Programming Languages: Homework 3

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Due in **three** weeks, December 3 1998

Note: *You are required to include a printout of a session showing a run of your program on some general testdata.*

Problem 1. *[Problems 5.1 & 5.2 (pp. 198 & 199) in Sethi: Programming Languages—Concepts and Constructs. 2nd Edn.]*

Problem 2. Write a generic Ada program to perform heap sort of any array of elements, where the elements in the array are assumed to support a comparison operation.

```
generic
   type ITEM is private;
   type SORT_ARRAY is array(POSITIVE range <>) of ITEM;
   with function "<"(U,V: ITEM) return BOOLEAN is <>;
function HEAP_SORT(A: SORT_ARRAY) return SORT_ARRAY is

   -- MISSING BODY

end HEAP_SORT;
```

Problem 3. Write a PASCAL function that takes a polynomial and returns the polynomial that is its derivative.

The derivative of x^n is $\frac{d}{dx}x^n = nx^{n-1}$.

The Pascal program (called "`PolyDiff`") may use a bound on the degree of the polynomial represented. Make sure that the program works on the following examples:

$$\frac{d}{dx}(x^7 - 3x^5 + 8x^4 - 3x^2 + 19x + 2),$$

and

$$\frac{d^3}{dx^3}(2x^8 - 7x^5 - 6x^4 + 3x^3 + 2x^2 + 7).$$

Rewrite the same program in Ada and `C++` while making use of the data encapsulation facilities.

Remark on the differences in style of programming as you go from PASCAL to Ada and `C++`.