

Module 2B Questions:

1. HOW WOULD YOU TEST THE FOLLOWING: Do high school seniors from a particular school who attend a summer math camp score above the state mean on the math subtest of the state's standardized achievement test ? (n=15)

- a. Test one mean against a hypothesized constant.
- b. Test the difference between two means (independent samples).
- c. Test the difference in means between two paired or dependent samples.
- d. Use a chi-squared test of association.

2. Which statement is NOT true about one-sample t-test?

- A. It is used to compare the sample mean of a variable to hypothesized value.
- B. The test only assumes that data are random sample from the population.
- C. The test statistic is t.
- D. If the null hypothesis is true, then t should have a t-distribution with n - 1 df

3. A team is studying weight gain in mice after 12 weeks on different diets. They calculate **Z-scores** for each mouse's weight gain relative to the overall distribution and separately run a **two-sample t-test** comparing average weight gain between the Chow and HFD groups.

Why do Z-scores and t-tests answer *different scientific questions* about the data, even though they both use means and variability? Describe conceptually:

- what a Z-score tells you about an individual mouse,
- what a t-test tells you about differences between groups, and
- why the two measures shouldn't be interpreted as interchangeable.

4. JAX body weight data for male C57BL/6J at 12 weeks: **29.3 g \pm 2.3 g (mean \pm SD)** for ~120 males.

Treat this as your reference population ("wild-type C57BL/6J males at 12 weeks"). You engineer a new line with a candidate obesity-related allele ("Allele X") on a C57BL/6J background and measure body weights at 12 weeks in a sample of **n = 20** male mice carrying Allele X. $\bar{x}=30.0\text{g}$ and $s = 2.5\text{ g}$.

- A. A particular C57BL/6J male at 12 weeks weighs 34.0g. What is his Z-score relative to the reference population?
- B. Does the Allele X line have a significantly higher mean body weight than the reference C57BL/6J population (29.3 g, one-sided test, $\alpha = 0.05$)? Assume the sampling distribution of the mean is approximately normal. ←you analyzed this with Z score previously but pretend that you don't know the population σ and only know the sample (20) information.

5. **Using the 12-mouse dataset**, answer the question: Do B6 Chow mice gain weight over 12 weeks (mean gain > 0)?

6. Two species of net-casting spiders, **deinopsis** and **menneus**, co-exist in eastern Australia, a place that – in my opinion - produces a disproportionate number of deadly organisms. The following

summary statistics (see table below) about the size of the prey of these two species were obtained.
With 95% confidence: Are the two population variances the same?

	<i>deinopsis</i>	<i>menneus</i>
n	10	10
\bar{X}	10.26 mm	9.02
s^2_x	$(2.51)^2$	$(1.90)^2$