

# CS 6320 Natural Language Processing

## Homework 4

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### 1. Statistical Parsing

$S \rightarrow NP VP$	.80	$Det \rightarrow the$	.40
$NP \rightarrow Det N$	.30	$Det \rightarrow a$	.40
$VP \rightarrow V NP$	.20	$N \rightarrow meal$	.01
$V \rightarrow includes$	.05	$N \rightarrow flight$	.02

Using the above grammar rules, fill out the rest of the probabilistic CKY chart in the figure below:

Sentence: "The flight includes a meal."

$Det: 0.4$ $Det \rightarrow The$ $0,1$	$NP: 0.3 \times 0.4 \times 0.02$ $= 0.0024$ $NP \rightarrow DT N$ $0,2$	$0,3$	$0,4$	$S: 0.8 \times 0.0024$ $\times 0.000012$ $= 2.3 \times 10^{-8}$ $S \rightarrow NP VP$ $0,5$
	$N: 0.02$ $N \rightarrow flight$ $1,2$	$1,3$	$1,4$	$1,5$
		$V: 0.05$ $V \rightarrow includes$ $2,3$	$2,4$	$VP: 0.2 \times 0.05$ $\times 0.0012$ $= 0.000012$ $VP \rightarrow V NP$ $2,5$
			$Det: 0.40$ $Det \rightarrow a$ $3,4$	$NP: 0.3 \times 0.4$ $\times 0.01$ $= 0.0012$ $NP \rightarrow Det N$ $3,5$
				$N: 0.01$ $N \rightarrow meal$ $4,5$

The flight includes a meal

## 2. Thematic Role Labelling

Thematic Role	Definition Example
Agent	The volitional causer of an event <i>The waiter spilled the soup.</i>
Experiencer	The experiencer of an event <i>John has a headache.</i>
Force	The non-volitional causer of the event <i>The wind blows debris from the mall into our yards.</i>
Theme	The participant most directly affected by an event <i>Only after Benjamin Franklin broke the ice...</i>
Result	The end product of an event <i>The French government has built a regular-size baseball diamond...</i>
Content	The proposition or content of a propositional event <i>Mona asked "You met Mary Ann at a super market?"</i>
Instrument	An instrument used in an event <i>He turned to poaching catfish, stunning them with a shocking device...</i>
Beneficiary	The beneficiary of an event <i>Whenever Ann Callahan makes hotel reservations for her boss...</i>
Source	The origin of the object of a transfer event <i>I flew in from Boston.</i>
Goal	The destination of an object of a transfer event <i>I drove to Portland.</i>

Using the thematic role definitions from the above table, assign the various verb arguments in the following WSJ examples to their appropriate thematic roles:

1. The intense heat buckled the highway about three feet.

heat: Force

highway: Theme

2. He melted her reserve with a husky-voiced paeon to her eyes.

He: Agent

her reserve: Theme

husky-voiced paeon: Instrument

her eyes: Beneficiary

3. But Mingo, a major Union Pacific shipping center in the 1890s, has melted away to little more than the grain elevator now.

Mingo, a major Union Pacific shipping center: Theme

melted away to little more than the grain elevator: Result