Practice for Exam 2

General advice

- The format and rules for the exam are the same as for the first exam.
- Acknowledge the Law of the Farm. Create your own outlines and/or flashcards. Do not ignore basic math skills. It is assumed you can interpret and work with proportions, percentages, orders of magnitude, orders of operation, and rounding.

Additional practice problems

6.2 Breast cancer, 1 in 9? Reconsider the research question in Exercise 6.1. However, let us now test whether the expected lifetime incidence of breast cancer in the population is greater than 1 in 9.
(A) Write the null hypothesis using proper statistical notation.
(B) Recall that the researcher selected an SRS of $n = 21$ from the study population. Build the pmf for the number of cases in the sample of this size conditional upon this new null hypothesis being correct. Use the binomial app.
(C) The expected number of cases μ in the sample (if the null hypothesis is true) is given by this simple formula $\mu = np_0$, where p_0 represents the binomial proportion under the null hypothesis. Calculate the expected number of cases.
(D) The researcher observed 5 breast cancer cases in the sample. Calculate the *P* value. Interpret this result.

4.9 <u>Standard</u> normal. A *standard normal* random variable is a normal random variable with μ = 0 and σ = 1. This is sometimes called a Z variable: Z~N(0, 1). For each of the standard normal probabilities below, draw the pdf curve, shade the appropriate AUC, and determine the probability. Use the normal pdf app.
(A) $\Pr(Z \le -2.12)$ [cumulative probability]
(B) $\Pr(Z \ge 2.12)$ [right tail]
(C) $\Pr(Z \le 2.12)$ [cumulative probability]
(D) $\Pr(-2.12 \le Z \le 2.12)$ [AUC between the tails]
(E) $\Pr(Z \le -2.12)$ or $\Pr(Z \ge 2.12)$ [two-tailed AUC]

5.15 Titer. The *titer* of a substance refers to its strength or concentration. Vaccine manufacturer using immunologic assays to assess their products' titers. Immunologic analyses are not perfect, so repeated measurements on the same batch provide slightly different results each time they are done. It is assumed that the measurement error associated with repeated samples will vary according to a normal distribution that will demonstrate the true titer μ of the vaccine on average. Based on manufacturer's reports, the σ of the immunoassay is 0.070. Three measurements on a batch of vaccine reveals the following titers: {17.40, 17.36, 17.45}. Calculate a 95% confidence interval for the true titer μ of this batch. What is the margin of error of the above estimate?

5.17 Graduate student age. A graduate school with many thousands of students has an unknown mean age. The standard deviation of the age distribution is assumed to be σ = 5.
(A) How many individuals need to be studied to estimate the population mean age with a margin of error of 3 years and 95% confidence?
(B) How many individuals need to be studied to cut the margin of error down to 2 years?
(C) How many individuals need to be studied to cut the margin of error down to 1 year?
(D) How many individuals need to be studied to maintain a margin of error of 1 year now seeking 99% confidence?

5.18 Binge drinking. An SRS found that 18 of 52 students admitted to binge drinking in a survey.
(A) What the point estimate for the prevalence of binge drinking based on this survey.
(B) Can the large sample method be used to calculate CIs for the population prevalence with these data?
(C) Estimate the population prevalence of binge drinking with 90% confidence. What is the margin of error for this estimate? [Derive the margin of error from the CI. Do not do a separate calculation.]
(D) Estimate the population prevalence with 95% confidence. What is the margin of error for this estimate?
(E) How many individuals need to be studied to cut the margin of error down to .05?
(F) Explain the difference between $\hat{p}$, p, and P?