Instructions: Always show how you set up the problem, in order to receive partial credit for a problem. On most problems, you don’t need to get the numerical answer, so long as you show how you would proceed to get the answer by inserting the appropriate numbers into the correct formula. You may use the book only for the tables in the back.

1) (10 Points) An airline, believing that 5% of passengers fail to show up for flights, overbooks (i.e. sells more tickets than there are seats). Suppose a plane will hold 265 passengers, and the airline sells 275 seats. Assuming a binomial distribution, what’s the probability the airline will not have enough seats so that someone will get bumped (i.e. find probability that there are less than 10 no-shows). You don’t need to find this, just set up the expression substituting appropriate numbers into the formulas.
2) (20 Points) An outbreak of food-borne illness was attributed to Salmonella, and the source of the illness was suspected to be ice cream from a particular company. Health officials sampled 9 production runs from the company to determine levels of Salmonella in the ice cream. The levels are:

\[0.59 \quad 0.14 \quad 0.33 \quad 0.69 \quad 0.23 \quad 0.99 \quad 0.52 \quad 0.39 \quad 0.42\]

a) Find the median, quartiles and interquartile range, showing how you got them.

\[M = \quad Q_1 = \quad Q_3 = \quad IQR = \]

b) Are there any outliers? Show why or why not.

c) Sketch a boxplot for the data.
3) (30 Points) A mean level of Salmonella exceeding 0.3 is considered to be very dangerous. Suppose that we know the population variance to be 0.09. Test whether the health department has evidence that the mean exceeds 0.3. Use \( \alpha = 0.01 \). (The sample mean is \( \bar{x} = 0.478 \)).

a) \( H_0 \):

b) \( H_A \):

c) Test statistic:

d) Rejection region: (i.e. when would you reject \( H_0 \)?)

e) Decision. State whether or not you reject \( H_0 \), and give a reason for your decision.

f) Find the \( p \)-value for the test.
g) Using a sample of size 9, what is the power of the previous hypothesis test to reject $H_0$ if the population mean is 0.45?

4) (10 Points) The health department wants to find a 95% two-sided confidence interval for the mean Salmonella level in ice cream. They want to base the interval on the sample variance, which they calculate to be 0.066, rather than assuming a population variance. Find the interval (recalling the sample mean of 0.478).
5) Short Answer. (30 Points)

a) A reviewer suggests that it would have been better in Problem 4 to use a one-sided interval. How could you justify a one-sided interval from the health department standpoint?

b) Another reviewer questions whether the assumptions for the confidence interval in Problem 4 are satisfied. List the assumptions, and specify whether you think they are satisfied for the given data.

c) The confidence interval for $\mu$ is often misinterpreted. Many interpret it to mean that there is a 95% chance that the interval will contain $\mu$. Is this a correct interpretation? Is so, state why. If not, give a correct interpretation for the given 95% confidence interval.
d) Another reviewer doubts that the number of no-shows in Problem 1 follows a binomial. There is no doubt that 275 tickets will be sold, nor that the probability of an individual no-show is 5%. What other assumption must be satisfied? Is it likely that this other assumption is satisfied in practice?

e) There are two types of life tables, namely current and cohort tables. If one starts this year to construct such a table for the life expectancy of a newborn infant in the US, which type of table is likely to give the longer life expectancy? Give a brief rationale for your answer.