# Economics 288

## Fall 2002

## Problem Set 1

### Due October 8, 2000

Use Fortran, Matlab, C, Gauss, Maple, or Mathematica or similar language. If you don't know a language, learn Matlab. Your written solutions to all exercises should explain what you did and what you found in a compact form, followed by a listing of your computer code and output. *Don't just give me computer code and output.* For example, use tables where useful.

1. Write a subroutine (procedure, etc.), called ADDXY, that takes as input two scalars, $x$ and $y$, and produces $x+y$ as output. Similarly write a routine MXY that takes $x$ and $y$ and produces $x\ y$, and a routine DXY that takes $x$ and $y$ and produces $x/y$. Write a program which reads two scalars, $x$ and $y$, applies each of MXY, DXY, and ADDXY to $x$ and $y$, and prints the answers in a readable fashion. For example, the printout should consist of statements like "THE SUM OF—AND—IS—," "THE PRODUCT OF — ...," and so on.

2. Write a routine FEVAL that takes as input a function of two variables $F$ and two scalars $x$ and $y$ and produces as output the value of $F(x, y)$. Write a program that reads two scalars $x$ and $y$, applies FEVAL to each of MXY, DXY, and ADDXY together with the scalars $x$ and $y$, and prints the answers in a readable fashion. For example, the printout should consist of statements like "THE SUM OF—AND—IS—", "THE PRODUCT OF—...", etc.

3. Compute

$$(1682\,xy^4 + 3x^3 + 29\,xy^2 - 2x^5 + 832)/107751$$

for $x = 192119201$ and $y = 35675640$. Does your computer get the right answer?

4. Compute

$$8118\,x^4 - 11482\,x^3 + x^2 + 5741\,x - 2030$$

for $x = 0.707107$. Does your computer get the right answer?

5. Solve the linear equations

$$\begin{aligned} 64919121\,x - 159018721\,y &= 1 \\ 41869520.5\,x - 102558961\,y &= 0 \end{aligned}$$

Compute the solution using double precision arithmetic on your computer and then compute the solution analytically. Do they agree?

6. Let

$$f(x) = \frac{4970\,x - 4923}{4970\,x^2 - 9799\,x + 4830}$$

Use a finite difference approach from Section 5 to compute $f''(1)$ for $h = 10^{-4}$, $10^{-5}$, and $10^{-8}$. How do the finite-difference results compare to the true derivative value?

7. Write programs to determine the relative speeds of addition, multiplication, division, exponentiation, logarithm (base 10), the sine function, and the tangent function on your computer.

8. Write a program which determines your machine $\epsilon$ and your machine zero.

9. Apply the stopping rules (8.4) and (8.6) to the following sequences: (a) $x_k = \sum_{n=1}^{k} \frac{3^n}{n!}$; (b) $x_k = \sum_{n=1}^{k} n^{-2}$; (c) $x_k = \sum_{n=1}^{k} n^{-1.001}$; (d) $x_k = \sum_{n=1}^{k} n^{-.5}$. Use $\epsilon = .01$, $.001$, and $.0001$. For each $\epsilon$, determine the number of terms computed before the stopping rule makes a choice and compute the error of the answer. Hint: use a table such as

Number of terms

| | $\epsilon$ : | | |
|---|---|---|---|
| Problem | .01 | .001 | .0001 |
| (a): | ? | ? | ? |
| (b): | ? | ? | ? |
| (c): | ? | ? | ? |
| (d): | ? | ? | ? |