MAT4010 Pretest Probability

0.1. You know that I have two children. I can either have two boys, two girls or one of each. I then use the rule that says that the probability is favorable over possible, so the probability of one of each is $1/3$. Why is that not correct?

0.2. You roll two identical D6 dice at the same time.

(a) How many possible outcomes are there?

(b) Are you more likely to get a 1 and a 6, or 6 twice?

0.3. Imagine a society that has a cultural preference for boys, and suppose all families continue having babies until they get a boy, at which time they stop. Suppose for simplicity that you are not allowed to have more than 4 children. (This last condition is actually not significant.) In this society, will there be

(a) More boys that girls?

(b) More girls than boys?

(c) Equally many boys and girls?

0.4. The South African mathematician John Kerrich was interned in a prison camp in Denmark during WWII. To pass the time, he carried out probability experiments. He tossed a coin 10,000 times, and got 5067 heads.

(a) What is frequency and what is relative frequency?

(b) What does the Law of Large Numbers say?

(c) How likely do you think it would be to get a result that is 67 more away from the expected value?

0.5. Can you explain the Monty Hall Problem about the car and the goats behind the three doors? You are a contestant on a TV game show faced with three doors. There is a car behind one door and a goat behind each of the two other. You pick one door, and instead of opening it, the host opens another door with a goat behind it and asks if you want to switch. Should you switch or stick with your first guess?

0.6. There are two formulas for computing the variance, the sample variance $\frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2$ and the population variance $\frac{1}{n}\sum_{i=1}^{n}(X_i - \mathrm{E}(X))^2$. When do you use them?