# ISyE 6739 – Group Activity 9

Names:                                    Group Number:

**Problem 1.** The results below show the performance of the Georgia Tech's basketball team in season 2016-17. Assume this represents a random sample of their performance. Answer the following parts:
  a) Find a 90% two-sided confidence interval for the mean score difference. Can we conclude that on average the score difference is zero? (Excel file is on T-square.)
  b) Find the sample size for which the estimation error is 0.1
  c) Find a 90% one-sided confidence interval for mean attendance. Which one would be more appropriate, lower bound or upper bound.

| Opponent | Results | Score Diff | Attend |
|---|---|---|---|
| TENNESSEE TECH | W | 15 | 6018 |
| SOUTHERN | W | 15 | 4360 |
| OHIO | L | -6 | 4802 |
| SAM HOUSTON STATE | W | 8 | 4181 |
| TULANE | W | 14 | 4479 |
| at Penn State | L | -7 | 6032 |
| at Tennessee | L | -23 | 12634 |
| at VCU | Wot | 3 | 7637 |
| ALCORN STATE | W | 24 | 4599 |
| GEORGIA | L | -17 | 8600 |
| WOFFORD | W | 4 | 4725 |
| NORTH CAROLINA A&T | W | 7 | 5024 |
| NORTH CAROLINA | W | 12 | 7754 |
| at Duke | L | -53 | 9314 |
| LOUISVILLE | L | -15 | 6160 |
| CLEMSON | W | 12 | 5602 |
| at NC State | W | 10 | 17781 |
| at Virginia Tech | L | -1 | 6598 |
| at Virginia | L | -13 | 14459 |
| FLORIDA STATE | W | 22 | 6542 |
| NOTRE DAME | W | 2 | 8600 |
| at Clemson | L | -12 | 7530 |
| at Wake Forest | L | -12 | 10962 |
| TUSCULUM | W | 38 | 2437 |
| BOSTON COLLEGE | W | 11 | 7391 |
| at Miami | L | -9 | 7111 |
| SYRACUSE | W | 6 | 8600 |
| NC STATE | L | -2 | 6950 |

**Problem 2.** In a light bulb manufacturing process, the consistency of light is an important quality characteristic. For testing the consistency, a grayscale picture of the light bulb is taken. See an example below. The picture is then transformed to a matrix, whose elements are between 0 (black) and 1 (white). A sample of 10 pixels of the illuminated area is randomly taken and the value of each pixel is recoded as follows: 0.9765, 0.9961, 1.000, 0.9922, 0.9961, 1.000, 0.9922, 0.9843, 0.9804, 1.000. Find a 95% confidence interval for the variance and standard deviation of pixel values, which indicate the consistency of light.
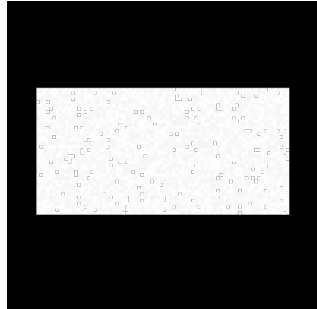
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0.9765 | 0.9961 | 0.9647 | 0.9647 | 0.9804 | 0.9765 | 0.9882 | 0.9804 | 0 |
| 0 | 0.9647 | 0.9922 | 0.9882 | 0.9725 | 0.9961 | 0.9804 | 0.9725 | 0.9882 | 0 |
| 0 | 0.9686 | 0.9647 | 0.9922 | 0.9922 | 1.0000 | 0.9882 | 1.0000 | 0.9843 | 0 |
| 0 | 1.0000 | 0.9843 | 0.9961 | 0.9804 | 0.9608 | 1.0000 | 0.9961 | 1.0000 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Problem 3. Red v.s. Yellow**

**m&m:** An engineer from packaging department of m&m is interested in estimating the proportions of red and yellow candies. She takes a random sample of two fun size packets of m&m and count the number of red and yellow candies.

v.s.

Answer the following questions:
a) Find point estimates for the proportions of red and yellow candies.
b) Find a 95% two-sided confidence interval for each proportion. Compare the results and draw conclusions.
c) For red candies, what would be the required sample size if we wanted the estimation error (E) to be less than 0.01.
d) Answer part c, using the conservative approach.

**Problem 4.** Time to failure (TTF) of a machine (denoted by X) follows an exponential distribution with $\lambda$ failure/day. We know that the mean and variance of X is $1/\lambda$ and $1/\lambda^2$, respectively. Construct a 95% large-sample confidence interval for $\lambda$.

The historical data shows that the sample mean of TTF for 100 machines is 10 days. Calculate the lower bound and upper bound of the CI you derived above.

**Problem 5.** Construct a 95% large-sample confidence interval for $\alpha$ given $X_1, X_2, ..., X_n \sim Beta(\alpha, 1)$ with pdf $f(x) = \alpha(x)^{\alpha-1}; 0 < x < 1$.