MTH 324, Exam #2, Fall 2022 Name ______

Instructions: Answer each question thoroughly. For questions in Part 1, use the work you did at home to answer the questions. Be sure to answer each part of each question. In Part 2, report exact answers unless directed to round.

Part I:

Use the work you did at home to answer these questions about tax paid and the neighborhoods in our dataset.

- 1. State your null and alternative hypotheses for the husbands and wives question.
- 2. What kind of test did you conduct? What is the P-value for your tests?
- 3. What do you conclude from your test? State your conclusion in plain language in context.
- 4. What is the null and alternative hypotheses for your one-way ANOVA?

5. What were the results of your test? Using Tukey's method and a box plot, which machines need to be recalibrated the most. Explain your reasoning.

6. For the graduate business school data, state the null and alternative hypotheses for your test of proportions. What did you conclude about the differences in marital status between the genders?

7. What are the null and alternative hypotheses for your three-way ANOVA? List them all and label them clearly.

8. Did any of the null hypotheses get rejected for your test? Which ones? State the form of your final model.

9. Describe the normality of the data? Is it normal? Are there significant deviations from normal?

10. Describe the Tukey intervals for the three main effects. (There are 5 intervals altogether. Explain what each one means.)

11. State the null and alternative hypotheses for your one-sample test of school debt levels. What is your P-value? What did you conclude?

12. For your sampling distribution, describe the shape of the distribution.

13. What is the mean of your means? What is the mean of the data? Are they similar?

14. What is the standard deviation of your means? What is the standard deviation of the data? Given that you took samples of size 50, what is the predicted standard error from the central limit theorem? Is it similar to what you simulated? Part II:

15. Describe the main results of the Central Limit Theorem.

16. Consider a binomial experiment that conducted 15 trials and resulted in 11 successes and 4 failures. Find the maximum likelihood function for this outcome and then use it to find the maximum likelihood estimate of p (the proportion of successes).

17. At the beginning of the semester a representative sample of 501 students were surveyed and asked if they owned a dog. The sample proportion was 0.559. Use this information to construct a 95% confidence interval for the proportion of all STAT 200 students who own a dog.

18. A sample of 80 students is selected and it is determined that their mean math SAT score is 510. If the true mean math score is actually 500 (with a standard deviation of 100), what is the power of the one-sample test to detect this 10-point difference?

19. If you want to determine the appropriate sample size needed to conduct a poll with just at 2% margin of error for a proportion, with a 95% level of confidence, use the formula n =

 $p(1-p)\left(\frac{z^*}{E}\right)^2$. Use this formula with p = 0.5 to estimate the sample size needed.

20. Describe what a Latin Square design is. Give an example of a Latin Square design for three levels of data, each with 4 levels each.