These problems are bonus examples. They should be ticked and solution paths uploaded by **23:59 on June 28, 2021**.

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(1) **Unemployment and a reduced workweek.**
In an effort to increase employment, France mandated in February 2000 that all companies with 20 or more employees reduce the workweek to 35 hours. The economic of the shortened workweek was analyzed in *Economic Policy* (2008). The researchers focused on several key variables such as hourly wages, dual job holdings and level of unemployment. Assume that in the year prior to the 35-hour workweek law, unemployment in France was 12%. Suppose that in a random sample of 500 French citizens (eligible workers) taken several years after the law was enacted, 53 were unemployed. Determine if the French unemployment rate dropped after the enactment of the 35-hour workweek law.

(2) **Testing the placebo effect**
The placebo effect describes the phenomenon of improvement in the condition of a patient taking a placebo pill that looks and tastes real but contains no medically active chemicals. Physicians at a clinic in LaJolla, California, gave what they thought were drugs to 7000 asthma, ulcer and herpes patients. Although the doctors later learned that the drugs were really placebos, 70% of the patients reported an improved condition. Use this to test the placebo effect at the clinic.

(3) **Rolling die**
A d-sided die with colored sides was rolled n times. The outcomes are stored in the file `die.Rdata` (each side appeared at least once.).

(a) Visualize the relative frequencies in a colored barplot and add the standard error of each frequency. Given your graphic, what is your opinion on the assertion: 'the die is fair'?

(b) Test the null hypothesis that the die is fair with a χ^2-test on the 5%-significance level (without `chisq.test()`)

i. What are the observed (absolute) frequencies? What are the expected frequencies under the null hypothesis?

ii. What is the value x^2 of the χ^2-statistic? How is the χ^2-statistic X^2 distributed under the null hypothesis (in the context of the associated model)

iii. What is the rejection area? Do you reject the null hypothesis?

iv. Compute the p-value and interpret your result.

(c) Test the null hypothesis that the side 'orange' appears twice as often as the other sides (which appear with the same probability), on the 10%-significance level.

i. From the output of `chisq.test()` read the value of the χ^2-statistic and the p-value.

ii. Can you reject the null hypothesis?

iii. Based on your calculations someone claims that the die is not loaded (i.e., it is fair). What do you answer the person?

(4) **MBA students**

One way to assess the benefits of an MBA degree is to investigate the salaries received by MBA students several years after graduation. In 1998, the Graduate Management Admission Council estimated that the median earnings for graduates of full-time, highly ranked MBA programs four years after graduating was \$96000 (Selections, Winter 1999). A random sample of 50 graduates from the class of 1996 of a particular highly ranked MBA program were mailed a questionnaire and asked to report their earnings for 2000. Fifteen useable responses were received; 9 indicated earnings greater than \$96000 and 6 indicated earnings below \$96000.

(a) Specify the null and alternative hypotheses that should be used in testing whether the median income of graduates of the MBA program was more than \$96000 in 2000.

(b) Conduct the test of the previous part using $\alpha = 0.05$ and draw your conclusion in the context of the problem.

(5) **CD players**

A manufacturer of compact disk (CD) players has established that the median time to failure for its players is 5250 hours of utilization. A sample of 20 CDs from a competitor is obtained, and they are continuously tested until each fails. The 20 failure times range from five hours (a defective player) to 6575 hours, and 14 of the 20 exceed 5250 hours. Is there evidence that the median failure time of the competitor differs from 5250 hours? Use $\alpha = 0.1$.