2. Determine which characteristics of an algorithm the following procedures have and which they lack.

An algorithm is a finite set of precise instructions for performing a computation or solving a problem.

Some properties are listed in the text: input, output, definiteness, correctness, finiteness, effectiveness, and generality.

a. procedure double(n:positive integer)
   while (n > 0)
     n = 2n

This is simply an infinite loop that has no output. It certainly is a finite set of precise instructions, but it’s completely useless since it doesn’t solve any problem.

d. procedure choose(a, b:integers)
   x = either a or b

This fails to be definite because of the choice. As a “non-deterministic” algorithm, it is interesting.

Summary. None of these four fit the basic definition of algorithm since all fail to perform a computation or solve a problem. They all have inputs from specified sets. None have explicit outputs, although 2c and 2d can be interpreted as having outputs. 2a and 2b are definite, but 2c is not because a variable is not initialized, and 2d has the explicit choice. The question of correctness can’t even be considered since we don’t know what they’re supposed to do. Two of them aren’t finite, 2a and 2c, but infinite loops instead. Effective? Can each of the steps be performed in a finite amount of time? Sure. The question of generality also can’t be considered as we don’t know what the purposes are.

12. Describe an algorithm to replace the triple (x, y, z) with (y, z, x). What’s the minimum number of assignment statements needed.

Here’s one solution. Put x in a temporary variable t; put y in x; put z in y; and put t in x. That is, t = x; x = y; y = z; z = x. It takes four assignments.

16. Describe an algorithm that for finding the smallest integer in a finite sequence of natural numbers.

Assume A is a nonempty array indexed from 0 through n – 1. This algorithm will return the smallest integer s in the array.

function smallest(A, n: array of natural numbers)
   s = A[0]
   i = 1
   while (i < n)
     if (A[i] < s) s = A[i]
     i = i + 1
   return s

19. Describe an algorithm to produce the maximum, median, mean, and minimum of three integers.

There are so many ways to do this that almost any two people will come up with different solutions.