Homework №16

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22.4 There are two reasons why we can't use the large-sample confidence interval to estimate the proportion p in the population who share these two risk factors. At first, $\hat{p}$ is too close to 0. Secondly, people reached might have provided wrong data.

22.6 We start with the **PLAN** part as the **STATE** part is the description of the problem itself.

PLAN
We must find the $\hat{p}$ value and the z^* value for the 90% confidence interval to find the confidence interval.

SOLVE

$\hat{p} = \dfrac{1552}{4111} \approx 0.378$. From Table C, we get that $z^* = 1.645$. Therefore, the confidence interval is $0.378 \pm 1.64 \times \sqrt{\dfrac{0.378 * (1 - 0.378)}{4111}}$ which is 0.378 ± 0.012. In other words, the confidence interval is between 0.366 and 0.39

CONCLUDE
We are 90% confident that the proportion of the weightlifting injuries in this age group that were accidental is between 0.366 and 0.39.

22.7 (a) $\hat{p} = \dfrac{42}{165} \approx 0.255$. Therefore, ME $= 1.96 \times \sqrt{\dfrac{0.255(1-0.255)}{165}} \approx 0.0665$.

(b) To get a ± 3 margin of error, we need n to be at least $\left(\dfrac{1.96}{0.03}\right)^2 \times 0.255 \times (1 - 0.255) \approx 810.898$. Therefore, $n = 810.898$ is the answer.

22.9 We start with the **PLAN** part as the **STATE** part is the description of the problem itself.

PLAN
We test the null hypothesis H_0. Our null hypothesis is is $H_0 : p = 0.5$ and the alternative hypothesis is $H_a : p \neq 0.5$.

SOLVE

$\hat{p} = \dfrac{140}{250} = 0.56$. $z = \dfrac{0.56 - 0.5}{\sqrt{\frac{0.5\times(1-0.5)}{250}}} \approx 1.90$. We then get that the corresponding P-value is $P = 0.0574$.

CONCLUDE
Since $P = 0.0574 \approx 0.05$, we can say that there is some evidence, yet not strong, that the proportion of times a Belgian euro coin spins heads is not 0.50. However, since P ¿ 0.05, we accept the null hypothesis H_0.

22.10 We start with the **PLAN** part as the **STATE** part is the description of the problem itself.

PLAN
We test the null hypothesis H_0. Our null hypothesis is is $H_0 : p = 0.5$ and the alternative hypothesis is $H_a : p > 0.5$.

SOLVE

$\hat{p} = \dfrac{22}{32} = 0.6875$. $z = \dfrac{0.6875 - 0.5}{\sqrt{\frac{0.5\times(1-0.5)}{32}}} \approx 1.90 \approx 2.121$. We then get that the corresponding P-value is $P = 0.017$.

CONCLUDE
Since $P = 0.017 < 0.05$, we reject the null hypothesis H_0 and conclude that there is a strong evidence that the candidate with the better face wins more than half the time.

22.11 (a) We cannot use the z test for the proportion since $10 \times 0.5 = 5 < 10$ and the number of trials is not sufficiently large.

(b) We can use the z test for the proportion if the sample is derived using SRS.

(c) We cannot use the z test for the proportion since $200 \times (1 - 0.99) = 2 < 10$ and the number of trials is not sufficiently large.

22.39 (a) We start with the **PLAN** part as the **STATE** part is the description of the problem itself.

PLAN

We test the null hypothesis H_0. Our null hypothesis is is $\mathrm{H}_0 : p = 0.5$ and the alternative hypothesis is $\mathrm{H}_a : p \neq 0.5$.

SOLVE

$\hat{p} = \dfrac{22}{32} = 0.6875$. $z = \dfrac{0.6875 - 0.5}{\sqrt{\frac{0.5\times(1-0.5)}{32}}} \approx 1.90 \approx 2.121$. We then get that the corresponding P-value is $P = 2 \times 0.017 = 0.034$.

CONCLUDE

Since $P = 0.034 < 0.05$, we reject the null hypothesis H_0 and conclude that there is a strong evidence that people are not equally likely to choose either of the two positions when presented with two identical wine samples in sequence.

(b) We do not know whether we indeed have the SRS (Simple Random Sample) of the people. People who partook in the experiments might have a bias (response bias). Due to this reason, generalization of our conclusions to all wine tasters will, most likely, not yield accurate results.

22.41 $n = \left(\dfrac{z^*}{m}\right)^2 \times p^* \times (1 - p^*) = \left(\dfrac{1.96}{0.05}\right)^2 \times 0.6875 \times (1 - 0.6875) \approx 330.14.$

Hence, we would need at least 331 (we round up) wine tasters to estimate the proportion that would choose the first option to within 0.05 with 95% confidence.