MTH 154, Homework #6, Spring 2019 Name _____

Instructions: Work problems on a separate sheet of paper and attach work to this page. You should show all work to receive full credit for problems. Questions with compact answers can be recorded directly on this page. Graphs and longer answers that won't fit here, indicate which page of the work the answer can be found on and be sure to clearly indicate it on the attached pages. You may use Excel to complete the problems, but then submit Excel files online.

1. Scores on the ACT college entrance exam vary normally with mean $\mu = 18$ and $\sigma = 6$. The range of reported scores is 1-36. a) What range contains the middle 95% of individual scores? b) If the ACT scores of 25 randomly selected students are averaged, what range contains the middle 95% of the averages?

2. The length of pregnancies from conception to birth varies according to a distribution which is approximately normal with mean 266 days and a standard deviation of 16 days. Use the 68-95-99.7 rule to answer the following: a) almost all (99.7%) pregnancies fall into what range? b) how long are the longest 2.5% of all pregnancies?

3. The Wechsler Adult Intelligence Scale (WAIS) is an IQ test. Scores on the WAIS for the 20-34 age group are approximately normal with a mean of 110 and standard deviation of 15. Scores for the 60-64 age group are approximately normal with a mean of 90 and standard deviation of 15. Sarah, who is 30, scores 130 on the WAIS. Her mother, who is 60, scores 110. a) Express both scores in terms of the number of standard deviations from the mean within their own age group; b) who scored higher relative to their age cohorts? Sarah or her mother?

4. It is possible to score higher than 800 on the SAT, but scores above 800 are reported as 800 (which is to say, a student doesn't need a perfect score to receive an 800). In 2011, the scores of college-bound senior men one the SAT Math test followed a normal distribution with mean of 531 and standard deviation of 119. What percentage of scores were above 800 (and so reported as 800)?

5. The quartiles of any distribution are the 25^{th} and 75^{th} percentiles respectively. About how many standard deviations from the mean are the quartiles for the normal distribution?

6. A variety of clubs and social organizations exist for people who are statistically exceptional in some way. High IQ societies are one such example (you can find a list and their standards for admission here: http://www.iqsocieties.com/), but clubs based on other exceptional characteristics exist as well, such a tall clubs (for example, http://tall.org/join-tci-main/how-to-join/). Why might the perception of high IQ societies and tall clubs differ in the general public? Can you find any other examples of statistically unusual traits that have formed social clubs or other organizations? Break down their admissions standards into standard deviations (for comparison, both Mensa and Tall Clubs International have a cut-off around 2 standard deviations above the mean). Why do you think this cut-off is commonly chosen?

7. Three employees are to be selected at random out of an employee pool of 41 to attend a conference in Switzerland next year. How many different ways can the tickets to Switzerland be given out?

8. A puzzle writer is creating a word-scramble puzzle from the name “MAXIMILLIAN”. How many different options are there?

9. A soccer team has 11 players but only five can play at any one time (four plus goalie). Each player is assigned a specific position for the opening toss. How many different ways can those five players be chosen to start?

10. A bowl of marbles has 17 blue marbles, 11 red marbles, 14 green marbles, 20 black marbles, and 4 yellow marbles. How many ways are there to select one marble of each color?

11. Use Excel to evaluate each of the formulas below for the values $x = -3, -0.01, 1, 2.1, 5$. Create a graph of the results of the x-values vs. the output of the functions. Describe the curve that results (use a line graph).
    a. $y = 9.1x + 4.6$
    b. $y = 0.3 \cdot 2^x - 1$
    c. $y = x^2 - 4x + 5$
    d. $y = \sqrt{9x + 100}$

12. Find the value of the standard error for means given the standard deviations and sample sizes. Recall $SE = \frac{SD}{\sqrt{n}}$.
    a. $\sigma = 4.5, n = 61$
    b. $\sigma = 51, n = 112$
    c. $\sigma = 0.1, n = 1003$
    d. $\sigma = 27.3, n = 208$

13. Find the value of the standard error for proportions given the proportion and the sample sizes. Recall $SE = \sqrt{\frac{p(1-p)}{n}}$.
    a. $p = 75\%, n = 89$
    b. $p = 31\%, n = 134$
    c. $p = 49\%, n = 544$
    d. $p = 0.01\%, n = 307{,}560$