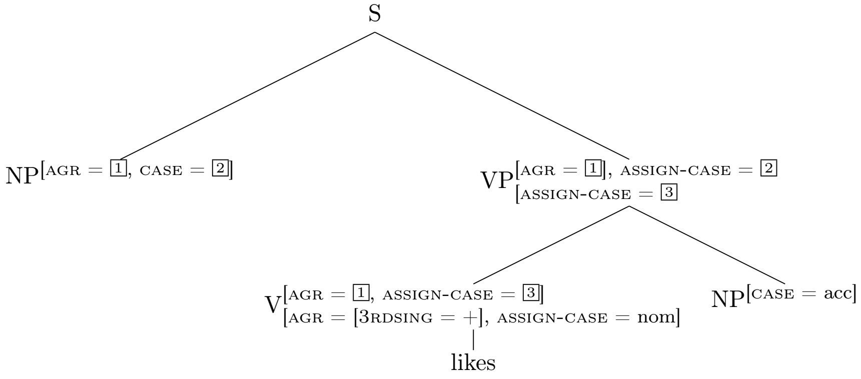
3.


S
NP[AGR = 1, CASE = 2]
VP[AGR = 1], ASSIGN-CASE = 2
[ASSIGN-CASE = 3
V[AGR = 1, ASSIGN-CASE = 3]
[AGR = [3RDSING = +], ASSIGN-CASE = nom]
NP[CASE = acc]
likes

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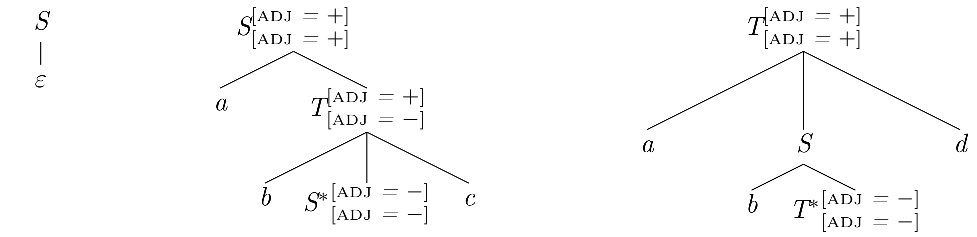
[1] At least with *likes* as a verb.

Exercise 2 *Consider the following TAG with feature structures:*



1. *Give a possible two-step derivation (= consisting of two adjunction steps) with this grammar by explaining which adjunction steps are taken.*

2. *Which language is generated by this TAG?*

Solution:

1. The second tree adjoins to the root of the first and the third tree adjoins then to the only T node in the derived tree, which is the one from the middle of the second tree.

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2. $\{a^{2n}b^{2n}c^nd^n \mid n \geq 0\}$

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Exercise 3 1. *Consider the following examples and classify them according to whether they are a) subject raising, b) object raising, c) subject control or d) object control structures.*

(3) John seems to be happy.

(4) John tried to be happy.

(5) John persuades Mary to come to the meeting.

(6) John expects Mary to come to the meeting.

2. *Now consider the following object raising example:*

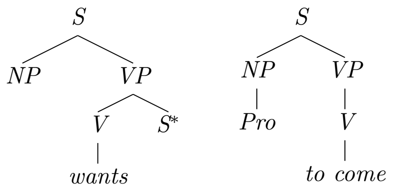
   (7) John wants Mary to come.

   Give the elementary trees and the derived tree that the XTAG grammar provides for **??**, *all trees without feature structues. Treat "to come" as a single lexical item.*

3. *Now consider a control example:*

   (8) John wants to come.

   The elementary trees for the verbs in **??** *are the following:*



   Decorate these trees, used in the context of the derivation of **??**, *with the feature* CONTROL *such that this feature shows the semantic structure sharing involved.*

Solution:

1. John seems to be happy: subject raising

   John tried to be happy: subject control

   John persuades Mary to come to the meeting: object control

   John expects Mary to come to the meeting: object raising

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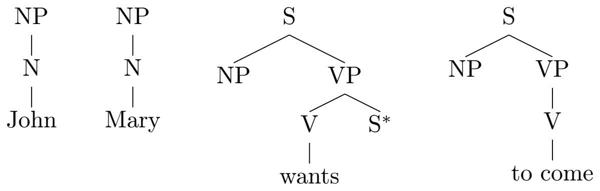
2. Elementary trees:



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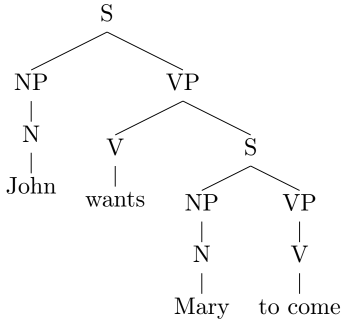
Derived tree:



