Computing tutorial – Waiting times

2pm–3pm Thursday 25th & 3pm-4pm Friday 26th November 2004

A.1 A bent coin has a probability of landing 'heads' equal to $f = 0.01$. Fred tosses the coin until he obtains one head. Let the number of tosses completed, when the head arrives, be N.

(a) What is the probability distribution of the random variable, N? Sketch the distribution.

(b) What is the mean value of N?

(c) What is the most probable value of N?

(d) Make a simulation of Fred's coin-tossing experiment, using a random number generator. Use whatever programming language you wish. Octave, C, perl, and python are all appropriate. Repeat the experiment many times and plot the histogram of N, comparing it with the theoretical result from part (a).

A.2 Felix tosses the coin until he obtains *two* heads. Let the number of tosses completed, when the second head arrives, be N.

(a) What is the probability distribution of the random variable, N? Sketch the distribution, or plot it using your favourite plotting program.

(b) What is the mean value of N?

(c) Make a simulation of Felix's coin-tossing experiment. [Try to make a single program that can solve both question 1 and 2, by changing a single argument.] Repeat the experiment many times and plot the histogram of N, comparing it with the theoretical result from part (a).

A.3 Fritz tosses the coin until he obtains *three* heads. Let the number of tosses completed, when the third head arrives, be N.

(a) What is the probability distribution of the random variable, N? Sketch the distribution, or plot it using your favourite plotting program.

(b) What is the mean value of N?

(c) Make a simulation of Fritz's coin-tossing experiment. [If you designed your program in question 2 well, you should be able to solve question 3 immediately.] Repeat the experiment many times and plot the histogram of N, comparing it with the theoretical result from part (a). Pay special attention to the shape of the plots for N between 1 and 200.