Mathematical problem solving Russell Brown
Test 3 20 April 1999

Answer all of the questions on the answer sheets provided. Each question is worth 14 points, for a total of 70. Provide as much explanation as you can. You may use a calculator.

1. Let n be a number which is greater than zero. Determine which is larger,

$$\frac{1}{n} \qquad \text{or} \qquad \frac{1}{n+1}.$$

2. (a) Suppose we roll two standard six-sided dice and add the two numbers which we obtain. What is the probability that this gives a sum of 5?

   (b) If we roll the pair of dice 3000 times, approximately how many times do we expect to obtain a sum of 5?

3. Suppose that we appear on the show "Let's make a deal" wearing a yellow banana costume. The set has been remodelled and now there are 7 doors to choose from. Behind one of the doors is a brand new 1999 Chevy Blazer and the remaining doors lead to $50 worth of Lay's potato chips.

   (a) If we pick a door, what is the probability of selecting the door which contains the brand new 1999 Chevy Blazer?

   (b) Suppose we choose a door and then Monty Hall opens 5 of the 6 remaining doors to reveal a total of $250 worth of Lay's potato chips, $50 behind each of the five doors. Then, we switch to the one remaining unopened door. What is the probability of winning the brand new 1999 Chevy Blazer if we follow this strategy?

4. Suppose we have an eight team soccer league, with four teams in two division. Each team plays a total of 10 games.

   (a) What is the total number of games played during a season?

   (b) Each team is scheduled to play the other teams in its division exactly 2 times and the remaining games are scheduled against the other division. How many games are played which involve two teams from different divisions? How many games are played which involve two teams from the same division?

5. Consider the picture below. Give the angle measure of the angles marked a and b. The hexagons are regular hexagons. The pentagons are not regular. Angles marked by the same letter have the same measure.