

CS6320, Fall 2018
Dr. Mithun Balakrishna
Homework 4
Due November 18th, 2018 11:59pm

A. Submission Instructions:

- Submit your solutions via eLearning.
- Please submit a single zip file with the following files:
 - For programming questions:
 - Source code file(s) in C/C++, Java, or Python. For using any other programming language, please get prior approval from the TA.
 - A ReadMe file with instructions on how to compile/run the code.
 - For all other questions, a PDF/Doc/PS/Image file with the solutions.
- Late Submission Penalty:
 - up to 2 hours late — 10% deduction
 - 2 - 4 hours late — 20% deduction
 - 4 - 12 hours late — 35% deduction
 - 12 - 24 hours late — 50% deduction
 - 24 - 48 hours late — 75% deduction
 - more than 48 hours late — 100% deduction (zero credit)

B. Problems:

1. Statistical Parsing (25 points)

$S \rightarrow NP VP$	.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:

Det: .40 [0,1]	NP: $.30 * .40 * .02$ = .0024 [0,2]	[0,3]	[0,4]	[0,5]
	N: .02 [1,2]	[1,3]	[1,4]	[1,5]
		V: .05 [2,3]	[2,4]	[3,5]
			[3,4]	[3,5]
				[4,5]
The	flight	includes	a	meal

2. Thematic Roles (25 points)

Thematic Role	Definition Example
Agent	The volitional causer of an event <i>The waiter spilled the soup.</i>
Experiencer	The experiencer of and 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.
2. He melted her reserve with a husky-voiced paeon to her eyes.
3. But Mingo, a major Union Pacific shipping center in the 1890s, has melted away to little more than the grain elevator now.

3. Word Sense Disambiguation (50 points):

```
function SIMPLIFIED LESK(word, sentence) returns best sense of word

  best-sense  $\leftarrow$  most frequent sense for word
  max-overlap  $\leftarrow$  0
  context  $\leftarrow$  set of words in sentence
  for each sense in senses of word do
    signature  $\leftarrow$  set of words in the gloss and examples of sense
    overlap  $\leftarrow$  COMPUTEOVERLAP(signature, context)
    if overlap > max-overlap then
      max-overlap  $\leftarrow$  overlap
      best-sense  $\leftarrow$  sense
  end
  return(best-sense)
```

Using WordNet Library API to access the WordNet dictionary, implement the SIMPLIFIED LESK algorithm to disambiguate the word *bank* in the sentence. Your output should show the word overlap for each sense of the word *bank* in WordNet and the final chosen sense.

The bank can guarantee deposits will eventually cover future tuition costs because it invests in adjustable-rate mortgage securities.