Homework 6: Implementation

This homework is due Thursday, March 2, 1989 (in recitation). Each weekday that the homework is late you lose 10% of the possible points.

When problems ask you to draw a stack, please draw the stack so that it grows upwards.

1. (3 points) Do exercise 6-1 on page 228 in the text. (Use static chaining and be sure to clearly show both the static and dynamic links.)

2. (3 points) Do exercise 6-2 on page 228 in the text. (Use static chaining and be sure to clearly show both the static and dynamic links.)

3. (3 points) Write down the static nesting levels of all identifiers (i.e., variable and procedure names) in the program found in Figure 6.5 on page 241 of the text.

4. (4 points) Do exercise 6-7, which starts on page 241 in the text.

5. (3 points) Do exercise 6-11 on page 248 in the text.

6. (4 points) Draw the stack, display, and SP registers just after the call `Q(P)` is executed (i.e., before `fp(5)` is executed) in the program skeleton in Figure 6.5 on page 241 in the text and then after the call `fp(5)` is made from that activation of `Q`. (Use a display instead of static links for this problem.)

7. This problem compares the implementation of FORTRAN procedures with Pascal.

   (a) (3 points) Estimate the number of memory references that will occur when calling a parameterless FORTRAN subroutine. (See pages 59-64 of the text.)

   (b) (5 points) Discuss the relative costs and benefits of the procedure mechanisms provided by FORTRAN and Pascal. (Discuss both efficiency and expressive power.)

8. Addressing nonlocal variables in Pascal programs can require several memory references. However, using displays instead of static chaining makes procedure call and return slower.

   (a) (5 points) What changes to the design of the Pascal language would ensure that static chaining was always as efficient as using a display for addressing nonlocal variables? Describe these changes to Pascal with as much precision as you can (e.g., give a new BNF grammar for any changes in syntax).

   (b) (5 points) Evaluate the effect of the changes you proposed in part (a) on the expressive power of Pascal. Would it be easier or harder to solve problems in the changed language?