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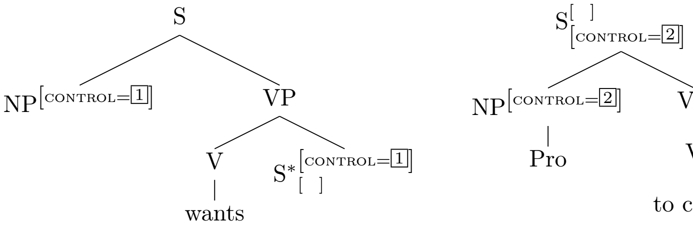

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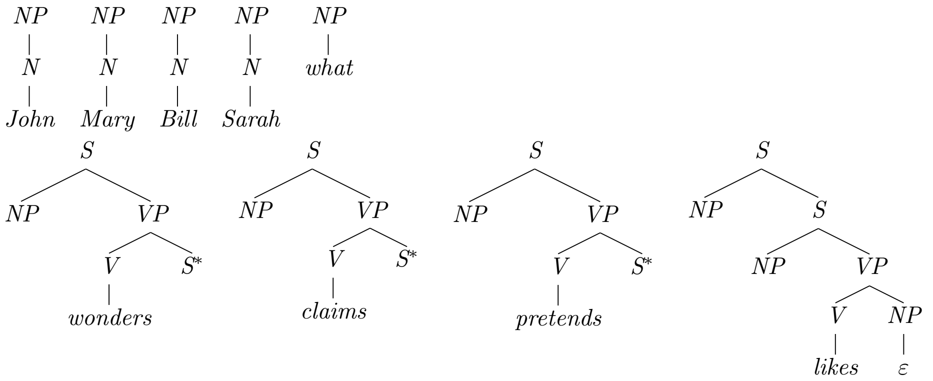
Exercise 4 *Consider the following example:*

(9) *John wonders what Mary claims Bill pretends Sarah likes.*

The elementary trees used by the XTAG grammar for deriving this sentence are the following:



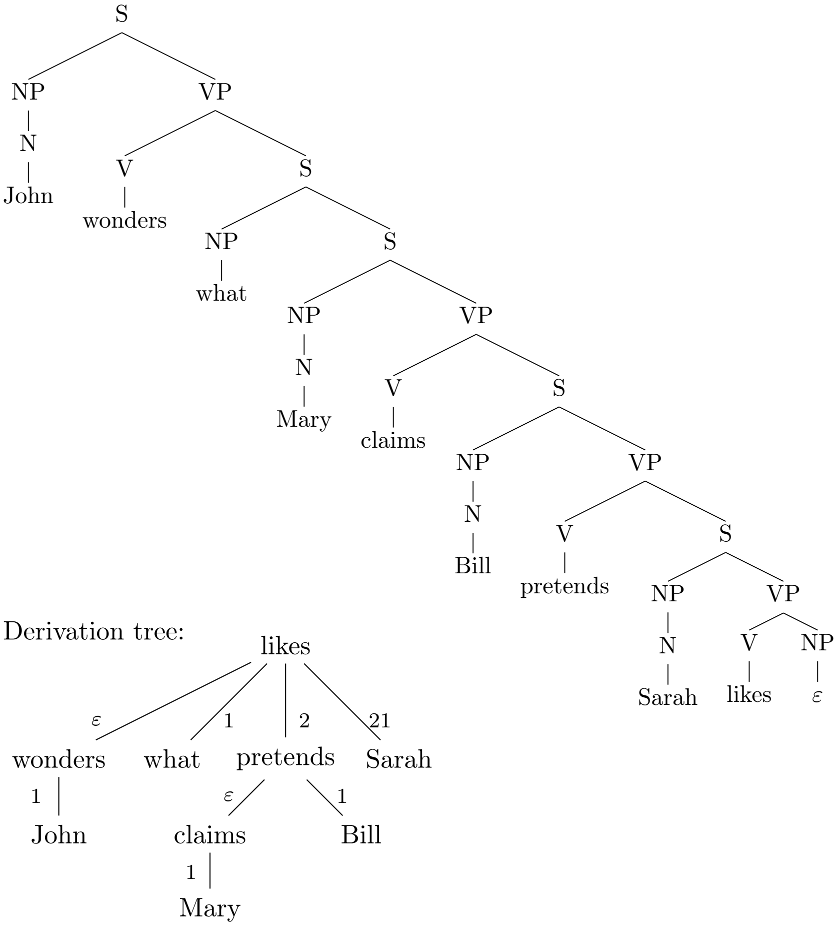
Give the derived tree (without features) and the derivation tree for **??**, *based on these elementary trees.*

Note: There was an error in the original exercise, the VP nodes where missing.

