AP Statistics

2019-03-29 10.1 Assignment

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Pg. 621-626 1,5,7,9,11,13,15,17,21,23,29-32

Question 1

Part A

Proportions as the potential responses are binomial (proportion of responses yes vs no) and not numerical (so means are impractical)

Part B

Observational

Question 5

Part A

Child: $p[1] = 0.30$, $n[1] = 50$

Adult: $p[2] = 0.15$, $n[2] = 100$

Checks

Normal

$n[1]p[1] = 15$

$n[1](1-p[1]) = 35$

$n[2]p[2] = 15$

$n[2](1-p[2]) = 85$

Independent

Yes, it can be reasonably assumed that there are more than 1000 adult jelly beans and 500 children's jelly beans.

Random:

Stated

$\hat{p}[1] - \hat{p}[2] = 0.15$

stddev = sqrt((0.3*0.7)/50 + (0.15*0.85)/100) = 0.074

For there to be a smaller proportion of red in the children's sample than the adult sample, $\hat{p}[1] - \hat{p}[2]$ would need to be ≤ 0.

z = (0 - 0.15)/stddev = -2.03

$P(\hat{p}[1] < \hat{p}[2]) = P(\hat{p}[1] - \hat{p}[2] < 0) = P(Z < -2.03) = 0.0212$

Part B

Yes. There is only a 2.12% chance that this or a more extreme result would occur. This is less than 5% and thus gives us sufficient evidence to reject the company's claim.

Question 7

Looking only at Woburn, $n = 228$ and $p = 0.012$

$np = 2.7$

The distribution is not normal as np is ≤ 10.

Additionally, randomness is not specified

Question 9

In the control group:

$n = 12$, $p = 0.67$

$np = 8$ which is ≤ 10, therefore, the distribution is not normal.

Question 11

$\bar{x}[1] = 73$, $n[1] = 158$, $\hat{p}[1] = 0.462$

$\bar{x}[2] = 26$, $n[2] = 143$, $\hat{p}[2] = 0.182$

$z[1-(0.1/2)] = 1.645$

stddev = $\text{sqrt}(\hat{p}[1](1-\hat{p}[1])/n[1] + \hat{p}[2](1-\hat{p}[2])/n[2]) =$

ME = 1.645*stddev = 0.0841

CI = $(\hat{p}[1] - \hat{p}[2]) \pm$ ME

CI = (0.1959,0.3641)

We are 90% confident that the difference between the proportions of the IM usage of these age groups is between 0.1959 and 0.3641

Question 13

$\bar{x}[1] = 986$, $n[1] = 2253$, $\hat{p}[1] = 0.438$

$\bar{x}[2] = 923$, $n[2] = 2629$, $\hat{p}[2] = 0.351$

$z[1-0.01/2] = 2.575$

stddev = $\text{sqrt}(\hat{p}[1](1-\hat{p}[1])/n[1] + \hat{p}[2](1-\hat{p}[2])/n[2]) = 0.014$

ME = stddev*z = 0.036

CI = $(\hat{p}[1] - \hat{p}[2]) \pm$ ME = (0.051,0.123)

We are 99% certain that the true difference between the proportions is between 0.051 and 0.123.

Part B

Yes as we are 99% certain that the true value is inside this interval (and this interval does not contain zero).

Question 15

$n[1] = 800$, $\hat{p}[1] = 0.79$

$n[2] = 400$, $\hat{p}[2] = 0.67$

$H[0]: p[1] - p[2] = 0$

$H[a]: p[1] - p[2] \neq 0$

p[1] = the true population proportion of teens who own an iPod or MP3 player

p[2] = the true population proportion of young adults who own an iPod or MP3 player

Question 17

Part A

Normalcy is met

Randomness is met (stated)

Independent is met

$\hat{p}[p]$ = sample proportion = 0.79*(800/1200) + 0.67*(400/1200) = 0.75

$z = 4.53$

$P = 0.0002$

Yes, we can reject the null hypothesis as P is less than 0.05.

Part B

$z[0.025] = 1.96$

CI = (0.066,0.174)

This is consistent as we are 95% confident that the true $\hat{p}[1] - \hat{p}[2]$ is between 0.066 and 0.174. This interval does not contain 0 and thus we are 95% confident that the true difference does not lie in this range.

Question 21

Part A

$\bar{x}[1] = 3396$, $n[1] = 19541$, $\hat{p}[1] = 0.174$

$\bar{x}[2] = 4929$, $n[2] = 29294$, $\hat{p}[2] = 0.168$

$H[0]: p[1] - p[2] = 0$

$H[a]: p[1] - p[2] \neq 0$

$\hat{p}[p] = (3396 + 4929)/(19541 + 29294) = 0.17$

$z = (0.174 - 0.168)/(\text{sqrt}(0.17*0.83)*\text{sqrt}(1/19541^2 + 1/20204^2)) = 1.74$

$P(Z < -1.74 \cup Z > 1.74) = 0.0818$

This is lower than the default significance level α (0.05), therefore, we cannot reject the null hypothesis.

Part B

A type I error would cause for us to reject the null hypothesis (and say that there was a poor distribution) when that is not the case while a type II error would cause us to accept the null hypothesis (and say there was a valid distribution) when that was not the case either.

A type two error is worse as it would cause the sampling to seem legitimate when it was not and cause false impressions about the breast cancer treatment.

Question 23

Part A

Two-proportion z test

Random √

Normal √ (per np and n(1-p) for each sample)

Independent √

Part B

This shows that the probability of receiving this result or a more extreme one when the null hypothesis is true is only 0.0007.

Part C

They should reject the null hypothesis and support that the pregnancy rate is higher for women who received intercessors' prayers.

Question 29: **B**

Question 30: **D**

Question 31: **B**

Question 32: **E**