

Comp Sci 321: Programming Languages — Homework 2

1 Binding Identifiers

Implement the function `binding-ids`, which takes a WAE (see lecture code or lecture slides) and produces a set of symbols. The set should contain the symbol corresponding to every binding identifier in the given WAE.

To represent these sets of symbols, use lists of symbols where each symbol appears at most once, and where symbols are ordered according to the `symbol<?` comparison procedure.

Hint: First, write a function that generates an unordered list of symbols with duplicates, and then write separate functions to re-order the list and then remove duplicates.

Hint: The PLAI language includes several helpful list-processing functions:

- `filter` - takes a predicate and a list, and returns a list that contains only values for which the predicate returned true. This is useful for removing a value from a list.
- `sort` - takes a list and a less-than comparison function (i.e., a function of two arguments where the result is true when the first argument is less than the second) and produces a sorted list.
- `member` - takes a value and a list, and returns `false` if the value is not in the list, and otherwise returns the portion of the list after (inclusively) the value of interest, which counts as a true value as far as conditionals are concerned.
- `remove-duplicates` - takes a list and returns a new list that has the same elements, but without duplicates.

Of course, you're also welcome to use other PLAI functions as you see fit.

As a reminder, you can find the PLAI documentation [here](#).

Hint: You are welcome to reuse the functions you write for one part in subsequent parts.

2 Bound Identifiers

Implement the function `bound-ids`, which is like `binding-ids`, but the result list contains a symbol for each bound identifier in the given WAE. The result list of symbols must be sorted and have no duplicates.

3 Free Identifiers

Implement the function `free-ids`, which is like `binding-ids`, but the result list contains a symbols for each free identifier in the given WAE. The result list of symbols must be sorted and have no duplicates.

4 Shadowed Identifiers

Implement the function `shadowed-ids`, which accepts a `WAE` and returns a list of the binding identifiers that are shadowed by another binding in the given `WAE`. The result list of symbols must be sorted and have no duplicates.

5 Handin Instructions

Provide definitions for `binding-ids`, `bound-ids`, `free-ids`, and `shadowed-ids`, as above.

Use the same definition for `WAE` we used in class.

Have the 8 rules from the Provost's website (see homework 1 for more details).

Submit your code via Canvas.

Your submission must include your test cases; submissions without test cases will get a grade of 0.