Solution:

Derived tree:

3 Punkte



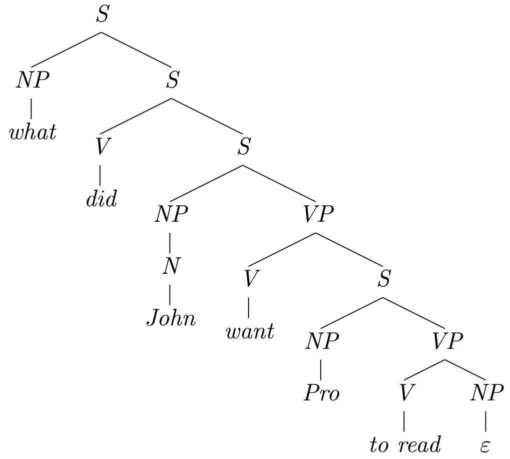
Derivation tree:

6 Punkte

Exercise 5 *The derived tree for*

(10) What did John want to read?

is as follows:



Decorate the S-nodes in this tree with the featues INV, WH, INVLINK, EXTRACTED *that one obtains when* *using the XTAG elementary trees. Assume that the final top-bottom unification has already taken place, i.e., every node has only a single feature structure.*

Solution:

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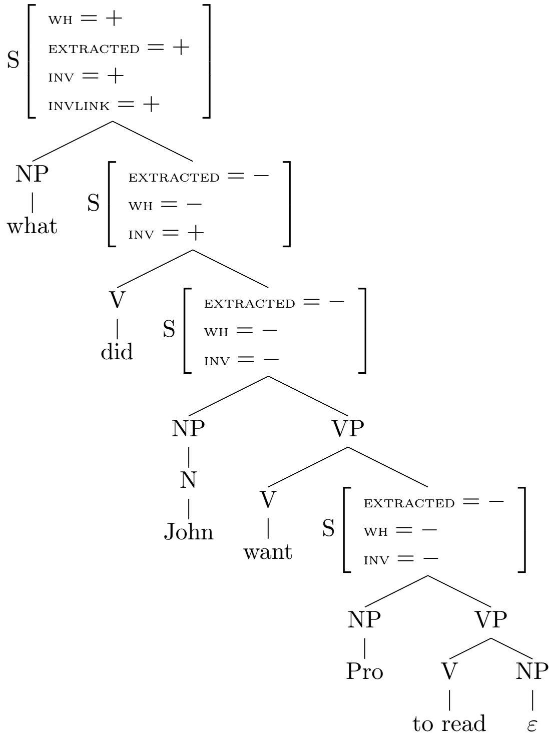
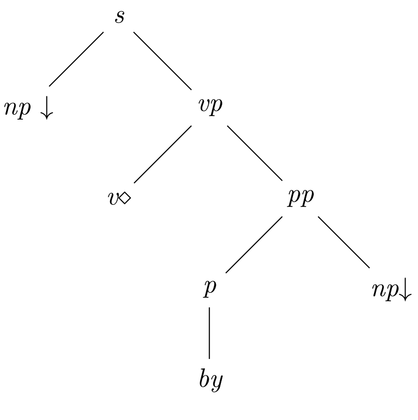
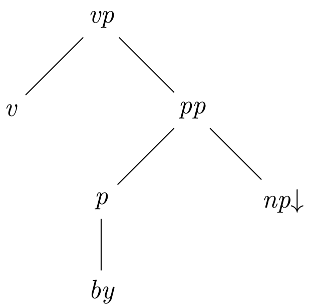

S [WH = +, EXTRACTED = +, INV = +, INVLINK = +]
NP
what
S [EXTRACTED = −, WH = −, INV = +]
V
did
S [EXTRACTED = −, WH = −, INV = −]
NP
N
John
VP
V
want
S [EXTRACTED = −, WH = −, INV = −]
NP
Pro
VP
V
to read
NP
ε

Exercise 6 *The goal of this exercise is to generate the following passive tree using XMG:*



$\alpha nx1Vbynx0$

To do so, we will use classes written in class (available in the code below), and a new one called ***`AgentPP`****, describing the following tree fragment:*



AgentPP

- *1: add to the class* `AgentPP` *dominance and precedence constraints so that it only describes the fragment given above (marked in code as* `** TASK1 **`*).*
- *2: write the class* `alphanx0Vbynx1` *which should assemble fragments* `Subject`*,* `VerbProjection` *and* `AgentPP`*. The only model of this class has to be the passive tree shown above. You will have to select the variables exported by the* `AgentPP` *class (marked in code as* `** TASK 2.1 **` *and* `** TASK 2.2 **`*).*

```
class Subject
export ?VP ?S ?NP
declare ?S ?VP ?NP
{ <syn> {
        node ?S [cat=s] {
                node ?NP (mark=subst) [cat=np]
                node ?VP [cat=vp]
        }
  }
}


class VerbProjection
export ?VP ?V
declare ?VP ?V
{ <syn> {
        node ?VP [cat=vp] {
                node ?V (mark=anchor) [cat=v]
        }
  }
}

class AgentPP
export ** TASK 2.2 **
declare ?VP ?V ?PP ?P ?By ?NP
{
  <syn>{
    node ?VP [cat=vp];
    node ?V [cat=v];
    node ?PP [cat=pp];
    node ?P [cat=p];
    node ?By (mark=flex) [cat=by];
    node ?NP (mark=subst) [cat=np];
    ** TASK 1 **
  }
}


class alphanx0Vbynx1
** TASK 2.1 **

value alphanx0Vbynx1
```

6 Punkte