

STA13 Homework 2

October 6, 2021

1. [Birthday problem](#) There are 10 people in a room. Assume each person's birthday is equally likely to be any of the 365 days of the year (we exclude February 29), and that people's birthdays are independent (we will define independence formally later, but intuitively it means that knowing some people's birthdays gives us no information about other people's birthdays; this would not hold if, e.g., we knew that two of the people were twins).

1. How many ways are there to assign birthdays to all the people in the room?
2. Can you easily count how many ways to assign birthdays so that at least one pair of people in the group have the same birthday?
3. Can you easily count how many ways to assign birthdays so that no two people share a birthday?
4. What is the probability that at least one pair of people in the group have the same birthday?

2. [Leibniz's mistake](#) If we roll two fair dice, which is more likely: a sum of 11 or a sum of 12? Leibniz argued that a sum of 11 and a sum of 12 are equally likely.

3. [Committees and team](#) Consider a group of four people, we want to divide them into 2 teams with each team having at least one member.

1. How many ways are there to break the people into two teams of two?
2. How many ways are there to break the people into two teams, with one team having 1 person and one team having 3 people?
3. How many ways are there to break the people into two teams?
4. What's the probability that we have two equal sized teams?
5. What's the probability that we have two unequal sized teams?

4. A certain family has 6 children, consisting of 3 boys and 3 girls. Assuming that all birth orders are equally likely, what is the probability that the 3 eldest children are the 3 girls?

5. A city with 6 districts has 6 robberies in a particular week. Assume the robberies are located randomly, with all possibilities for which robbery occurred where equally likely. What is the probability that some district had more than 1 robbery?

6. A woman is pregnant with twin boys. Twins may be either identical or fraternal (nonidentical). In general, $1/3$ of twins born are identical. Obviously, identical twins must be of the same sex; fraternal twins may or may not be. Assume that identical twins are equally likely to be both boys or both girls, while for fraternal twins all possibilities are equally likely. Given the above information, what is the probability that the woman's twins are identical?