Mth 102 – General Education Statistics – Practice Exam 6 – Solutions

1.
   a. A Type I Error would be stating that the defendant is guilty when he or she is actually innocent.
   b. A Type II Error would be stating that the defendant is innocent when he or she is actually guilty.
2.
   a. $H_0 : \mu = 18\,\text{mg}$

      $H_a : \mu < 18\,\text{mg}$
   b. At the 5% significance level, the critical value is -1.645.
3.
   a. We should conclude that there is not enough evidence to support the claim that the success of students who place directly into a course with their Math ACT score is lower than 65%. (i.e. Students who place via the ACT do equally as well as other students.)
   b. In this case, a Type II error was committed, since we *should* have rejected the null hypothesis (since 0.63 < 0.65) but we did not.
4.
   a. $p - value = 2 \cdot P(Z > 2.12) = 2 \cdot 0.0170 = 0.0340$
   b. We should reject, since *p*-value < α ,

5. It's actually very close. The sample size (20) is less than our required 30, so we need the distribution to be approximately normal. The normal probability plot looks fairly linear and there are no outliers on the box plot, so it does look like we can perform a test. (One might also argue that the distribution looks skewed right from the box plot, so the sample might not be from a normal population.)

6.
   (1) $H_0 : \mu = 26.4\,\text{yrs}$

   $H_a : \mu > 26.4\,\text{yrs}$

   (2) $\alpha = 0.05$

   (3) $Z = \dfrac{26.9 - 26.4}{6.4/\sqrt{40}} \approx 0.49$

   (4) critical value $Z_{0.05} = 1.645$ — *p*-value $P(Z > 0.49) = 0.3121$

   (5) We should *not* reject H_0.

   (6) There is not enough evidence at the 5% level of significance to support the claim that the average age of a woman before she has her first child is greater than the 1990 average age.

7.

(1) $H_0 : \mu = 11.9$ thousand miles

$H_a : \mu < 11.9$ thousand miles

(2) $\alpha = 0.05$

(3) $Z = \dfrac{11.7 - 11.9}{6.0/\sqrt{500}} \approx -0.75$

(4) critical value | p-value

$-Z_{0.05} = -1.645$ | $P(Z < -0.75) = 0.2266$

(5) We should *not* reject H_0.

(6) There is not enough evidence at the 5% level of significance to support the claim that the average distance was less last year than in 2000.

8.

(1) $H_0 : \mu = 80$ mg per five ounces

$H_a : \mu \neq 80$ mg per five ounces

(2) $\alpha = 0.05$

(3) $t = \dfrac{83 - 80}{3.5/\sqrt{42}} \approx 5.555$

(4) critical value | p-value

$t_{0.025,\,41} = 2.020$ | $2 \cdot P(t > 2.555) \approx 0$

(5) We should reject H_0.

(6) There is very strong enough evidence at the 5% level of significance to state that the mean caffeine content is not 80 mg per five ounces.

9.

(1) $H_0 : \mu = 36$ mpg

$H_a : \mu > 36$ mpg

(2) $\alpha = 0.01$

(3) $Z = \dfrac{37.2 - 36}{2.3/\sqrt{34}} \approx 3.04$

(4) critical value | p-value

$Z_{0.01} = 2.33$ | $P(Z > 3.04) = 0.0012$

(5) We should reject H_0.

(6) There is enough evidence at the 5% level of significance to support the claim that the Prizm exceeds 36 mpg on the highway.

10.

(1) $H_0 : \mu = 30\,\text{min}$

$H_a : \mu < 30\,\text{min}$

(2) $\alpha = 0.01$

(3) $Z = \dfrac{28.5 - 30}{3.5/\sqrt{36}} \approx -2.57$

(4) critical value $\quad$ p-value

$-Z_{0.01} = -2.33$ $\quad$ $P(Z < -2.57) = 0.0051$

(5) We should reject H_0.

(6) There is enough evidence at the 5% level of significance to support the claim that the average delivery time is less than 30 minutes.

11.

a. The two methods were using a *p*-value or using critical values.
b. Using a *p*-value gives more versatile results as it lets us determine the strength of our test.