# Extra review problems

1. Identify the flaw(s) in reasoning in the following scenarios. Explain what the individuals in the study should have done differently if they wanted to make such strong conclusions.

   (a) Students at an elementary school are given a questionnaire that they are asked to return after their parents have completed it. One of the questions asked is, "Do you find that your work schedule makes it difficult for you to spend time with your kids after school?" Of the parents who replied, 85% said"no". Based on these results, the school officials conclude that a great majority of the parents have no difficulty spending time with their kids after school.

   (b) A survey is conducted on a simple random sample of 1,000 women who recently gave birth, asking them about whether or not they smoked during pregnancy. A follow-up survey asking if the children have respiratory problems is conducted 3 years later. However, only 567 of these women are reached at the same address. The researcher reports that these 567 women are representative of all mothers.

   (c) An orthopedist administers a questionnaire to 30 of his patients who do not have any joint problems and finds that 20 of them regularly go running. He concludes that running decreases the risk of joint problems.

2. Suppose you have a biased coin that lands Heads 40% of the time and Tails 60% of the time. You flip the coin 7 times. What is the probability of getting at least one tails?

3. A study published in the *Journal of Personality and Social Psychology* asked a group of 200 randomly sampled men and women to evaluate how they felt about various subjects, such as camping, health care, architecture, taxidermy, crossword puzzles, and Japan in order to measure their attitude towards mostly independent stimuli. Then, they presented the participants with information about a new product: a microwave oven. This microwave oven does not exist, but the participants didn't know this, and were given three positive and three negative fake reviews. People who reacted positively to the subjects on the dispositional attitude measurement also tended to react positively to the microwave oven, and those who reacted negatively tended to react negatively to it. Researchers concluded that "some people tend to like things, whereas others tend to dislike things, and a more thorough understanding of this tendency will lead to a more thorough understanding of the psychology of attitudes."

   (a) What are the cases?

   (b) What is (are) the response variable(s) in this study?

   (c) What is (are) the explanatory variable(s) in this study?

   (d) Does the study employ random sampling?

   (e) Is this an observational study or an experiment? Explain your reasoning.

   (f) Can we establish a causal link between the explanatory and response variables?

(g) Can the results of the study be generalized to the target population at large?

4. Suppose we want to construct a probability distribution table for household income in the United States. Only one of the following a) - (d) could be correct. Which one must it be? What is wrong with the others?

(a)

| Income Range | $0-25k | $25k-50k | $50k-100k | $100k+ |
|---|---|---|---|---|
| Probability | 0.38 | -0.27 | 0.52 | 0.37 |

(b)

| Income Range | $0-25k | $25k-50k | $50k-100k | $100k+ |
|---|---|---|---|---|
| Probability | 0.18 | 0.39 | 0.33 | 0.16 |

(c)

| Income Range | $0-25k | $25k-50k | $50k-100k | $100k+ |
|---|---|---|---|---|
| Probability | 0.28 | 0.27 | 0.29 | 0.16 |

(d)

| Income Range | $0-25k | $24k-50k | $50k-100k | $100k+ |
|---|---|---|---|---|
| Probability | 0.28 | 0.27 | 0.29 | 0.16 |

5. After an introductory statistics course, 80% of students can successfully construct box plots. Of those who can construct box plots, 86% passed, while only 65% of those students who could not construct box plots passed. Calculate the probability that a student is able to construct a box plot if it is known that they passed. You can draw a tree diagram if that is helpful for you!

6. The following summary table shows the number of space launches in the US by the type of launching agency and the outcome of the launch (success or failure).

| | 1957-1999 | | 2000-2018 | |
|---|---|---|---|---|
| | Failure | Success | Failure | Success |
| Private | 13 | 295 | 10 | 562 |
| State | 281 | 3751 | 33 | 711 |
| Startup | - | - | 5 | 65 |

(a) What variables were collected on each launch in order to create to the summary table above?

(b) State whether each variable is numerical or categorical. If numerical, state whether it is continuous or discrete. If categorical, state whether it is ordinal or not.

(c) Suppose we wanted to study how the success rate of launches vary between launching agencies and over time. In this analysis, which variable would be the response variable and which variable would be the explanatory variable?

7. Consider 3 coins. Two coins are fair, yielding Heads with probability 0.50, while the third coins yields Heads with probability 0.75. Suppose you randomly select one of the coins and toss it 3 times, and it lands on Heads 3 times. What is the probability this is the biased coin?