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Date: Friday, September 30, 2016

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**MATH 181 F1 Worksheet: Non-transitive Dice**

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For a specific dice roll, we say die  $A$  beats die  $B$  if the value rolled on  $A$  is higher than the value rolled on  $B$ . We say die  $A$  wins over die  $B$  if  $A$  usually beats  $B$  (over 50% of the time).

**Question 1:****Analyze Efron's Dice (a set of four dice).**

If an opponent selects the die with all 3's, then which die should you select to win?  
In general if the opponent picks first can you always guarantee a win for yourself?

**Question 2:****Analyze Grime's Dice (a set of five dice).**

In general if the opponent picks first can you always guarantee a win for yourself?

**Question 3:****Playing with Pairs of Dice (Challenge Question).**

What if now we roll pairs of the same dice? Now we say a pair dice  $A$  beats a pair of dice  $B$  if the sum of the values rolled on dice set  $A$  is higher than the value rolled on dice set  $B$ . For pairs of Efron's Dice, if the opponent picks first can you always guarantee a win for yourself?