

CS4248
AY 2022/23 Semester 1
Tutorial 5 Solutions

1. a. This CFG generates ungrammatical sentences that violate number agreement and case. Examples of ungrammatical sentences include “her love he”, “them loves she”, etc.

b. Revised CFG:

$S \rightarrow NP-SG-SUBJ \ VP-SG$
 $S \rightarrow NP-PL-SUBJ \ VP-PL$
 $NP-SG-SUBJ \rightarrow PN-SG-SUBJ$
 $NP-PL-SUBJ \rightarrow PN-PL-SUBJ$
 $NP-OBJ \rightarrow PN-OBJ$
 $VP-SG \rightarrow V-SG \ NP-OBJ$
 $VP-PL \rightarrow V-PL \ NP-OBJ$
 $PN-SG-SUBJ \rightarrow \text{he} \mid \text{she}$
 $PN-PL-SUBJ \rightarrow \text{we} \mid \text{they}$
 $PN-OBJ \rightarrow \text{him} \mid \text{her} \mid \text{them}$
 $V-SG \rightarrow \text{loves} \mid \text{hates}$
 $V-PL \rightarrow \text{love} \mid \text{hate}$

2.

Step 1

First add all non-unit productions to P' :

$NP \rightarrow NP$ and N

$N \rightarrow \text{dog}$

$N \rightarrow (NP)$

Then add the following productions to P' :

$S \rightarrow NP$ and N

$S \rightarrow \text{dog}$

$S \rightarrow (NP)$

$NP \rightarrow \text{dog}$

$NP \rightarrow (NP)$

Step 2

$NP \rightarrow NP \ C \ N$

$N \rightarrow \text{dog}$

$N \rightarrow L \ NP \ R$

$S \rightarrow NP \ C \ N$

$S \rightarrow \text{dog}$

$S \rightarrow L \ NP \ R$

$NP \rightarrow \text{dog}$

$NP \rightarrow L \ NP \ R$

$C \rightarrow \text{and}$

$L \rightarrow ($

$R \rightarrow)$

Step 3

$NP \rightarrow NP \ D1$

$D1 \rightarrow C \ N$

$N \rightarrow \text{dog}$

$N \rightarrow L \ D2$

$D2 \rightarrow NP \ R$

$S \rightarrow NP \ D1$

$S \rightarrow \text{dog}$

$S \rightarrow L \ D2$

$NP \rightarrow \text{dog}$

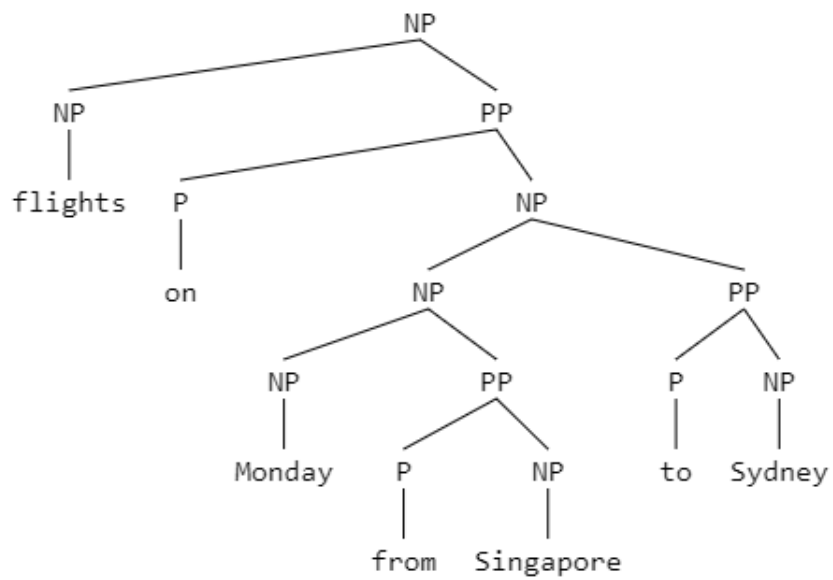
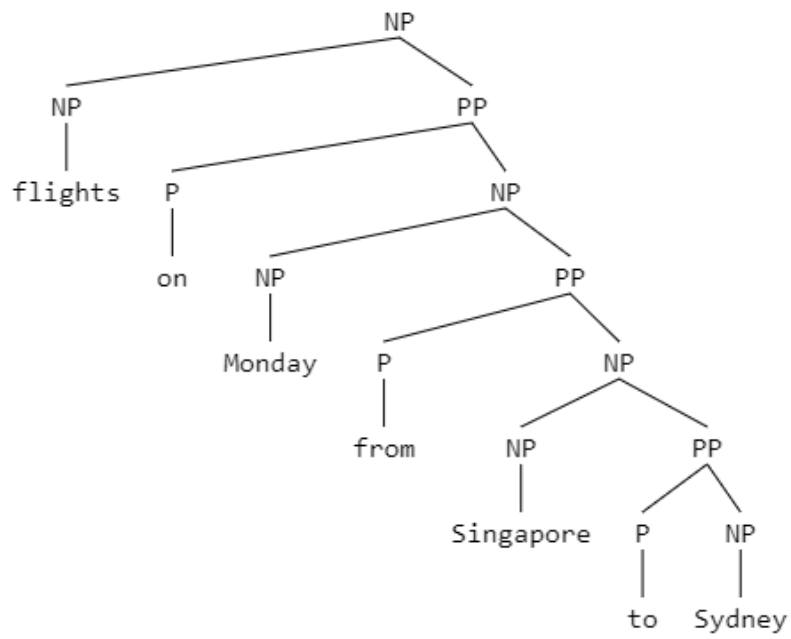
$NP \rightarrow L \ D2$

