HW10
50pts, no extra credit
This is a team assignment. Form teams and submit in Submitty!
Posted Friday, November 16, 2018
Due Tuesday, November 27, 2018

Problem 1 (5pts). [Modified from Scott]. In the following code, which of the variables will a compiler consider to have compatible types under structural equivalence? Under strict name equivalence? Under loose name equivalence?

type A = array [1..10] of integer
type B = A
a : A
b : A
c : B
d : array [1..10] of integer

Problem 2 (10pts). [Modified from Scott]. Explain the meaning of the following C declarations. Draw the type trees as we did in class.

double *x[n];
double (*y)[n];
double (*z[n])();
double (*w())[n];

Problem 3 (10pts). [Modified from Scott]. Consider the following declaration in C:
double (*bar(int, double(*)(double, double[])))(double);
Describe in English the type of bar. Draw the type tree.
How about
double (((*bar)(int, double(*)(double, double[])))(double);
Describe and draw the type tree. Is this a valid declaration in C? Explain your answer.

Problem 4 (5pts). [From Scott]. Consider the following C declaration, compiled on a 32-bit Pentium machine:

struct {
    int n;
    char c;
} A[10][10];

If the address of A[0][0] is 1000 (decimal), what is the address of A[3][7]?
Problem 5 (12pts). Consider the Pascal-like code for function `compute`. Assume that the programming language allows a mixture of parameter passing mechanisms as shown in the definition.

```pascal
double compute(first : integer /*by value*/, last : integer /*by value*/,
                incr : integer /*by value*/, i : integer /*by name*/, term : double /*by name*/)
result : double := 0.0
i := first
while i <= last do
    result := result + term
    i := i + incr
endwhile
return result
```

a. (2pts) What is returned by call `compute(1, 10, 1, i, A[i])`?
b. (2pts) What is returned by call `compute(1, 5, 2, j, 1/A[j])`?
c. (2pts) `compute` is a classic example of Jensen's device, a technique that exploits call by name and side effects. In one sentence, explain what is the benefit of Jensen’s device.
d. (6pts) Write `max`, which uses Jensen’s device to compute the maximum value in a set of values based off of an array `A`.

Problem 6 (8pts). [Modified from Scott]. Is it possible to write a `swap` routine in Java, or in any other language that uses the reference model for variables and thus only call-by-sharing? What exactly should `swap` do in such a language? (Hint: think about the distinction between the object to which a variable refers and the value (contents) of that object.)