CS6320, Spring 2018
Dr. Mithun Balakrishna
Homework 4
Due April 15th, 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. Parse Trees (30 points):

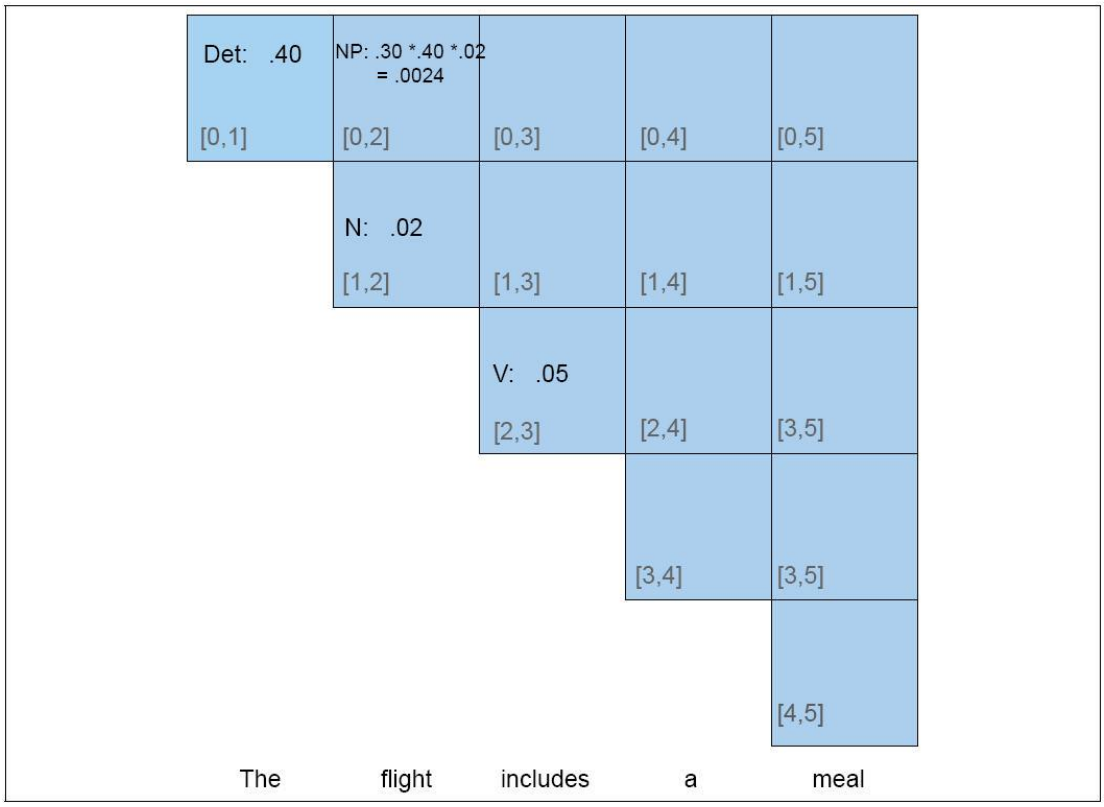
Draw parse tree structures for the following sentences:

1. Does American Airlines have a flight between five a.m. and six a.m.?
2. I would like to fly on American airlines.
3. Please repeat that.
4. Does American 487 have a first-class section?
5. I need to fly between Philadelphia and Atlanta.
6. What is the fare from Atlanta to Denver?

2. Statistical Parsing (20 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

3. Thematic Roles (20 points)

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

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 paean 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.

4. Word Sense Disambiguation (30 points):

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

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

Using WordNet as the 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.