

Mathematics 170: Ideas in Mathematics

Homework 8

This assignment is due Wednesday, July 1, 2009, at the beginning of class. Please hand the homework in in class. If you can't make it to class, place it in my mailbox in the departmental office (DRL 4W1) or bring it to my office (DRL 4N27). You are allowed to talk about the homework with each other, but please write it up alone.

1. Take a square. Make two copies, each reduced to half size in length and width, and position them in diagonal corners. Repeat the process infinitely often to create a fractal. What is the fractal? What is its dimension? (B+S 6.6.18 and 6.6.19)

2. Someone simultaneously flips a penny, a nickel, and a dime. Make a list of all the possible outcomes. What is the probability of seeing three presidents? What is the probability of seeing exactly two presidents? Suppose now that you do not see the outcome, but you are told that a president is showing. Now, what is the probability of seeing three presidents? Suppose, instead, that you are told that Lincoln is showing. What now is the probability of seeing three presidents? Why do the answers differ? (B+S 7.2.15)

3. Suppose someone has randomly generated two natural numbers and used them to make a fraction. Reduce the fraction to its lowest terms. Is there a 0.5 probability that both the numerator and the denominator are odd numbers? Why or why not? (B+S 7.2.29. Note that part of this question is to come up with a reasonable interpretation of the idea of a randomly generated natural number.)

4. Dungeons and Dragons players use dice in the shape of each of the regular solids. The faces are always numbered 1 through the number of total faces there are. You shake all five dice. what is the probability of your throwing a total of 6? (B+S 7.2.31)

5. Suppose you flip a fair coin 10 times on two different occasions. One time you see 10 heads, the other time you see *HHTHHHTTHT*. Is either one of these outcomes more likely than the other? Which one is random? Explain. (B+S 7.3.31)

6. Suppose you deal three cards from a regular deck of 52 cards. What is the probability that they will all be jacks? (B+S 7.4.11)

7. (a) You roll a fair die four times. What is the probability that you see at least one 6?

(b) You roll two fair dice twenty-four times. What is the probability that at least once, you see two 6s?

(c) You bet someone, at even money, that upon rolling a fair die four times you will see at least one 6. You repeat this bet many times. Do you expect to win or lose money?

(d) You bet someone, at even money, that upon rolling two fair dice twenty-four times you will, at least once, see two 6s. You repeat this bet many times. Do you expect to win or lose money? (Both bets mentioned here were bets that the Chevalier de Mere was interested in.)