

COMP9414: Artificial Intelligence

Solutions 7: Language Processing

1. **sentence:** This

constituents:

PRO1: PRO \rightarrow *this* from 0 to 1 by lexicon entry 1

NP1: NP \rightarrow PRO1 from 0 to 1 by Rule 2

active-arcs:

ARC1: S \rightarrow NP1 • VP from 0 to 1 by Rule 1

ARC2: NP \rightarrow NP1 • REL S from 0 to 1 by Rule 5

sentence: This is

constituents:

VERB1: VERB \rightarrow *is* from 1 to 2 by lexicon entry 2

VP1: VP \rightarrow VERB1 from 1 to 2 by Rule 6

S1: S \rightarrow NP1 VP1 from 0 to 2 from Rule 1 from ARC1

active-arcs:

ARC3: VP \rightarrow VERB1 • NP from 1 to 2 by Rule 7

sentence: This is the

constituents:

ART1: ART \rightarrow *the* from 2 to 3 by lexicon entry 3

active-arcs:

ARC4: NP \rightarrow ART1 • NOUN from 2 to 3 by Rule 3

sentence: This is the house

constituents:

NOUN2: NOUN \rightarrow *house* from 3 to 4 by lexicon entry 4

NP2: NP \rightarrow ART1 NOUN2 from 2 to 4 by Rule 3 from ARC4

VP2: VP \rightarrow VERB1 NP2 from 1 to 4 by Rule 7 from ARC3

S2: S \rightarrow NP1 VP2 from 0 to 4 by Rule 1 from ARC1

active-arcs:

ARC5: S \rightarrow NP2 • VP from 2 to 4 by Rule 1

ARC6: NP \rightarrow NP2 • REL S from 2 to 4 by Rule 5

sentence: This is the house that

constituents:

PRO2: PRO \rightarrow *that* from 4 to 5 by lexicon entry 5

REL1: REL \rightarrow *that* from 4 to 5 by lexicon entry 5

NP3: NP \rightarrow PRO2 from 4 to 5 by Rule 2

active-arcs:

ARC7: S \rightarrow NP3 • VP from 4 to 5 by Rule 1

ARC8: NP \rightarrow NP3 • REL S from 4 to 5 by Rule 5

ARC9: NP \rightarrow NP2 REL1 • S from 2 to 5 from ARC6

sentence: This is the house that Jack

constituents:

NAME1: NAME \rightarrow *Jack* from 5 to 6 by lexicon entry 6

NP4: NP \rightarrow NAME1 from 5 to 6 by Rule 4

active-arcs:

ARC10: S \rightarrow NP4 • VP from 5 to 6 by Rule 1

ARC11: NP \rightarrow NP4 • REL S from 5 to 6 by Rule 5

sentence: This is the house that Jack built

constituents:

VERB2: VERB \rightarrow *built* from 6 to 7 by lexicon entry 7

VP3: VP \rightarrow VERB2 from 6 to 7 by Rule 6

S3: S \rightarrow NP4 VP3 from 5 to 7 by Rule 1 from ARC10

NP5: NP \rightarrow NP2 REL1 S3 from 2 to 7 by Rule 5 from ARC9

VP4: VP \rightarrow VERB1 NP5 from 1 to 7 by Rule 7 from ARC3

S4: S \rightarrow NP1 VP4 from 0 to 7 by Rule 1 from ARC1

active-arcs:

ARC12: VP \rightarrow VERB2 • NP from 6 to 7 by Rule 7

2. (i) $S \rightarrow S$ and S

NP \rightarrow NP and NP

VP \rightarrow VP and VP

PP \rightarrow PP and PP

ADJP \rightarrow ADJP and ADJP

ADVP \rightarrow ADVP and PP

(ii) *Him and she went to the park.

*John and Jack drinks coffee.

*John went to the park and drink coffee.

*John went to he.

$S \rightarrow S$ and S

Do not have to agree

NP(plu, Case) \rightarrow NP(Case) and NP(Case)

LHS is plu and Case has to agree

VP(Case) \rightarrow VP(Case) and VP(Case)

Case has to agree

PP(acc) \rightarrow PP(acc) and PP(acc)

Case must be acc

PP(acc) \rightarrow PREP and NP(acc)

Case must be acc

ADJP \rightarrow ADJP and ADJP

Do not have to agree

ADVP \rightarrow ADVP and PP

Do not have to agree

(iii) $S(P \wedge Q) \rightarrow S(P)$ and $S(Q)$

$NP(X \wedge Y \wedge F) \rightarrow NP(X \wedge F)$ and $NP(Y \wedge F)$

$VP(X \wedge Y \wedge (F \wedge G)) \rightarrow VP(X \wedge Y \wedge F)$ and $VP(X \wedge Y \wedge G)$

$PP(X \wedge (F \wedge G)) \rightarrow PP(X \wedge F)$ and $PP(X \wedge G)$

$ADJP(X \wedge (F \wedge G)) \rightarrow ADJ(X \wedge F)$ and $ADJP(X \wedge G)$

$ADVP(X \wedge (F \wedge G)) \rightarrow ADVP(X \wedge F)$ and $PP(X \wedge G)$

(iv) For “A but B” there is generally a presupposition that the hearer would not believe B (or even believe $\neg B$) having accepted A.