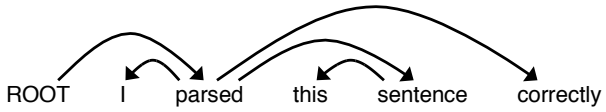
Assignment 5: Dependency Parsing

Homework assignments will be done individually: each student must hand in their own answers. Use of partial or entire solutions obtained from others or online is strictly prohibited. Electronic submission on Canvas is mandatory.

1. **Transition Mechanisms** (60 points)
   (a) (10 pts) Given a sentence *"I parsed this sentence correctly"* with the transitions, complete the following table. The first three steps are provided in the table, showing the configuration of the stack and buffer, as well as the transition and the new dependency (if has) for the following steps.



Stack	Buffer	New dependency	Transition
[ROOT]	[I, parsed, this, sentence, correctly]		Initial Configuration
[ROOT, I]	[parsed, this, sentence, correctly]		*SHIFT*
[ROOT, I, parsed]	[this, sentence, correctly]		*SHIFT*
[ROOT, parsed]	[this, sentence, correctly]	parsed → I	*LEFT-ARC*

   (b) (10 pts) A sentence containing n words will be parsed in how many steps (in terms of n)? Briefly explain in 1-2 sentences why.
   (c) (20 pts) Implement the transition mechanisms, *SHIFT*, *LEFT-ARC*, and *RIGHT-ARC*. (Please check the notebook for the details.)
   (d) (20 pts) Implement Minibatch Dependency Parsing based on the follwoing algorithm.

Algorithm Minibatch Dependency Parsing

Input: *sentences*, a list of sentences to be parsed and model, our model that makes parse decisions

Initialize *partial_parses* as a list of PartialParses, one for each sentence in *sentences*
Initialize *unfinished_parses* as a shallow copy of *partial_parses*
while *unfinished_parses* is not empty **do**
    Take the first *batch_size* parses in *unfinished_parses* as a minibatch
    Use the *model* to predict the next transition for each partial parse in the minibatch
    Perform a parse step on each partial parse in the minibatch with its predicted transition
    Remove the completed (empty buffer and stack of size 1) parses from *unfinished_parses*
end while
Return: The *dependencies* for each (now completed) parse in *partial_parses*.

2. **Neural Networks for Parsing** (40 points)

   (a) (20 pts) Build your neural network. (Follow the instruction in the notebook. Please **NOTE** that **DO NOT** use **torch.nn.Linear** or **torch.nn.Embedding** module in your code for this assignment, otherwise you will receive deductions for this problem.)

   (b) (20 pts) Train the network and report the Unlabeled Attachment Score (UAS).

Submission Instructions You shall submit a zip file named Assignment5_LastName_FirstName.zip which contains: (Those who do not follow this naming policy will receive penalty points)

- The Jupyter notebook which includes all your code and the output of each cell.
- A pdf file contains all your solutions for 1.(a) and 1.(b).