Composite Hypotheses[*]

Worksheet 20

1. In the shell game, three identical shells are placed face-down on a surface. A small ball is placed beneath one of these shells so that it cannot be seen, and the shells are then shuffled by the operator in plain view.

   (a) Give an appropriate hypothesis for the case that the player choice for the shall is better than chance.

   (b) Out of playing the game 60 times, the guess is correct 25 times. Test the hypothesis based on the binomial distribution and report a p-value.

   (c) Is the test significant at the 10%, 5%, 1% level?

   (d) Does your conclusion change if the guess is correct 27 times? 29 times?

2. Younger Americans are better than their elders at separating factual from opinion statements in the news, according to a new analysis from Pew Research Center. Their analysis is based on a nationally representative survey of 5,035 adults 18 years of age or older conducted from February 22 to March 4, 2018.

   (a) The United States which has 15% of the population between 18 and 29 years old and 22% between 50 and 64 year old. Estimate the sample sizes for each of these two age groups.

   (b) For the younger age group, 34% were able to correctly classify 5 factual and 5 opinion statements. For the older group, 22% made the classification correctly. Create 95% confidence intervals for the proportion of Americans of the appropriate age who would make the correct classification.

   (c) An educational program aimed at the youth is designed to help improve the ability to classify a fact from an opinion. With a hypothesis

   $$H_0 : p \leq p_0 \quad \text{versus} \quad H_1 : p > p_0,$$

   and for $p_0 = 0.34$, give the value of the power function $\pi(p)$ for $p = 0.34, 0.35, 0.36, 0.37.0.38$ and 0.39 with the choice of $\alpha = 0.02$ and a sample of size 750.

   (d) What qualititative change would you see in the power curve change if α is reduced to 0.01? Explain your answer.

   (e) Compute the power function for $\alpha = 0.02$ for a sample size of 1,500 for the same values for p

   (f) Give a sketch of the power curves in (c) and (e) and explain the difference in the two power functions.

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