

Homework #3

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Instruction: Do all the following empirical exercises using R. Turn in your R markdown file with answers and supporting tables and graphs, if any. Refer to the R output whenever appropriate when discussing your results. It does not matter which method you use to plot a time series variable.

Question 1: [Sample Space, Events, and Naive Probability]

We will roll six dices. Answer the following questions for this experiment.

1. Using R to generate the sample space for rolling six dices. Show 10 outcomes from the sample space.
2. Using R to generate the event when the sum of six dices is greater than 30. Show the outcomes in this event.
3. Using R and the naive definition of probability to calculate the probability of the event in 2.

Question 2: [Counting and Sample Space]

There are 1000 fans on the wait list for the OU-Texas game tickets, but there are only 100 tickets left. The OU ticket office determines who will get a ticket through lottery. What is the likelihood that both my wife and I would win the lottery? Use R to answer each of the following question.

1. How many possible combinations of the people who would win the lottery?
2. How many possible combinations that my wife and I would win the lottery?
3. What is the probability that both my wife and I would win the lottery?

Question 3: [Counting, Sample Space and Naive Probability: The Birthday Problem Redux]

Many of you probably have seen this problem in your undergrad statistics course. And now lets see if we could solve it in R.

Suppose that there are N people together at a party. What is the probability of at least one pair of attendants with the same birthday? This problem tests your understanding of naive probability, some properties of probability (derived from the three axioms discussed in class), and counting techniques. Let me walk you through this.

We will ignore leap years and assume that there are only 365 days in a year. We will also assume that births are equally distributed over the course of a year. Let's first define the event A

$$A = \{\text{there is at least one match}\}$$

We are interested in $\mathbb{P}[A]$

1. What is the sample space for this experiment? **Hint:** Note that you have N people, and every one of them have 365 possibilities for his/her birthday.
2. What are the possible combinations for no match at all? **Hint:** You can think of this as a sequential experiment (someone is waiting at the party door to make sure that nobody with the same birthday as the previous person would come in). In other words, there are 365 possibilities for the first person, 364 possibilities for the second and so on.
3. What is the probability of the occurrence of a no-match party? **Hint:** Use the naive definition probability

4. What is the probability of the occurrence of event A ? **Hint:** Use the property for probability for a complement of a set.