Exam II
Administered: Friday, October 13, 2016
28 points

For each problem part: 0 points if not attempted or no work shown,
1 point for partial credit, if work is shown,
2 points for correct numerical value of solution

Problem 1. (20 points)
The National Institute of Standards and Technology (NIST) maintains a variety of websites providing physical properties. The NIST Chemistry Webbook, http://webbook.nist.gov/chemistry/, reports various properties for numerous compounds. Where multiple entries exist for a single property of a given compound, NIST reports an average. For example, consider the critical temperature of benzene. NIST notes that from 1881 to 1995, this property has been reported by 41 researchers. Rather than reproduce the table in its entirety, here we present a few of the newest and oldest values and the following information.

Tc (K)	Reference
562.05 ± 0.07	Tsonopoulos and Ambrose, 1995
561.8	Chirico and Steele, 1994
562.2	Knipmeyer, Archer, et al., 1989
...	...
569.6	Schmidt, 1891
561.65	Young, 1889
564.9	Ramsay, 1881

$$\sum_{i=1}^{41} T_{C,i} = 23060.10 \text{ K} \quad \text{and} \quad \sum_{i=1}^{41} T_{C,i}^2 = 12970033.9686 \text{ K}^2$$

Perform the following tasks.

(a) Determine the sample mean of the critical temperature of benzene.
(b) Determine the sample variance of the critical temperature of benzene.
(c) Determine the sample standard deviation of the critical temperature of benzene.
(d) Identify the appropriate distribution to describe the mean of the critical temperature of benzene in this case.
(e) Determine the lower limit of a 98% confidence interval on the mean of the critical temperature of benzene.
(f) Determine the upper limit of a 98% confidence interval on the mean of the critical temperature of benzene.
(g) Identify the appropriate distribution to describe the variance of the critical temperature of benzene in this case.
(h) Determine the lower limit of a 98% confidence interval on the variance of the critical temperature of benzene.
(i) Determine the upper limit of a 98% confidence interval on the variance of the critical temperature of benzene.
(j) Explain your findings in parts (a) through (i) in language a non-statistician can understand.

Problem 2. (8 points)
A manufacturer of LED lightbulbs claims that the mean life of their batteries is $\mu = 50{,}000$ hours with a standard deviation of $\sigma = 5{,}000$ hours. (Assume that the lifetime of a single bulb obeys the normal distribution.) There are 8760 hours in a year.

(a) What is the probability that a single bulb is still functioning after three years?
(b) What is the probability that a single bulb is still functioning after seven years?

You outfit your doomsday underground bunker with six lightbulbs.

(c) What is the probability that all six bulbs are functioning after three years?
(d) What is the probability that at least one bulb is functioning after seven years?