# CS 480: Compiler Design
# Problem Set 2

Due: 06/11/2017

**Instructions:**
I leave plenty of space on each page for your computation. If you need more sheet, please attach your work right behind the corresponding problem. If your answer is incorrect but you show the computation process, then partial credits will be given. It is prefered that you type up your solution (you can use the DocHub extension on Google Drive to edit pdf files and insert images without using LaTeX) and upload your solution onto blackboard for grading.

**First Name**:

**Last Name**:

**Score**: **/100**

## Problem 1 BFS v.s. DFS : 20 pts

Breadth First Search (BFS) and Depth First Search (DFS, normaly leftmost) are two commonly used search algorithms for a tree-like data structure. Of course, the worst case is that the search target lies at the rightmost leaf of the structure (i.e. you have to search the whole tree). Please answering the following:
(a) Please briefly describe BFS.

(b) Please briefly describe DFS.

(c) Describe a scenario when BFS defeats DFS.

(d) Describe a a scenario when DFS defeats BFS.

## Problem 2 Research: Iterative Deepening: 15pts: 10 + 5

Iterative Deeping Search (IDS) is a hybrid search that combines DFS and BFS. Breadth First Search. Of course we want to combine the best of the both worlds.
(a) Please briefly describe IDS and its possible applications (that outperform BFS and DFS)

(b) Please explain how this technique would fit in the syntax parsing.

## Problem 3 Context Free Grammar: 20pts

Consider the following grammar:

$$A \to uA \mid wuA \mid B + B \mid \epsilon$$
$$B \to bB \mid CB \mid \epsilon$$
$$C \to cAw$$

$A$, $B$, and $C$ are the non-terminals in the grammar. If there is a conflict in choice for $A$ in the parse table, $A \to \epsilon$ has the priority.

1. Construct the FIRST sets for the grammar.

2. Construct the FOLLOW sets for the grammar.

3. Construct the LL(1) parse table for the grammar.

4. Show the sequence of stack and input configurations that occur during an LL(1) parse of the string "$cuw + b$". The stack should contain a single $A$ at the beginning of the parse.

## Problem 4 Unambiguous Context Free Grammar: 20pts

Write an unambiguous grammar for the language of balanced parentheses, i.e. the language that contains (among other) the sequences $\epsilon, (), (()), ()(), (()(()))$ but none of the following $(, ), )(, (()), ()())$.

## Problem 5 Unambiguous CFG: 25pts: 5*5

Given following grammar:

$$A \to -A$$
$$A \to A - id$$
$$A \to id$$

(a) Finding a string that has two different syntax trees to show the grammar is ambiguous.

(b) Now make two different unambiguous grammars (i.e. adding new rules into the grammar) for the same language based on:
(b-1) One where prefix minus binds stronger than infix minus.

(b-2) One where infix minus binds stronger than prefix minus.

(c-1) Show your grammar in (b-1) is unambiguous by applying the grammar to the input you discover in (a)

(c-2) Show your grammar in (b-2) is unambiguous by applying the grammar to the input you discover in (a)