Homework 9.

(Due Nov. 17)

10.1.4 A new radar system is being developed to detect packages dropped by airplane. In a series of trials, the radar detected the packages being dropped 35 times out of 44. Construct a 95% lower confidence bound on the probability that the radar successfully detects dropped packages.

10.1.8 Suppose that you wish to find a population proportion p with accuracy $\pm 2\%$ with 99% confidence. What sample size n would you recommend if p could be 0.5? What if the population proportion p can be assumed to be no larger than 0.40?

10.1.18 The dielectric breakdown strength of an electrical insulator is defined to be the voltage at which the insulator starts to leak detectable amounts of electrical current, and it is an important safety consideration. In an experiment, 62 insulators of a certain type were tested at 180°C, and it was found that 13 had a dielectric breakdown strength below a specified threshold level.

(a) Conduct a hypothesis test to investigate whether this experiment provides sufficient evidence to conclude that the probability of an insulator of this type having a dielectric breakdown strength below the specified threshold level is larger than 5%.

(b) Construct a one-sided 95% confidence interval that provides a lower bound on the probability of an insulator of this type having a dielectric breakdown strength below the specified threshold level.

10.2.2 (As for (c), repeat (a) and (b) with the data in (c))
Die A is rolled 50 times and a 6 is scored 4 times, while a 6 is obtained 10 times when die B is rolled 50 times.

(a) Construct a two-sided 99% confidence interval for the difference in the probabilities of scoring a 6 on the two dice.

(b) Calculate a p-value for the two-sided null hypothesis that the two dice have equal probabilities of scoring 6.

(c) What would your answers be if die A produced a 6 40 times in 500 rolls and die B produced a 6 100 times in 500 rolls?

10.2.12 ($\alpha = 0.05$)
Recall from Problem 10.1.16 that in a particular day, 22 out of 542 visitors to a website followed a link provided by an advertiser. After the advertisements were modified, it was found that 64 out of 601 visitors to the website on a day followed the link. Is there any evidence that the modifications to the advertisements attracted more customers?

10.1.16 (Not a homework problem)
In a particular day, 22 out of 542 visitors to a website followed a link provided by one of the advertisers. Calculate a 99% two-sided confidence interval for the probability that a user of the website will follow a link provided by an advertiser.

10.3.6 ($\alpha = 0.05$) **Taste Tests for Soft Drink Formulations**
A beverage company has three formulations of a soft drink product. DS 10.3.6 gives the results of some taste tests where participants are asked to declare which formulation they like best. Is it plausible that the three formulations are equally popular?

10.3.14 ($\alpha = 0.05$) As experiment was performed to investigate how long batteries remain charged under certain storage conditions. A total of 125 batteries were charged to the same level and stored in the designated conditions. After 24 hours all 125 batteries were tested and it was found that 12 of them had charges that had dropped below the threshold level. After an additional 24 hours the remaining 113 batteries were tested and it was found that 53 of them had charges that had dropped below the threshold level. Finally, after an additional 24 hours the remaining 60 batteries were tested and it was found that 39 of them had charges that had dropped below the threshold level. It is claimed that for these batteries under these storage conditions the time in hours until the charge drops below the threshold level has a Weibull distribution with parameters $\lambda = 0.065$ and $a = 0.45$. Are the results of this experiment consistent with that claim?

10.4.2 ($\alpha = 0.05$) **Fertilizer Comparisons**
Seedlings are grown without fertilizer or with one of two kinds of fertilizer. After a certain period of time a seedling's growth is classified into one of four categories, as given in DS 10.4.2. Test whether the seedlings' growth can be taken to be the same for all three sets of growing conditions.

10.4.6 Show that for a 2×2 contingency table the Pearson chi-square statistic can be written

$$X^2 = \frac{n(x_{11}x_{22} - x_{12}x_{21})^2}{x_{1\cdot}x_{\cdot 1}x_{2\cdot}x_{\cdot 2}}$$

10.4.10 **Asphalt Load Testing**
An experiment was conducted to compare three types of asphalt. Samples of each type of asphalt were subjected to repeated loads at high temperatures, and the resulting cracking was analyzed. For type A, 57 samples were tested, of which 9 had severe cracking, 17 had medium cracking, and 31 had minor cracking. For type B, 49 samples were tested, of which 4 had severe cracking, 9 had medium cracking, and 36 had minor cracking. For type C, 90 samples were tested, of which 15 had severe cracking, 19 had medium cracking, and 56 had minor cracking. Does this experiment provide any evidence that the three types of asphalt are different with respect to cracking?