Day 20 - Review prompts

For each prompt, make sure you can answer all the usual questions:

- observational units and types of variables
- hypotheses, statistic, parameter
- z-statistic and p-value using the empirical rule
- scope of inference
- confidence interval computation
- power calculations, if possible, and types of errors

Prompt 1: Map turtle sex ratios

Northern map turtles (*Graptemys geographica*) nest on sandy beaches along Lake Champlain. Like many turtles, a hatchling's sex is determined by the temperature of its nest: warmer nests produce more females, cooler nests produce more males. Biologists are concerned that warmer summers could be pushing hatchling sex ratios away from 50:50, but changes in shoreline vegetation are also shading some beaches, which could push sex ratios in the other direction.

During the summer of 2026, biologists located nests on beaches along the Vermont shore of Lake Champlain and randomly selected 100 of them. From each selected nest, they randomly chose **one** hatchling and determined its sex. Of the 100 hatchlings, **65 were female**.

Power question: The biologists plan to repeat the study next summer with another 100 nests, and will consider the evidence convincing if the p-value is 0.05 or less. Suppose the true proportion of female hatchlings is actually 0.60.

a. Using the empirical rule, what values of $\hat{p}$ would lead to a p-value of 0.05 or less?
b. Sketch the null and true sampling distributions of $\hat{p}$ on the same axes, and shade the area representing power.
c. What is the power of the test? Interpret it in context.

Prompt 2: Bear spray in Glacier National Park

Glacier National Park is home to both grizzly and black bears, and park rangers urge every hiking group to carry bear spray. Suppose a 2023 visitor survey found that 40% of hiking groups on the park's trails carried bear spray. In 2026, the park launched an education campaign (new trailhead signs and a short video shown when visitors buy their park pass), and park managers want to know whether the proportion of hiking groups carrying bear spray has increased since 2023.

Over the summer of 2026, rangers worked at the park's 10 busiest trailheads on randomly selected days. On each of those days, they approached randomly selected hiking groups as they started their hikes and asked whether anyone in the group was carrying bear spray. In total, they surveyed **150 hiking groups**, and **66 of them** said they were carrying bear spray.

Power question: The park plans to repeat the survey next summer with another 150 groups, and will consider the evidence of an increase convincing if the p-value is 0.025 or less. Suppose the campaign has actually raised the proportion of hiking groups carrying bear spray to 0.52.

a. Using the empirical rule, what values of $\hat{p}$ would lead to a p-value of 0.025 or less?
b. Sketch the null and true sampling distributions of $\hat{p}$ on the same axes, and shade the area representing power.
c. What is the power of the test? Interpret it in context.