**Stat 301 – Quiz 5**

**You are to work with one partner on this assignment. Open this file in Word or in Google Docs and type in your answers. Then one of you will subject the document in Canvas for grading. Make sure you work collaboratively and give both names. This quiz should be submitted by noon, Tuesday, Jan. 14.**

**Names:**

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| **From Investigation 1.2:** A standard test for extra-sensory perception (ESP) asks subjects to identify which of five symbols is on the front of a card. The subject sees only the back of the card while the experimenter focuses on the front. |  |

(a) Suppose you plan to give a subject 25 rounds to identify the correct symbol, randomly shuffling the cards in between each attempt. Let the random variable *C* denote the number of correct identifications in those 25 trials. Let $π$ represent that subject’s long-run probability of a correct identification. Does *C* follow a binomial distribution? If so, justify each of the four criterion.

(b) If the subject does not have ESP and guesses each time, what can you assume about the probability of a correct identification?

 Null hypothesis:

(c) If the subject does have ESP, what can you assume about the probability of a correct identification?

 Alternative hypothesis:

Let’s assume the null hypothesis is true and that we are willing to assume we have a Binomial process with *n* = 25 and $π$ = 0.20. It can also be shown that expected value of a binomial random variable is E(X) = *n* × $π$ and the standard deviation is $\sqrt{n×π(1-π)}$.

(d) Using these formulas, calculate the expected value (long-run average or mean) and standard deviation of *C* under the null model.

In the [One Proportion Inference](http://www.rossmanchance.com/applets/OneProp/OneProp.htm) applet,

* Enter the **probability of heads** = 0.20. Notice, that we can’t assume coin tossing anymore, so (after you tab or press Enter) the applet changes to a more generic “probability of success.”
* Specify the **sample size** *n* = 25.
* Check the **Exact Binomial** box and the **Summary Stats** box (verify your calculations of the mean and standard deviation)

(e) Use trial and error to specify values in the **As Extreme As** box to decide how many of the 25 trials the subject would need to answer correctly to give you strong evidence that the subject is able to do better than guessing in the long run. (You can also drag the red line.) Explain your reasoning. [*Hint*: How small are you going to require the p-value to be to reject the null hypothesis?]

Suppose instead you constructed a test involving 10 symbols, still providing 25 attempts.

(f) Specify the new null and alternative hypotheses (in symbols).

(g) Create the new corresponding binomial distribution in the applet. Describe if/how the mean, standard deviation, and shape change with these new hypotheses.

(h) Now how many attempts would the subject need to match correctly to give you convincing evidence the subject had ESP?

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| **Definition:** A *Type I Error* is committed if you decide to reject the null hypothesis even though it is true. |

(i) What is the probability of committing a Type I Error in this study?