# DISCUSSION FOR FOURTH TUTORIAL

DATE: NOVEMBER 7 OR 14, 2011 : DUE IN TUTORIAL NOVEMBER 21 OR 28, 2011

The following problem is from Martin Gardner, "Mathematical Games: The Paradox of the Non-transitive Dice and the Elusive Principle of Indifference."

Two people play a game with three dice. Player 1 chooses one of the three dice then player 2 choose one of the remaining two dice. The player who throws the higher number with their chosen die wins and they play this game many times. Assume that each die has three numbers between 1 and 9 such that the opposite faces are identical and assume that each of the numbers 1 through 9 appear on at least one of the faces. You will find that each of the dice must have three different numbers.

Design three dice such that player 2 will win on average by choosing the correct die. That is you should design three six sided dice so that no matter which die player 1 chooses, there is a die that player 2 can choose so that his or her probability of wining will be greater than $1/2$.
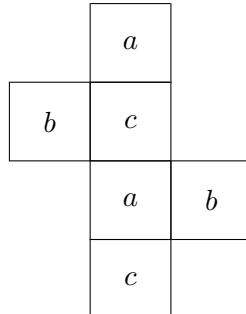
Consider at least one of several extensions :

(1) find all possible sets of three dice satisfying these conditions.
(2) consider dice with more than 6 sides and more numbers.
(3) if we allow more people and more numbers on the dice is it possible to find more non-transitive dice?