Cumulative AP Practice Test 3 Solutions

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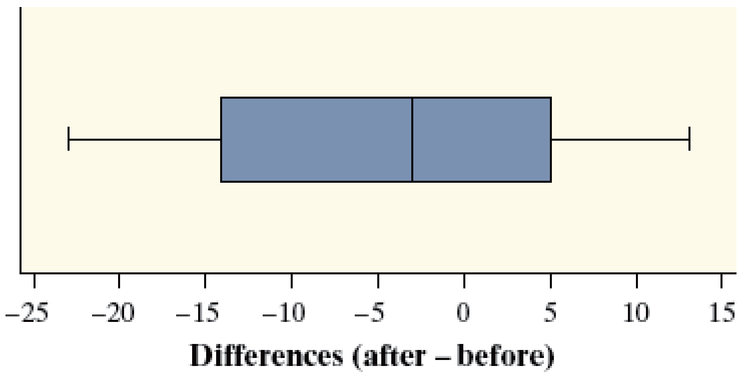
AP3.31 Let μ_d = mean difference in weight gain (After − Before)

$H_o: \mu_d = 0$ versus $H_a: \mu_d < 0$ $\quad\quad t = \dfrac{\bar{x}_d - \mu_d}{\dfrac{s_d}{\sqrt{n}}}$

- **Random** A random sample of dieters in the program was taken
- **Normal** The boxplot of sample differences is relatively symmetric and there are no outliers so it is plausible that the differences came from a Normal distribution.



- **Independent** The difference in weights for each dieter can be treated as independent.

$t = -1.21$, P-value = 0.1232, df = 14. Since the P-value is greater than 0.05, we fail to reject the null hypothesis. We do not have convincing evidence that the diet had a long-term effect, i.e., it does not appear that dieters were able to maintain the initial weight loss.

AP3.32 (a) This is an observational study. No treatments were imposed on the two groups.
(b)

p_1 = actual proportion of all VLBW babies who graduate from high school

p_2 = actual proportion of all normal-birth-weight babies who graduate from high school

$H_o: p_1 = p_2$ versus $H_a: p_1 < p_2$

- Both groups of babies were randomly selected and form two independent groups.

  $n_1\hat{p}_1 = (242)\left(\dfrac{179}{242}\right) = 179$ and $n_1(1-\hat{p}_1) = (242)\left(\dfrac{63}{242}\right) = 63$

  $n_2\hat{p}_2 = (233)\left(\dfrac{193}{233}\right) = 193$ and $n_2(1-\hat{p}_2) = (233)\left(\dfrac{40}{233}\right) = 40$

- All values are greater than 10 so the Normal condition is met.

Using $\hat{p}_c = \dfrac{179+193}{242+233} = 0.783$, $z = \dfrac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\dfrac{\hat{p}_c(1-\hat{p}_c)}{n_1} + \dfrac{\hat{p}_c(1-\hat{p}_c)}{n_2}}} = -2.34$

The corresponding P-value is 0.0095. Since the P-value is so small, we reject the null hypothesis. There is enough evidence to suggest that the proportion of all VLBW babies who graduate from high school by age 20 is significantly less than the proportion of all normal-birth-weight babies who graduate from high school by age 20.

AP3.33 (a) Predicted distance = -73.64 + 5.7188 (temperature). (b) The slope = 5.7188. For every one-degree (Celsius) increase in the water discharge temperature, the predicted increase in the distance of the nearest fish from the outflow pipe is 5.7188 meters. (c) Yes. The residual plot shows no apparent pattern and the original scatterplot shows a strong linear relationship between temperature of the discharge water and the distance of the fish from the outflow pipe. (d) Predicted distance = -73.64 + 5.7188(29) = 92.21 meters. If you examine the residual plot, the point with a fitted value of 92.21 has a negative residual. This means that the model is overpredicting.

AP3.34 Define W= the weight of a randomly selected gift box. We know that

$$\mu_W = 8(2) + 2(4) + 3 = 27$$

$$\sigma_W = \sqrt{8(0.5^2) + 2(1^2) + 0.2^2} = 2.01$$

(b) Since the three distributions are approximately Normal, the weight distribution will be as well.

$$P(W > 30) = P\left(z > \frac{30-27}{2.01}\right) = P(z > 1.49) = 0.0681.$$

(c) Let X = the number of boxes that weigh more than 30 ounces. This is a binomial setting with $n = 5$ and $p = 0.0681$. $P(X \geq 1) = 1 - P(X = 0) = 1 - (1 - 0.0681)^5 = 0.2972.$

(d) $P(\overline{w} > 30) = P\left(z > \dfrac{30-27}{\frac{2.01}{\sqrt{5}}}\right) = P(z > 3.34) = 0.000419$

AP3.35

(a)

μ_A = mean annual return for stock A

μ_B = mean annual return for stock B

$H_o : \mu_A = \mu_B$ versus $H_a : \mu_A \neq \mu_B$

$$t = \frac{(\overline{x}_A - \overline{x}_B) - (\mu_A - \mu_B)}{\sqrt{\frac{s_A^2}{n_A} + \frac{s_B^2}{n_B}}}$$

- Both samples are large (50 > 30)
- The two groups of stock prices form independent samples.
- The daily returns for both A and B were randomly selected from the previous five years.
  $t = 2.067$; $P-\text{value} = 0.0416$; $\text{df} = 90.53$

Since 0.0416 < 0.05, we reject the null hypothesis. There is enough evidence to suggest that there is a significant difference in the mean return on investment for the two stocks.

(b) σ_A = standard deviation of the return for stock A

σ_B = standard deviation of the return for stock B

$H_o : \sigma_A = \sigma_B$ versus $H_a : \sigma_A > \sigma_B$

(c) Values of F that are significantly greater than 1 would indicate that the price volatility for stock A is higher than that for stock B. (d) $F = \frac{(12.9)^2}{(9.6)^2} = 1.806$. (e) Assuming there is no difference in the standard deviations for the two stocks, we would observe a test statistic of 1.806 or greater only 6 out of 200 times in the simulation. This represents the P-value of the test ($P = 0.03$). Since this value is less than 0.05, we would reject the null hypothesis. There is enough evidence to conclude that the price volatility of stock A is greater than that of stock B.