PHYS 410: Computational Physics   Fall 2000   Homework 1
Due: Tuesday, September 19, 10:30 (except Problem 0)

Problem 0: Login to your account on `sgi1.physics.ubc.ca`, and change your password using the `passwd` command. *Ensure that you have finished this task before* **Tuesday, September 12, 10:30***, and before you complete Problem 1b.*

Problem 1a: Send me (`choptuik@physics.ubc.ca`) an e-mail message from *your own account* on the Physics & Astronomy Department, Sun server, `physics.ubc.ca`. Use the system's "hostname" `physics`, for the subject of the message, and include *your* name in the body of the message. Incidentally, note that there is a Unix command `hostname`.

Do the remaining problems using your account on the SGI machine, `sgi1.physics.ubc.ca`*. In particular note, that "∼" in the following refers to your home directory on that machine, and all file and directory references are to files on* `sgi1` *As always, send me mail immediately if you encounter problems using any of the machines.* IMPORTANT!! Be sure to read all instructions carefully, as your grade will depend on certain files being in the right places with the right names. *Note that you will be copying files owned by user* `phys410` *several times.*

Problem 1b: Send me an e-mail message from *your own account* on the Numerical Relativity Group SGI machines `sgi1`. Again, use the hostname for the subject of the message, and include your name in the text of the message.

Problem 2: I have created directories for each of you which you may use to "publish" Web pages (related to this course) via the Numerical Relativity web server (`http://laplace.physics.ubc.ca`). Your personal directory (which I'll refer to as your Web directory) is `/Public/Students/<accountname>` where `<accountname>` is the name of your account on the SGIs. I have created a "template" homepage named `/Public/Students/phys410/index.html`. Copy this HTML file into your Web directory (use the same name—`index.html`) and modify the HTML file to reflect your name, address, phone-number etc. Use your text editor of choice (presumably `vi` or `emacs`) to perform the modifications. If you don't feel like publishing any specific piece of information, specify it as "unlisted". Below the horizontal rule (line) in the template file, add suitably labelled links to (a) the course home page (b) the instructor's home page and (c) at least 5 Web pages that have something to do with quantum teleportation. Check your work by verifying that you can get to your home page by going to our Course page, selecting "Student Pages" and then your name.

Problem 3a: I have created a subdirectory named `hw1` (for Homework 1) in your home directory. I have also changed the permissions on this directory so that your work remains private; please do not alter the permissions until after the homework has been graded. In this new directory, create another subdirectory named `a3`. In that directory (`~/hw1/a3`), and using `vi` or `emacs`, create a file named `apple` which contains the following text from *Gravitation*, by Misner, Thorne and Wheeler. Try to duplicate the spacing, line breaks, punctuation etc. as closely as possible.

```
Once upon a time a student lay in a garden under an apple tree reflecting
on the difference between Einstein's and Newton's views about
gravity.  He was startled by the fall of an apple nearby.  As he
looked at the apple, he noticed ants beginning to run along its
surface. His curiousity aroused, he thought to investigate the
principles of navigation followed by an ant.  With his magnifying glass,
he noted one track carefully, and, taking his knife, made a cut in the apple
skin one mm above the track and another cut one mm below it.  He peeled
off the resulting little highway of skin and laid it out on the face
of his book.  The track ran as straight as a laser beam along this
highway.  No more economical path could the ant have found to cover
the ten cm from start to end of that strip of skin.  Any zigs and
zags or even any smooth bend in the path on its way along the apple
peel from starting point to end point would have increased its length.

   ``What a beautiful geodesic'', the student commented.
```

Problem 3b: Create a file in the same directory (`~/hw1/a3`) called `kumquat` which is identical to `apple` except that all occurences of the word "apple" are replaced with "kumquat". Leave a brief note in a file called `README` (again in the same directory) which describes how you created `kumquat` and made the changes.

Problem 4: In a directory `~/hw1/a4`, create a file called `stripped` whose contents are identical to `~phys410/hw1/q4/input` except that all lines which have a 'c' or 'C' in the first column have been removed. Leave a brief note in `~/hw1/a4/README` which describes how you solved the problem.

Problem 5: Create `~/hw1/a5`. In that directory, create copies of the files `~phys410/hw1/q5/First.c` (a simple `C` program) and `~phys410/hw1/q5/first.f` (a `FORTRAN` version of the same simple program). Create executable files (commands), `first` and `First` by issuing the commands `make first` and `make First`, respectively. Leave a note in `~/hw1/a5/README` which describes what happens when you type each `make` command. Type `first`. Document what happens in `README`. Type `First`. Document what happens in `README`. Change your working directory to your home directory (recall that `cd` with no arguments always takes you home) and type `First`. What happens and why? (Be sure to answer in `~/hw1/a5/README`). Return to `~/hw1/a5` and make modified versions of the `C` and `FORTRAN` programs called `Second.c` and `second.f`, respectively, which print out

```
Hello World!  My name is <your name>
```

where `<your name>` is, of course, to be replaced by your name. Make the executables `Second` and `second` and verify that your modifications were successful. (Beware that `FORTRAN` statements must start in column 7 or higher, and must not extend past column 72.)

Problem 6: Make the directory ~`/hw1/a6`. The file `/usr/lib/dict/words` contains a list of words (mostly genuine English words), one per line. How many words does the file contain? Answer in ~`/hw1/a6/README`. In ~`/hw1/a6` create files with the following names and contents (words should appear one per line):

- `3letter` which contains all the three-character (three-letter) words in `/usr/lib/dict/words` in alphabetical order
- `13letter` which contains all the thirteen-character words in `/usr/lib/dict/words` in alphabetical order
- `r4letter` which contains all the four-letter words in `/usr/lib/dict/words` in *reverse* alphabetical order (*Hint:* Use the Unix `sort` command)
- `5vowels` which contains all the words in `/usr/lib/dict/words` which contain all five of the vowels 'a', 'e', 'i', 'o' and 'u'

Leave comments in ~`/hw1/a6/README` which describe how you solved each problem.

Problem 7: Use the plotting program `gnuplot` to produce a plot of $\sin(8x)\sin(9x)$ for $0 \leq x \leq 1$. Save your plot as the postscript file `plot.ps` in the directory ~`/hw1/a7`. *Hint:* Use `gnuplot`'s extensive on-line help: you may find `help plot`, `help postscript` and `help output` particularly useful.