Homework I
Introduction to Programming

September 3, 2002

This is a rather unusual first programming assignment in that it does not involve using a computer!

1. Write a function f which given the price p of a pizza in cents and the diameter d of the pizza in inches, computes the price per square inches.

2. If the functions f, g, and h are defined as follows:

$$f(x) = x^2 + 3x + 2 \qquad g(x) = f(x-2) - h(x) \qquad h(x) = 5$$

What are the values of: $f(2)$, $f(5+2)$, $g(g(f(1)))$, $h(1/0)$, $g(1/0)$?

3. If the functions f, g, and h are defined as follows:

$$f(n) \;=\; \begin{cases} h & \text{if } n = 0 \\ g(f(n-1)) & \text{if } n > 0 \end{cases}$$

$$g(x)(n) \;=\; \begin{cases} x(1) & \text{if } n = 0 \\ x(g(x)(n-1)) & \text{if } n > 0 \end{cases}$$

$$h(n) \;=\; n+1$$

What is $f(2)(3)$?

4. A programmer was assigned the job of writing a program for computing the distance between any two points on Earth given their latitudes and longitudes. After searching for days and days he found the following formula for computing the distance between any two points on a sphere:

$$d = 2R \tan^{-1} \sqrt{\frac{1-T}{1+T}}$$

where R is the radius of the sphere and T is:

$$T = \sin(lat_1)\sin(lat_2) + \cos(lat_1)\cos(lat_2)\cos(long_1 - long_2)$$

Happy to have found the solution and knowing that the radius of the Earth is approximately 3964 miles, he wrote a straightforward program transliterating the above formula in his favorite programming language. He tested his program on a few cities like:

- Bloomington (latitude 39.165, longitude -86.517)
- Eugene (latitude 43.854, longitude -122.933)
- Cairo (latitude 30.050, longitude 31.250)

and his program gave the expected answers.

He turned his program to the boss who immediately fired him! Why?