CS314 Fall 2018

Assignment 5

1 Lexical/Dynamic Scoping

```
procedure main():
    int var = 10;
    procedure set_var(int val):
        var = val;
    end set_var
    procedure proc1():
        set_var(1);
    end proc1
    procedure proc2():
        int var = 2;
        set_var(4);
        print var;
    end proc2
    print var;
    set_var(41);
    proc1();
    print var;
    proc2();
end main
```

(a) Suppose the procedure **main()** uses static (lexical) scoping. What will it print, and why?

(b) Suppose the procedure **main()** uses dynamic scoping. What will it print, and why?

2 Lexical Scoping

This problem uses the following procedure. This procedure uses static (lexical) scoping.

```
procedure main():
    int a;
    procedure proc1(int i):
        int b;
        b = a + 1;
        procedure recursion(int k):
            print b;
            b = b - 1;
            if (b > 1):
                recursion(k * b);
            else:
                a = k;
        end recursion
        b = b + i;
        recursion(1);
    end proc1
    a = 1;
    proc1(4);
    print a;
end main
```

(a) What does this procedure print? (Give the output of procedure **main()**.)

(b) Rewrite the procedure **main()** where each variable (argument variables, declared variables, procedure names) is renamed by their (level, offset) pairs.

(c) How does procedure **proc1** find variable **a** in instruction **b = a + 1;**? Show the RISC instructions corresponding to the high-level instruction **b = a + 1;** in this procedure. You should use the same ILOC instruction format as used in class.

(d) Show the stack frames at the beginning of procedure **proc1**. Label each frame with its procedures name, and make sure you include the

local variables and their values. Show all access links and control links between the stack frames, and the frame pointer (FP), by drawing arrows. You should use the frame layout in the figure below.

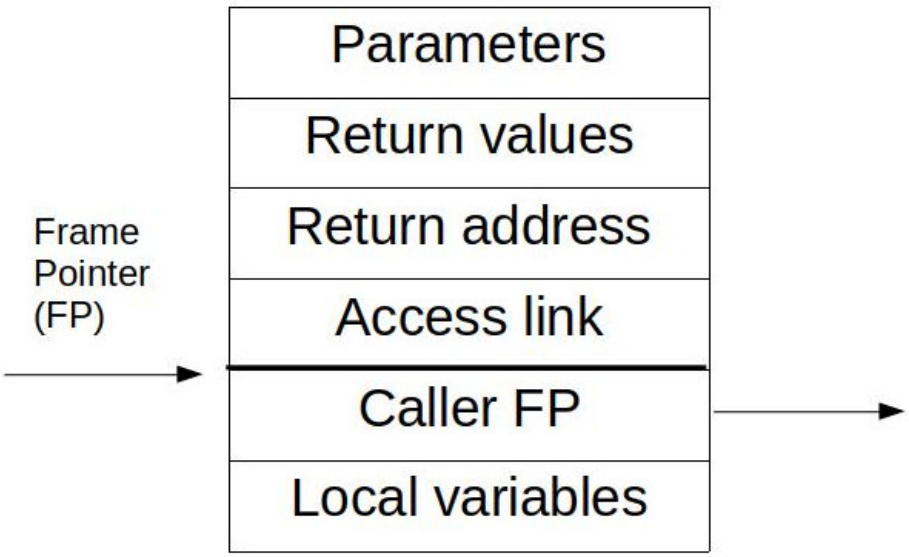

Figure 1: Figure for the frame layout