Unix/Linux commands
Fortran sample code

Homework 1
Due 1 February 2023

A. Read Sections 1.1 to 1.4 of Chapter 1 in *Introduction to Computational Physics for Undergraduates*.

B. Use vim, MacVim, Emacs, gedit or another text editor of your choice to create a text file named `UnixCommands.txt` on your computer. In this file, describe briefly (not more than a sentence per command) the meaning of the following Unix/Linux commands:

cd	ls -a	mkdir	rmdir	pwd	cp	touch
cd ..	mv -iv	rm -iv	rm -rf	more	head	tail
cd .	chmod	date	df	./Einstein.o	cpp Newton.cpp	wc
cd ∼/	gfortran Einstein.f90	gunzip	gzip	chmod	sftp	ssh
tar -tvf	tar -tzvf	tar -xvf	tar -xzvf	tar -cvf	tar -czvf	cd ../../

C. The Fortran code shown below reads x (real number) from standard input (i.e., keyboard), computes $\psi(x)$ given by

$$\psi(x) = \sin^3\left(x^2\right)\ \cos^2\left(\sqrt{|x|}\right)\ \left(1 - e^{-x^2/4}\right) + \frac{1}{7}\, e^{\sqrt{|x|}\cos(|x|)}\,,$$

and writes the value of $\psi(x)$ to standard output (i.e., terminal).

```
PROGRAM evalMathExpression

! This program reads x (real number) from keyboard and computes and writes the
! value of psi(x) to standard output (terminal).

! History:
!   Version        Programmer      Date            Description/Comments
!   -------        ----------      ----------      ------------------------
!      1           Your Name       xx/xx/xxxx      Code created from scratch
!
! INPUT:
!         Quantity         Units         Description
!         --------         -----         --------------
!            x             none          Keyboard input
!
! OUTPUT:
!        Quantity          Units         Description
!        --------          -----         -------------
!           psi            none          wave function of a QM object
!
! SPECIAL REQUIREMENTS: none


      IMPLICIT none
      REAL :: x, psi_x, term1, term2, term3, term4

! Input x value from standard input (keyboard)
      WRITE(*,*) "Input value for x:"
```

```
      READ(*,*) x

      term1 = SIN(x*x)**3
      term2 = COS(SQRT(ABS(x)))**2
      term3 = 1.0 - EXP(-x*x/4)
      term4 = EXP(SQRT(ABS(x)) * COS(ABS(x))) / 7.0

! Compute function f(x)
      psi_x = term1 * term2 * term3 + term4


! Write results to standard output (screen)
      WRITE(*,*) x, psi_x

      STOP 'Regular stop encountered'
END PROGRAM evalMathExpression
```

Tasks

1. Open `evalMathExpression.f90` with a text editor of your choice (e.g. `vim`, `MacVim`, `Emacs`, `gedit`) and enter the Fortran program line by line into this file.

2. Compile the program:

```
gfortran -o evalMathExpression.o evalMathExpression.f90
```

Check whether or not the binary (executable) file `evalMathExpression.o` has been created. If errors have occurred, correct them and recompile the code until the Fortran compiler generates the binary version of the code.

4. To run the program, type

```
./evalMathExpression.o
```

at the shell prompt and hit the return button. You will be prompted to input a value for x. Run the code for $x = 0.5$ and 1.5. The results will be

```
   0.500000000       0.266236067
   1.50000000        0.179099947
```

HOMEWORK SUBMISSION INSTRUCTIONS

1. Create a sub-directory named `LastFirst_HW1`.
2. Copy `UnixCommands.txt` and `evalMathExpression.f90` to `LastFirst_HW1`.
3. Create a gzipped archive file of your homework: `tar -czvf LastFirst_HW1.tgz LastFirst_HW1/.`
4. Email the archive file `LastFirst_HW1.tgz` to `ewhart317@gmail.com`. Put `PHYS 317 HW 1` in the subject line.