Assignment: Lab3
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Original Grammar

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(1) S -> NP VP
(2) S -> NP VP PP
(3) NP -> det n
(4) NP -> n
(5) NP -> NP PP
(6) VP -> aux VP
(7) VP -> v NP
(8) PP -> p NP

Part 1: Modify grammar into CNF

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(1) ok
(2) needs to be separated:
S -> XS PP
XS -> NP VP

(3) needs dummy non-terminals:
NP -> XD XN
XD -> det
XN -> n

(4) ok
(5) ok

(6) needs dummy non-terminal:
VP -> XA VP
XA -> aux

(7) needs dummy non-terminal:
VP -> XV NP
XV -> v

(8) needs dummy non-terminal:
PP -> XP NP
XP -> p

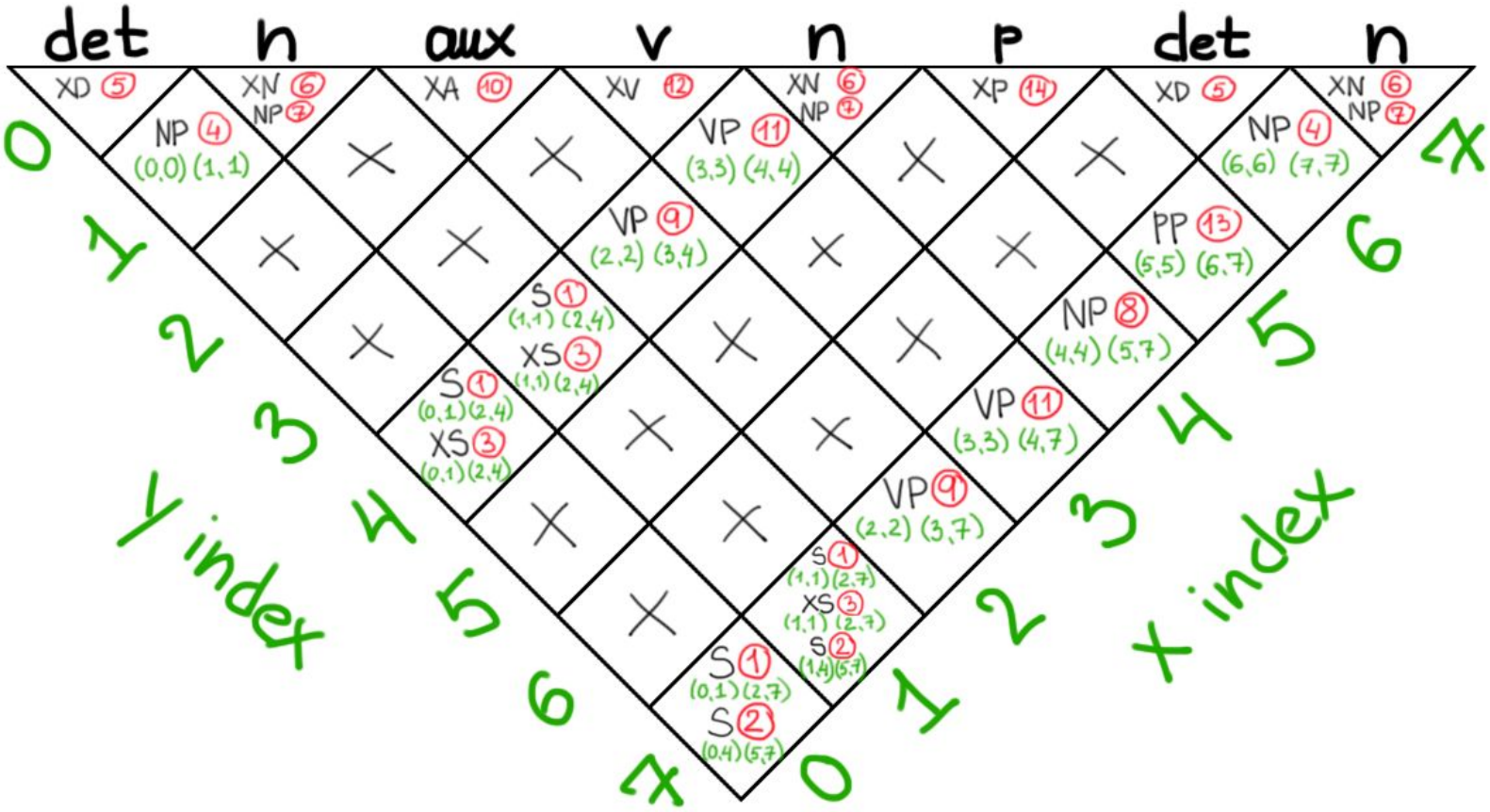
Combined:

(1) S -> NP VP
(2) S -> XS PP
(3) XS -> NP VP
(4) NP -> XD XN
(5) XD -> det
(6) XN -> n
(7) NP -> n
(8) NP -> NP PP
(9) VP -> XA VP
(10) XA -> aux
(11) VP -> XV NP
(12) XV -> v
(13) PP -> XP NP
(14) XP -> p

Part 2: CYK parsing table

Each cell contains:

- Result of a grammar rule (black)
- Number of the applied rule (red)
- The (x,y) indexes of components (green)



Part 3: Possible parse trees

Two possible parses:

(S (NP (XD det) (XN n)) (VP (XA aux) (VP (XV v) (NP (NP n) (PP (XP p) (NP (XD det) (XN n)))))))

(S (XS (NP (XD det) (XN n)) (VP (XA aux) (VP (XV v) (NP n)))) (PP (XP p) (NP (XD det) (XN n))))

This is indicated by the two successful S sentence parses in the last cell as well as the lack of duplicate ways to generate other sub-components of each sentence (everything has only one way of resolving)

Part 4: Parse of the original grammar

Using the following parse as a base:
(S (NP (XD det) (XN n)) (VP (XA aux) (VP (XV v) (NP (NP n) (PP (XP p) (NP (XD det) (XN n)))))))

Original grammar would look like:
(S (NP det n) (VP aux (VP v (NP (NP n) (PP p (NP det n))))))

Part 5: Sentences from new lexicon

Rule modifications:
(5) XD -> the

(6) XN -> dog | cat | penguin | girl | boy

(7) NP -> dog | cat | penguin | girl | boy

(10) XA -> can

(12) XV -> bite | pet | buy

(14) XP -> for

New sentences:
the girl can pet the cat
the cat can bite the dog
the boy can buy the penguin for the girl

(or something weird like "cat pet boy")