STA410/2102 (Statistical Computation), Fall 2007

Homework #1

Due: In class by 6:10 p.m. **sharp** on Tuesday October 2. (If you prefer, you may bring your assignment to the instructor's office, Sidney Smith Hall room 6024, any time before it is due; slide it under the door if he is not in.)

Warning: Late homeworks, even by one minute, will be penalised!

Note: Homework assignments are to be solved by each student individually. You may discuss assignments in general terms with other students, but you must solve it on your own, including doing all of your own computing and writing.

Include at the top of the page: Your name and student number.

Special Note: When writing programs in R for homework, you should include some comment lines to explain what you are doing. Also, you should hand in both the program itself, and the program's output.

The assignment:

1. Convert (with explanation) each of the following values to double-precision floating-point format.

(a) 6

(b) -27

(c) 84.375

2. For each of the following R expressions, determine what value is returned by R. Then, if that value is "Inf" or "0" explain why that is so; if not, provide (with explanation) that value's double-precision floating-point representation.

(a) (1/2) * 2∧1024

(b) (1/2) * 2 * 2∧1023

(c) 2 * 2∧1023 * (1/2)

(d) 2∧(-1074) * 3 / 4

(e) 2∧(-1074) / 4 * 3

(f) 2∧(-1074) - 2∧(-1074) * 3 / 4

(g) sum(2∧(1023:971))

(h) sum(2∧(1023:970))

(i) Explain what is "special" about the value of expression (g) above. [Hint: how does it compare to other expressible values?]

3. Think of one <u>other</u> summary statistic for flipping a coin 100 times, <u>besides</u> the four already used in class. (Try to choose one that seems "interesting", and is <u>not</u> very similar to those used in class.)

(a) Describe the statistic in words.

(b) Describe the statistic with a precise formula.

(c) Write a program in R to repeatedly simulate 100 coin flips, 1000 times, each time computing your statistic. (See the Special Note, above.) [You may wish to begin with the file "Rcoins" from the course web page, but you will have to modify it appropriately.]

(d) Compute the sample mean of your statistic, and its standard deviation.

(e) Display a histogram of your statistic. [You may wish to use, say, the R command "jpeg" to save an image of the histogram in order to submit it.]

4. Write a program in R to perform a Monte Carlo simulation to estimate $\mathbf{E}[Z^4 \cos(Z)]$, where $Z \sim \text{Normal}(0, 1)$. Output both the estimate and its standard error. Use enough replications to make the standard error less than 0.05. (See the Special Note, above.) [You may use the R command "rnorm" if you wish.]

5. Write a program in R to perform a Monte Carlo simulation to estimate $\mathbf{E}[Z^Y]$, where $Z \sim \text{Normal}(0, 1)$ and $Y \sim \text{Poisson}(10)$, with Y and Z independent. Again, output both the estimate and its standard error. (See the Special Note, above.)