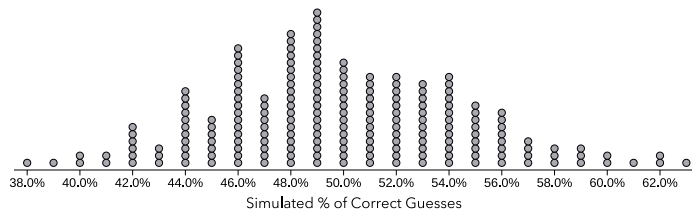


1. A recent study by Microsoft in Japan investigated the impacts of moving to a four-day work week. In the study, they gave all of their employees 100 percent of their pay to work 80 percent of their usual hours. Microsoft reported a statistically significant increase in productivity compared to the same time period the previous year.
 - a. What is the meaning of statistically significant in this context?
 - b. Using what you know about experiments, what is one way to improve this study? Why would this be challenging for Microsoft?

2. According to the pregnancy tracking apps, there are a few “predictors” for determining a baby’s biological sex before the anatomy scan at 20 weeks. But do they actually work? One example is the “ring test” where the mother holds a dangling ring (attached to a thread or string) over the belly. If it swings in a circular motion, it’s a girl. If it moves back and forth like a pendulum, it’s a boy. Suppose we sampled 100 women who did the ring test prior to giving birth and 56 of them predicted the sex correctly.

A simulation was performed under the assumption that someone is just guessing (true percent of correct guesses is 50 percent). The graph shows the results of 200 trials of the simulation.



- What does the dot above 61 percent represent?
 - What percent of the 200 trials resulted in a percent correct of 56% or more?
 - Do the results from our sample of 100 women and this simulation provide convincing evidence that the ring test is better at predicting the baby’s sex than just guessing?
- d. What sample results would convince you that the ring test is an effective predictor of a baby’s sex? Explain.
- e. If we instead sampled 500 women and again 56% correctly predicted the sex of the baby with the ring test, would we be more convinced or less convinced of the ring test’s effectiveness? Explain.

3. A recent study was done to determine if consuming peanut products during infancy could reduce the likelihood of developing a peanut allergy. From age six months to five years, half of the 600 infants susceptible to allergies who participated in the study were randomly assigned to completely avoid peanuts and the remaining infants were assigned to consume at least six grams of peanut protein weekly. At five years of age, the researchers monitored the children while they consumed peanut products in a controlled environment. 17.3 percent of the group who completely avoided peanuts had developed a peanut allergy compared to 3.2 percent of the group with regular peanut exposure.
- What type of experiment is described in this scenario?
 - Identify the explanatory variable and the response variable.
 - Calculate the difference in percent of children who developed a peanut allergy.
 - A statistical test determined the probability of observing a difference in percentages this large or larger purely by chance is less than 0.01%, assuming there is no difference in the development of peanut allergies between the two groups. Does this probability provide convincing evidence that early and regular exposure to peanut products will reduce the likelihood of developing a peanut allergy?
4. A recent study was done to determine the effectiveness of different types of exercise on cardiovascular health. 406 adults with high blood pressure were recruited for the study. Subjects were randomly assigned to complete an aerobic exercise program, a resistance exercise program, a combination of aerobic and resistance exercise program, or no exercise program over a one-year period. At the end of one year, researchers determined the cardiovascular (CVD) risk profile for the participants based on several common factors.
- Identify the treatments.
 - What is the purpose of including a group who did not complete an exercise program?
 - The researchers determined there was a statistically significant difference in the CVD risk profiles for subjects who completed the aerobic program and the combination program compared to the control group. Explain what this means in the context of this study.
 - The difference was not statistically significant for the resistance only group compared to the control group. Explain what this means in the context of the study.

5. Researchers have developed a liquid repellent intended to keep porcupines from gnawing on wooden bridges in a local park. The researchers will conduct a well-designed experiment to test the effectiveness of the repellent by placing wooden stakes in the ground and randomly assigning them to receive either the repellent or a placebo treatment. Which of the following is true about this experiment?
- A) The experiment cannot provide sufficient evidence that the repellent causes the porcupines to avoid stakes; only an association can be demonstrated.
 - B) Any non-zero difference in gnawing behavior will provide sufficient evidence that the repellent causes the porcupines to avoid gnawing on the stakes.
 - C) All stakes with the repellent would need to have less gnawing than all stakes with the placebo to provide sufficient evidence that the repellent is effective.
 - D) The difference in the amounts of gnawing behavior on stakes given the two treatments must be statistically significant to provide sufficient evidence that the repellent is effective.

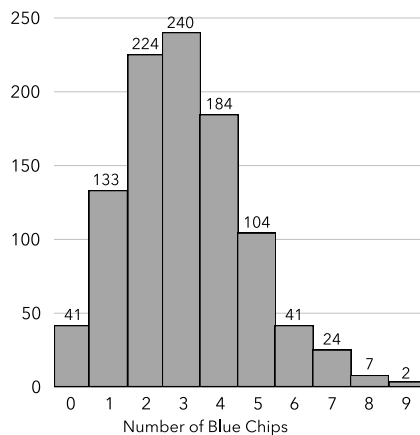
6. 40 university undergraduate students will be randomly selected from those expressing interest to attend an online webinar hosted by a famous author. Of the 1,207 undergraduate students who expressed interest, 93 were from the University of Michigan. Of the 40 randomly selected to attend the webinar, 6 were from the University of Michigan. A consulting statistician is concerned that there may have been a selection bias in the choosing of the participants. To investigate how likely it is that at least 6 of the 40 students chosen to attend would have been from the University Michigan purely by chance, the statistician ran a simulation. The simulation is described by the following steps:

Step 1: Locate 93 blue and 1,114 red chips.

Step 2: Select 40 chips at random.

Step 3: Record the number of blue chips in the 40 chips that were selected.

The results of 1,000 trials of the simulation are shown in the histogram.



Based on the results of the simulation, is there convincing statistical evidence at the 5% significance level that selecting at least 6 of the 40 students from the University of Michigan is unlikely to have occurred by chance alone?

- A) Yes, because 6 appears after the third quartile of simulated values.
- B) Yes, because the expected number of blue chips is not close to 6.
- C) No, because the simulation suggests that selecting at least 6 of 40 students from the University of Michigan would occur about 7.4% of the time purely by chance alone.
- D) No, because the simulation suggests that selecting between 0 and 9 students from the University of Michigan is likely.