CSE 3302/5307 Programming Language Concepts

Homework5 - Fall 2023

Due Date: Sep.30, 2024, 11:59p.m. Central Time

Problem1 - 30%

Consider the following program which is written in C syntax.

```c
int x = 1;

void f1() {
    int x = 3;
    f2();
    printf(x)
}

void f2() {
    int x = 2;
    printf(x)
}

int main() {
    f1();
    printf(x)
}
```

What will be printed after running `main()` when it uses static scoping? dynamic scoping? Justify the operation in each case.

Problem2 - 40%

Extend tuples to records, and write the (a) syntax for expression and value form(s) in BNF and (b) operational semantic rules for records. You can assume $x_1, x_2, ..., x_n$ for arbitrary attribute names (and x_j for an arbitrary attribute). Example usage for records:

- Elements are indexed by labels:

  - $\{y = 10\}$
  - $\{id = 1, salary = 50000, active = \textbf{true}\}$

- The order of the record fields is insignificant:

  - $\{y = 10, x = 5\}$ is the same as $\{x = 5, y = 10\}$

- To access fields of a record:

  - $a.id$
  - $b.salary$

Including typing semantics and their syntax correctly would correspond to a 5% bonus.

Problem3 - 30%

Another way of defining **let** might be to desugar it by executing it immediately. That is, to regard **Let x=**t_1 **in** t_2 as an abbreviation for the substituted body $t_2[t_1/x]$. Consider implementing a functional language with call-by-value evaluation, would this be a good idea? Justify why or why not. Explictly state any conditions for the equivalence of $t_2[t_1/x]$ and **Let x=**t_1 **in** t_2 in your justification.