Math 161, Spring 2000. Assignment 2
Due Friday, April 28

Do all work in a *Mathematica* notebook and submit the notebook as an attachment to an email to the TA.

Starting with the model of the riffle shuffle of a deck of cards in the distributed notes and the *Mathematica* notebook available at

`http://math.ucsd.edu/~msharpe/pokershuffle2.nb`,

do the following.

Start with the deck in the same order as in the notes: all hearts, then spades, then diamonds, then clubs, each suit being in the order 2 through Ace.

(a) cut the deck;
(b) shuffle twice;
(c) cut the deck again;
(d) deal a poker hand to 4 players;
(e) look at the hand of the first player.

Questions:

1. It would appear that at most 52^2 possible arrangements of the card deck are possible. Use *Mathematica* to investigate whether there are exactly 52^2.

2. Use *Mathematica* to count the number of ways in which, under the deal described above, the first player has a card distribution of the type "one pair" (2-1-1-1), "two pairs" (2-2-1), "full house" (3-2), "4 of a kind" (4-1), "flush" (all from one suit).

3. Solve the same problems assuming instead that all possible hands are equally likely. (That is, there are $\binom{52}{5}$ possible poker hands the first player may get and, unlike the scheme described above, all are assumed equally likely to occur.)

4. Make a nice tabular arrangement comparing the results in questions 2 and 3.

5. Make a nice graphical arrangement comparing the results of questions 2 and 3. You may wish to use the features of the add-on package Graphics`Graphics`. Be sure to make appropriate labels.

6. Determine a *Mathematica* function which unshuffles a deck. That is, it the function inverse to shuffle1. Show that when it is nested 7 times, it gives the same result as shuffle1. Is this surprising?