**UT Math 2600 Submission for OTM Statistics – TMM 010**

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|   | Learning Outcome Description | Describe how the Courses or Programs address each outcome |
| 1  | \* Select and produce appropriate graphical, tabular, and numerical summaries of the distributions of variables in a data set. Summarize such information into verbal descriptions. | Given a data set students will generate the appropriate graph(s) and summary statistics through the use of statistical software then answer follow up questions and summarize their findings.  |
| 2  | \* Summarize relationships in bivariate data using graphical, tabular, and numerical methods including scatter plots, two-way tables, correlation coefficients, and least squares regression lines. Investigate and describe the relationships or associations between two variables using caution in interpreting correlation and association. | Students will implement subjective (scatterplot) and objective methods (correlation coefficient test) to determine whether two variables are correlated. If the correlation test is statistically significant then students will proceed to express the relationship of the two variables using least squares regression analysis. Furthermore, students will analyze the residual plot to verify whether the regression line is a good representation of the data. |
| 3  | \* Use the normal distribution to interpret z-scores and compute probabilities | Students will calculate z-scores and find probabilities corresponding to the area: (1) to the left of z-score (2) to the right of a z-score and (3) between two z-scores. The meaning of a z-score and its probability will be verbally and graphically understood. Conversely, students will be given a percentile or probability and be able to determine the corresponding z-score and corresponding variable value. Furthermore, students will determine when to apply the Central Limit Theorem and use the correct z-score calculation for this situation. |
| 4  | \* Understand the principles of observational and experimental studiesincluding sampling methods, randomization, replication and control. Understand how the type of data collection can affect the types of conclusions that can be drawn. | Students will identify whether a given scenario describes an observational study or experimental study. Furthermore, students will be able to classify whether a study is using any one of the following sampling methods: random, convenience, cluster, stratified, and systematic. Most importantly, students will be able to determine whether a study conducted an appropriate sampling technique that is representative of the population and therefore will yield valid results.  |
| 5  | \* Construct a model for a random phenomenon using outcomes, events, and the assignment of probabilities. Use the addition rule for disjoint events and the multiplication rule for independent events. Compute conditional probabilities in the context of two-way tables. | Students will be able to calculate basic probabilities for simple events using relative frequency approximation or classical approach (requires equally likely events) with the aid of listing the sample space. For compound events students will use the addition rule for the “or” statement and the multiplication rule for the “and” statement while being aware of disjoint events and independent events and computing the probabilities accordingly. Furthermore, students will calculate conditional probabilities in the context of two-way tables.  |
| 6  | \* Introduce the concept of a sampling distribution. Discuss the distribution of the sample mean and sample proportion under repeated sampling (Central Limit Theorem). Students should be expected to simulate or generate sampling distributions to observe, empirically, the Central Limit Theorem. | Given a small population size, students will utilize sampling with replacement to generate all the simple random samples of a certain size and then calculate the statistic and probability for each sample. Students will then condense their findings in a sampling distribution table and be able to determine whether that statistic is an unbiased estimator or not by comparing the population parameter and the mean of the sampling distribution.  |
| 7  | \* Estimate a population mean or proportion using a point estimate and confidence intervals, and interpret the confidence level and margin of error. Understand the dependence of margin of error on sample size and confidence level. | Students will realize the population mean is estimated by the sample mean and population proportion is estimated by the sample proportion. Furthermore, students will construct and interpret confidence intervals. Consequently, students will have to understand that the confidence level (and sample size) determines the critical value which directly impacts the size of the confidence interval. |
| 8  | Determine the appropriate sample size for a specific margin of error and confidence level. | Students will determine the necessary sample size for estimating proportion (whether previous information available or not: p-hat known or unknown) and for studies estimating the mean (with sigma known). Students must be able to identify the margin of error and confidence level given and use the normal distribution or t distribution to figure out the critical value necessary in calculating these quantities.  |

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| 9 | \*Given a research question involving a single population, formulate null and alternative hypotheses. Describe the logic and framework of the inference of hypothesis testing. Make a decision using a p-value and draw an appropriate conclusion. Interpret statistical significance. | Students will employ the 4 step process for hypothesis testing: stating the null and alternative hypotheses; calculating the test statistic; then making a decision by using either p-value method or critical region method; finally writing out conclusion in a simple, non-technical fashion that relates back to the original claim. Students will know how to do this by hand and through the use of statistical software. |
| 10 | \*Carry out a hypothesis test for a mean or proportion. Interpret statistical and practical significance in this setting. | After completing a hypothesis test, students will determine whether their result is statistically significant or not. Moreover, students will be asked whether the result is also practically significant.  |
| 11 | Perform interval estimation and hypotheses testing for two-sample problems (e.g., difference of two means or proportions and chi-square test of independence). | Topic Not Covered |