

Physics 693 – Core Skills for Computational Science Fortran Homework

- Homework is to be turned in by email (denewman@alaska.edu).
- Late homework will have 10% deducted from total points possible.

Part I – These are simple programs to get you started using Fortran and compiling.

Program 1: (2 points)

Write a simple “Hello World” program. The program should prompt the user for their first name, last name, and gender. The program should output a hello greeting using the persons first and last name and honorific (either Mr. or Mrs.). If an incorrect gender is entered, the program should display an error message.

Program 2: (3 points)

Write a program to compute the factorial of a number. The main program should repeatedly ask for an input number, use a function to calculate the factorial of that number, and display results. The program should exit when a negative number is given as input.

Part II – This is a more advanced Fortran program that will be developed on one of the workstations, but the final run will need to be done on Pacman using batch processing. (15 points)

In this program, you will write a simple one-dimensional finite difference solver. The N difference equations are represented by a vector with initial values of all zeroes. In addition, there are boundary values of 1.0 at each end of the vector.

For each time step t out of a total of T time steps, element i of the vector X is updated as follows:

$$X_i^{(t+1)} = (X_{i-1}^{(t)} + 2X_i^{(t)} + X_{i+1}^{(t)}) / 4$$

We will add the (inefficient) constraint for consistency of results that no element is updated in step t+1 until its neighbors have been updated in step t.

As you are developing your code, run with values for N and T of less than 1000. You may wish to print your X array with code similar to:

```
PRINT 20, x(1:N)
20 FORMAT (10f10.8)
```

For your final runs, execute the code on Pacman using batch processing. Use parameters $N=500000$ and $T=100000$. Only **print the first and last elements** (NOT the boundary values!) of your array **after the last iteration** is complete using format F10.8. So, your program's output will consist of 2 values only.

Turn in the your source code, makefile, batch script, and output from the batch run. Run the code first with default optimization and then with full optimization and hand in comparison timings. A simple way to time codes is to use the unix "time" command.

You will be graded on program correctness and clarity of your code. The entire program will probably take fewer than 50 lines, including comments (a major component of "clarity of your code").