Classroom Voting Questions: Statistics

Power and Inference as a Decision

1. We want to investigate whether people in Pottersville have more expensive cars than people in Baileytown. We gather a sample of people from both towns and compute the average values of the cars in each. Suppose that in reality the residents of Pottersville have more expensive cars, on average, but our sample sizes are not large enough for us to detect this difference. What type of error did we make?

   (a) Type I error

   (b) Type II error

   (c) Not enough information is given.

   Answer: (b). The null hypothesis is that the mean value of the cars is the same, however we are told that there really is a difference, so the null hypothesis is false. Because we did not detect the difference, this means that we failed to reject this false null hypothesis.

   by Kelly Cline

   STT.06.04.010

2. We want to investigate whether the trout in lake Able are the same size, on average, as the trout in lake Baker. We gather a sample of trout from each lake, and we find that the trout in lake Able are larger by a statistically significant amount. However, in reality both populations of trout have the same average size, and we just happened to get a sample from Able that were unusually large, due to bad luck. What type of error did we make?

   (a) Type I error

   (b) Type II error

   (c) Not enough information is given.

   Answer: (a). The null hypothesis is that the mean sizes of the trout are the same, and we rejected that null hypothesis. However, it turns out that the null hypothesis was true, and so we made a Type I error.

   by Kelly Cline

   STT.06.04.015

3. The manager of a university computing help line is trying to decide whether to hire additional staff. She has decided to hire if there is evidence that the average time callers to the help line must wait on hold before receiving assistance is greater than 5 minutes. She decides to collect data in order to test $H_0 : \mu = 5$ versus $H_a : \mu > 5$ where μ is the mean time on hold. From the callers' perspective, which type of error would be more serious?

   (a) Type I error

   (b) Type II error

   (c) Both types of error would be considered equally serious

   Answer: (b).

   by Roxy Peck for the textbooks: Roxy Peck and Jay Devore, Statistics: The Exploration and Analysis of Data, 6th Edition, Brooks/Cole Cengage Learning 2008 and Roxy Peck, Chris Olsen and Jay Devore, Introduction to Statistics and Data Analysis, 3rd Edition, Brooks/Cole Cengage Learning 2008.

   STT.06.04.020

   CC HZ MA207 F09: 25/**75**/0 time 1:10
   CC KC MA207 F09: 21/**62**/17 time 2:00
   AS DH MA3321 Su12: 14/**79**/7 time 2:00
   AS DH 1333 010 S13: 53/**42**/5 time 3:10
   AS DH 1333 020 S14: 24/**68**/8 time 3:00 ,
   AS DH 1333 010 F14: 0/**86**/14 time 2:40 ,
   AS DH 1333 020 S15: 0/**100**/0 time 3:00 ,
   AS DH 1333 020 F15: 4/**96**/0 time 3:40 ,
   CC KC MA207 F15: 75/**25**/0 time 4:00
   CC KC MA315 F15: 0/**94**/6 time 2:00
   AS DH 1342 010 F17: 12/**85**/4 time 3:10
   CC KC MA207 F18: 19/**81**/0
   AS DH 1342 020 F18: 11/**89**/0 time 3:10
   CC KC MA207 S19: 20/**76**/4
   CC KC MA315 S19: 35/**65**/0
   AS DH 1342 040 S19: 0/**100**/0 time 3:40
   AS DH 1342 030 F19: 8/**92**/0 time 3:30

4. Suppose that the P-value in a hypothesis test is 0.08. If the significance level for the test is $\alpha = 0.05$, which of the following is the appropriate decision?

   (a) Fail to reject H_0

   (b) Reject H_0

   (c) There is not enough information given to know whether or not H_0 should be rejected.

Answer: (a).

by Roxy Peck for the textbooks: Roxy Peck and Jay Devore, Statistics: The Exploration and Analysis of Data, 6th Edition, Brooks/Cole Cengage Learning 2008 and Roxy Peck, Chris Olsen and Jay Devore, Introduction to Statistics and Data Analysis, 3rd Edition, Brooks/Cole Cengage Learning 2008.

STT.06.04.030

CC HZ MA207 F09: **53**/6/41 time 1:20
CC KC MA207 F09: **87**/13/0 time 2:00
AS DH MA3321 Su12: **93**/7/0 time 0:50
CC KC MA207 F15: **100**/0/0 time 0:30
CC KC MA207 F18: **59**/18/23

5. In order to investigate a claim that the average time required for the county fire department to respond to a reported fire is greater than 15 minutes, county staff determined the response times for 40 randomly selected fire reports. The data was used to test $H_0 : \mu = 15$ versus $H_a : \mu > 15$ and the computed P-value was 0.12. If a 0.05 level of significance is used, what conclusions can be drawn?

   (a) There is convincing evidence that the mean response time is 15 minutes (or less).

   (b) There is convincing evidence that the mean response time is greater than 15 minutes.

   (c) There is not convincing evidence that the mean response time is greater than 15 minutes.

   Answer: (c).

   by Roxy Peck for the textbooks: Roxy Peck and Jay Devore, Statistics: The Exploration and Analysis of Data, 6th Edition, Brooks/Cole Cengage Learning 2008 and Roxy Peck, Chris Olsen and Jay Devore, Introduction to Statistics and Data Analysis, 3rd Edition, Brooks/Cole Cengage Learning 2008.

   STT.06.04.040

   CC HZ MA207 F09: 6/18/**76** time 1:20
   CC KC MA207 F09: 28/14/**59** time 1:45
   AS DH MA3321 Su12: 0/20/**80** time 1:40
   CC KC MA207 F15: 0/0/**100** time 0:40
   CC KC MA207 F18: 5/0/**95**

6. Carol reports a statistically significant result ($P < 0.02$) in one of her journal articles. The editor suggests that because of the small sample size of the study ($n = 20$), the result cannot be trusted and she needs to collect more data before the article can be

published. He is concerned that the study has too little power. How would you respond to the editor?

(a) The study has enough power to detect the effect since the significant result was obtained.

(b) Because the sample size so small, increasing the sample size to 200 should ensure sufficient power to detect a small effect.

(c) Setting the $\alpha = 0.01$ would be an alternative to collecting more data.

(d) Because the P-value is so close to $\alpha = 0.05$, the effect size is likely to be small and hence more information is needed.

Answer: (a). (A)* correct Since Carol rejected H_0, it is not possible that she made a Type II error ($\beta = 0$ so power $= 1$). The P-value calculation includes the sample size.

(B) Carol has already detected a significant result so a bigger sample size is not needed.

(C) Setting $\alpha = 0.01$ would not increase the power; in fact, it would decrease the power.

(D) Since P is so close to $\alpha = 0.05$, the effect size is not likely to be small.

by Murphy, McKnight, Richman, and Terry

STT.06.04.050

AS DH MA3321 Su12: **0**/50/33/17 time 3:00
CC KC MA207 F15: **56**/44/0/0 time 2:00
CC KC MA315 F18: **13**/84/0/3