Confidence Interval For a Population Proportion $p$

1. Recently, ACT, Inc. reported that 71.9% (363) of 505 randomly selected college students in public colleges that were freshmen in 2010 returned to college in 2011 for their sophomore year.

   a. Estimate the national freshman-to-sophomore retention rate in public colleges with a 95% confidence interval.

   b. Choose the correct answer to the following statement: If we calculated a 98% confidence interval instead of a 95% confidence interval, the 98% confidence interval would be
      i)    narrower         ii)    wider

   c. Choose the correct interpretation of the 95% confidence interval in part a:
      i) In 95% of all random samples of public colleges, the freshman-to-sophomore retention rate will be 71.9%.
      ii) In 95% of all random samples of public colleges, the freshman-to-sophomore retention rate is between 68.0% and 75.8%.
      iii) There is a 95% chance that the interval (68.0%, 75.8%) contains the true freshman-to-sophomore retention rate for public colleges.
      iv) There is a 95% chance that the true freshman-to-sophomore retention rate of public colleges is in the interval (68.0%, 75.8%)
      v) If many random samples are selected, each sample with 505 public college freshmen, 95% of the sample freshman-to-sophomore retention rates $\hat{p}$ will be in the interval (.680, .758).

2. Advances in the technology related to clubs and balls have enabled recent professional golfers to hit the ball farther than professional golfers in the past. According to statistics collected by the PGA (Professional Golf Association), in all PGA tournaments during 2008, 36 of the 190 golfers (18.9%) had a mean driving distance of more than 285 yards. In PGA tournaments played through the month of June 2013, 43 of 194 golfers (22.2%) have a mean driving distance more than 285 yards. Use the 2013 data to construct a 95% confidence interval for the proportion of professional golfers in all PGA tournaments during 2013 who will have a mean driving distance more than 285 yards. Does it appear that a significantly higher proportion of golfers in 2013 will have a mean driving distance more than 285 yards when compared to the proportion in 2008? (That is, does the confidence interval contain 0.189?)
3. Sociologists and sports psychologists have noticed that in many sports, the athletes who make it to the professional level in their respective sport were the older participants (that is, their birthdate is early in the “sport year”) in the sport as a youth. This phenomenon has been noticed around the world in various sports such as soccer (Europe), hockey (Canada), and baseball (USA).

In youth baseball leagues the “sport year” begins on Aug. 1, so children born in August are the older participants. In a random sample of 250 major league baseball players born since 1975, 35 were born in the month of August. National demographic statistics show that 9% of all births in the general population occur in August.

**Question:** Is there a higher percentage of professional baseball players born in August than in the general population? Use a 95% confidence interval to answer the question.

4. Wildlife biologists inspect 153 deer taken by hunters and find 32 of them carrying Lyme disease ticks.
   a. Calculate a 90% confidence interval for the proportion of deer that carry Lyme disease ticks.
   b. If the scientists want to cut the margin of error in half, how many deer must they inspect?
   c. If the scientists want to estimate the proportion of deer that carry Lyme disease ticks to within .02 with 90% confidence, how many deer should they sample? (Use \( p = .20 \).)