Probability, Math 60, Spring 2006

• **Instructor:** Marius Ionescu, office 402 Bradley Hall.

• **Textbook:** Introduction to Probability (second revised edition) by Charles M. Grinstead and J. Laurie Snell

• **WebPage:** [http://www.math.dartmouth.edu/~m60s06](http://www.math.dartmouth.edu/~m60s06)
Short History

• Probability theory began in seventeenth century France.

• Two great French mathematicians, Blaise Pascal and Pierre de Fermat, corresponded over two problems from games of chance.

• Many of the early problems of probability might well have been suggested by gamblers’ experiences.
Simple experiments; Simulations

- The naturalist Buffon tossed a coin 4040 times, resulting in 2048 heads and 1992 tails.
- The English biologist W. F. R. Weldon recorded 26,306 throws of 12 dice.
- The Swiss scientist Rudolf Wolf recorded 100,000 throws of a single die without a computer.
• We will be introducing some probabilistic concepts via experiment.

• You will need to simulate probabilistic phenomena to do this.

• I recommend using maple.

  – **Maple for Mac OS X:**

  – **Maple for Windows:**
Probability

• We shall first consider chance experiments with a finite number of possible outcomes $\omega_1, \omega_2, \ldots, \omega_n$:
  
  – rolling a die
  – tossing a coin

• A random variable is an expression whose value is the outcome of a particular experiment.

• We shall assign probabilities to the possible outcomes of this experiment.
Examples

• Random Numbers

• Coin Tossing
Dice Rolling

• The famous letters between Pascal and Fermat were instigated by a request for help from a French nobleman and gambler, Chevalier de Méré.

• de Méré had been betting that, in four rolls of a die, at least one six would turn up.

• He changed the game to bet that, in 24 rolls of two dice, a pair of sixes would turn up.
Heads or Tails

- Peter and Paul play a game called *heads or tails*.

- A fair coin is tossed a sequence of times.

- Each time a head comes up Peter wins 1 penny from Paul, and each time a tail comes up Peter loses 1 penny to Paul.

- What is the probability that he will win $j$ pennies?