AP* Statistics Quiz A – Chapter 19 – Key

A report on health care in the US said that 28% of Americans have experienced times when they haven't been able to afford medical care. A news organization randomly sampled 801 black Americans, of whom 38% reported that there had been times in the last year when they had not been able to afford medical care. Does this indicate that this problem is more severe among black Americans?

1. Test an appropriate hypothesis and state your conclusion. (Make sure to check any necessary conditions and to state a conclusion in the context of the problem.)

Hypotheses: $H_0 : p = 0.28$. The proportion of all black Americans that were unable to afford medical care in the last year is 28%.
$H_A : p > 0.28$. The proportion of all black Americans that were unable to afford medical care in the last year is greater than 28%.

Model: Okay to use the Normal model because the sample is random, these 801 black Americans are less than 10% of all black Americans, and $np = (801)(0.28) = 224.28 \geq 10$ and $nq = (801)(0.72) = 576.72 \geq 10$.

We will do a one-proportion z-test.

Mechanics:

$$n = 801,\ \hat{p} = 0.38$$
$$z = \frac{0.38 - 0.28}{\sqrt{\frac{(0.28)(0.72)}{801}}}$$
$$P = P(\hat{p} > 0.38) = P(z > 6.29) \approx 0$$

Conclusion: With a P-value so small (barely above zero), I reject the null hypothesis. There is evidence to suggest that the proportion of black Americans who were not able to afford medical care in the past year is more than 28%.

2. Was your test one-tail upper tail, one-tail lower tail, or two-tail? Explain why you chose that kind of test in this situation.

One-tail, upper tail test. We are concerned that the proportion of people who are not able to afford medical care is higher among black Americans.

3. Explain what your P-value means in this context.

If the proportion of black Americans was 28%, we would almost never expect to find at least 38% of 801 randomly selected black Americans responding "yes".

AP Statistics Quiz B – Chapter 19 – Key*

The International Olympic Committee states that the female participation in the 2004 Summer Olympic Games was 42%, even with new sports such as weight lifting, hammer throw, and modern pentathlon being added to the Games. Broadcasting and clothing companies want to change their advertising and marketing strategies if the female participation increases at the next games. An independent sports expert arranged for a random sample of pre-Olympic exhibitions. The sports expert reported that 202 of 454 athletes in the random sample were women. Is this strong evidence that the participation rate may increase?

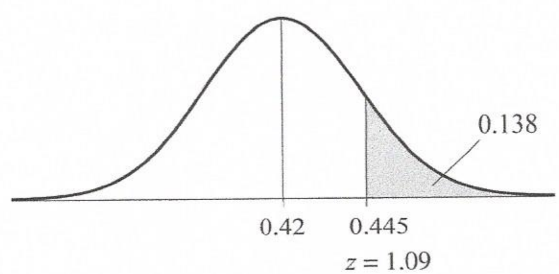
1. Test an appropriate hypothesis and state your conclusion.

Hypotheses: $H_0: p = 0.42$. The female participation rate in the Olympics is 42%.
$H_A: p > 0.42$. The female participation rate in the Olympics is greater than 42%.

Model: Okay to use the Normal model because the sample is random, these 454 athletes are less than 10% of all athletes at exhibitions, and $np = (454)(0.42) = 190.68 \geq 10$ and $nq = (454)(0.58) = 263.32 \geq 10$. Use a $N(0.42, 0.023)$ model, do a 1-proportion z-test.

Mechanics: $n = 454,\ x = 202,\ \hat{p} = \frac{202}{454} = 0.445$

$$z = \frac{0.445 - 0.42}{\sqrt{\frac{(0.42)(.58)}{454}}} = 1.09$$



$$P = P(\hat{p} > 0.445) = P(z > 1.09) = 0.138$$

Conclusion: With a *P*-value (0.138) so large, I fail to reject the null hypothesis that the proportion of female athletes is 0.42. There is not enough evidence to suggest that the proportion of female athletes will increase.

2. Was your test one-tail upper tail, lower tail, or two-tail? Explain why you choose that kind of test in this situation.

One-tail, upper test. The companies will change strategies only if there is strong evidence of an increase in female participation rate from current rate of 42%.

3. Explain what your *P*-value means in this context.

If the proportion of female athletes has not increased, we could expect to find at least 202 females out of 454 pre-Olympic athletes about 13.8% of the time.

AP* Statistics Quiz C – Chapter 19 – Key

A company claims to have invented a hand-held sensor that can detect the presence of explosives inside a closed container. Law enforcement and security agencies are very interested in purchasing several of the devices if they are shown to perform effectively. An independent laboratory arranged a preliminary test. If the device can detect explosives at a rate greater than chance would predict, a more rigorous test will be performed. They placed four empty boxes in the corners of an otherwise empty room. For each trial they put a small quantity of an explosive in one of the boxes selected at random. The company's technician then entered the room and used the sensor to try to determine which of the four boxes contained the explosive. The experiment consisted of 50 trials, and the technician was successful in finding the explosive 16 times. Does this indicate that the device is effective in sensing the presence of explosives, and should undergo more rigorous testing?

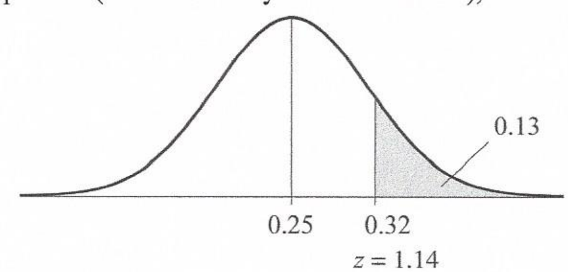
1. Test an appropriate hypothesis and state your conclusion.

Hypotheses: $H_0: p = 0.25$. The device can detect explosives at the same level as guessing.
$H_A: p > 0.25$. The device can detect explosives at a level greater than chance.

Model: OK to use a Normal model because trials are independent (box is randomly chosen each time), and $np = 12.5$, $nq = 37.5$. Do a 1-proportion z-test.

Mechanics: $\hat{p} = 0.32$, $z = 1.14$, $P = 0.13$

Conclusion: With a *P*-value so high I fail to reject the null hypothesis. This test does not provide convincing evidence that the sensor can detect the presence of explosives inside a box.



2. Was your test one-tail upper tail, lower tail, or two-tail? Explain why you chose that kind of test in this situation.

One-tail, upper tail. The device is effective only if it can detect explosives at a rate higher than chance (25%).

3. Explain what your *P*-value means in this context.

Even if the device actually performs no better than guessing, we could expect to find the explosives 16 or more times out of 50 about 13% of the time.