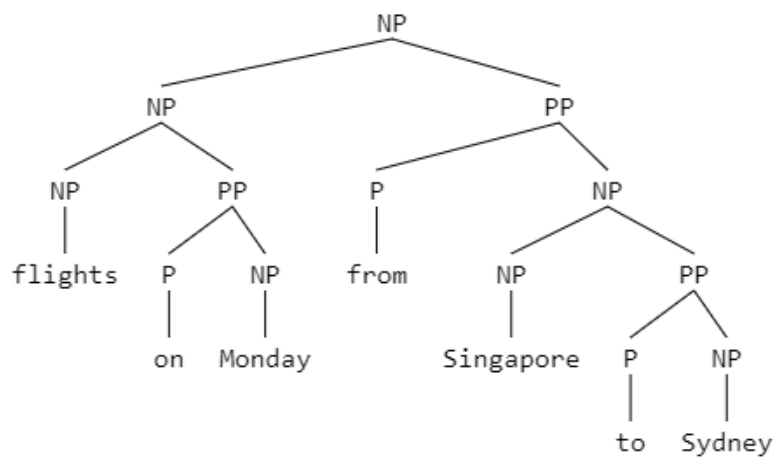
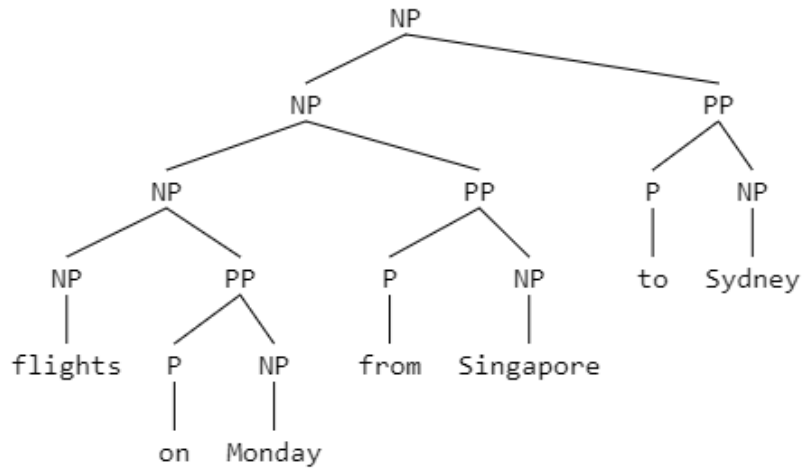
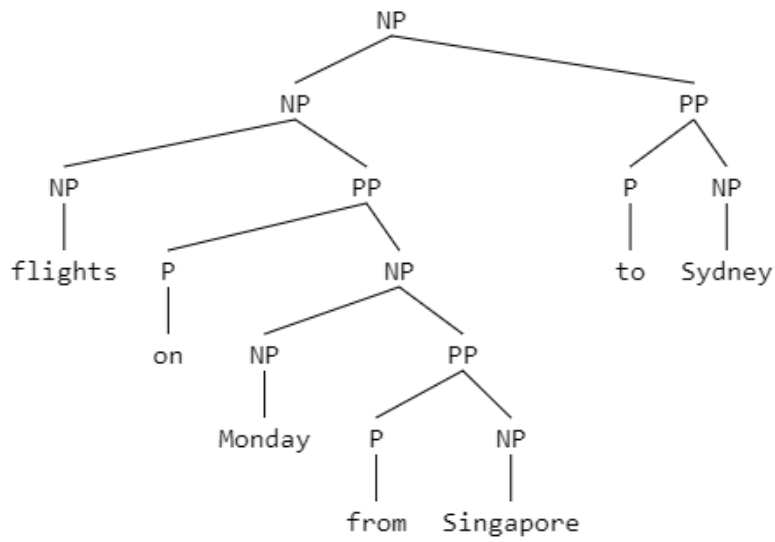
$C \rightarrow \text{and}$

$L \rightarrow ($

$R \rightarrow)$

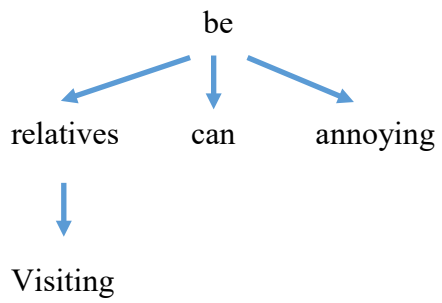
3. 5 different parse trees



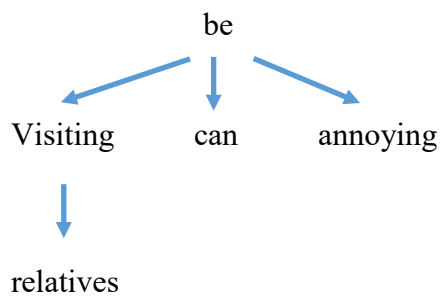


4.

2 dependency parse trees:



Semantic interpretation: Relatives (the visiting kind) can be annoying



Semantic interpretation: The act of visiting (going to relatives' houses) can be annoying