Math 119 – Review 4 **Name:** _____

Directions: Work together on this review for Test 4. Do not try to cram/write your solutions on this paper. Generate a list of formulas, assumptions and procedures (list of steps) that you will need to put on your formula card for the exam. Your formula card may be as big as one sheet of paper, front and back side, but no worked out examples are allowed on this sheet/card!!

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1. Information on a packet of seeds claims that the germination rate is 92%. What's the probability that more than 95% of the 160 seeds in the packet will germinate? Be sure to discuss your assumptions and check the conditions that support your model.

2. When a truckload of apples arrives at the Krusty-O Cereal factory, a random sample of 150 apples is selected and examined for bruises, discoloration, and other defects. The whole truckload will be rejected if more than 5% of the sample is unsatisfactory. Suppose that in fact 8% of the apples on the truck do not meet the desired standard. What's the probability that the shipment will be accepted anyway?

3. A random sample of 865 voters in one state reveals that 408 favor approval of an issue before the legislature.
   (a) Construct the 90% confidence interval for the true proportion of all voters in the state who favor approval.
   (b) If the analysts want to cut the margin of error in half, how many voters should they include in their sample?

4. In a double-blind, clinical study of an allergy drug, 1742 of the 2025 subjects receiving treatment reported experiencing significant relief from their symptoms. Conduct a 1-Prop-Z-Test (hypothesis test) that tests whether the new treatment is more effective than the current effectiveness rate of the number one selling allergy drug, which is 83%?
   (a) State the null and alternate hypothesis.
   (b) What is the z-score associated with the sample proportion?
   (c) Calculate the p-value.

5. A manufacturer of paper used for packaging requires a minimum strength of 20 pounds per square inch. To check on the quality of the paper, a random sample of 30 pieces of paper is selected each hour from the previous hour's production and a strength measurement is recorded for each. The standard deviation σ of the strength of measurements, computed by pooling the sum of squares of deviations of many samples is known to equal 2 pounds per square inch.

   (a) Describe the approximate sampling distribution model of the sample mean of $n = 30$ test pieces of paper, with attention to assumptions and conditions. Make a sketch using the 68–95–99.7 Rule. Assume the mean of the population of strength measurements is 21 pounds per inch.

   (b) What is the approximate probability that, for a random sample of $n = 30$ test pieces of paper, $\overline{x} < 20$?

   (c) The manufacturing process allows for a control engineer to adjust a set of dials on factory machinery which can fix the average strength of paper to be a certain value (plus or minus some small deviation). What value would you select for the mean paper strength, μ, in order that $P(\overline{x} < 20)$ be equal to 1 in 1000?

6. The mean replacement time for a particular model of a washing machine is 10.3 years and the standard deviation is 2.7 years. What is the probability that a sample of 25 washing machines will have a mean replacement time of at least 12 years? Assume the population of replacement times is normally distributed.

7. Write the null and alternate hypothesis you would use to test each of the following situations. Then state whether the alternate hypothesis is one-sided or two-sided.

   (a) A business student wants to conduct a taste test to see whether students prefer Starbucks Coffee to the cafeteria coffee.

   (b) A budget override in a small town requires a two-thirds majority to pass. A local newspaper conducts a poll to see if there's evidence it will pass.

8. Production managers at the Krusty-O factory must monitor the output to be sure that the level of defective products remains small. They periodically inspect a random sample of the items produced. If they find a significant increase in the proportion of boxes of Krusty-O's that must be rejected, they will halt the assembly process until they problem can be identified and repaired.

   (a) In this context, what is a Type I error?

   (b) In this context, what is a Type II error?

   (c) Which type of error would the factory owners, the Krusty family, consider more serious?

   (d) Which type of error might customers consider more serious?

9. The painful wrist condition called carpal tunnel syndrome can be treated with surgery or less invasive wrist splints. In September 2002, Time magazine reported on a study of 176 patients. Among the half that had surgery, 80% showed improvements after three months, but only 48% of those who use the wrist splints improved.

   (a) What is the standard error of the difference in the two proportions?

   (b) Construct a 95% confidence interval for this difference.

   (c) State an appropriate conclusion.

10. In 1998, a San Diego reproductive clinic reported 42 live births to 157 women under the age of 38, but only 7 live births for 89 clients aged 38 or older. Is this strong evidence of a difference in the effectiveness of the clinics methods for older women?

    (a) State the null and alternate hypothesis.

    (b) What is the z-score associated with difference between the sample proportions?

    (c) Calculate the p-value.

    (d) If you concluded there was a difference, estimate that difference with a confidence interval and interpret your interval in the context.