Problem 1: Sincich, 7.13

Let $\mu =$ mean caloric content of Virginia school lunches. To test the claim that after the testing period ended, the average caloric content dropped, we test:

H_0: $\mu = 863$
H_a: $\mu < 863$

Problem 2, Sincich 7.34.

a. Let μ = mean Mach rating score for all purchasing managers. To determine if the mean Mach rating score is different from 85, we test:

H_o: $\mu = 85$
H_a: $\mu \neq 85$

b. The rejection requires $\alpha/2 = .10/2 = .05$ in each tail of the z-distribution. From Table IV, Appendix B, $z_{.05} = 1.645$. The rejection region is $z < -1.645$ or $z > 1.645$.

c. The test statistic is $z = \dfrac{\bar{x}-\mu_o}{\sigma_{\bar{x}}} = \dfrac{99.6-85}{12.6/\sqrt{122}} = 12.80$

d. Since the observed value of the test statistic falls in the rejection region ($z = 12.80 > 1.645$), H_0 is rejected. There is sufficient evidence to indicate that the true mean Mach rating score of all purchasing managers is not 85 at $\alpha = .10$.

Problem 3: Sincich, 7.37

2nd edition (Sincich 6.27):

a. To determine if the process is not operating satisfactorily, we test:

H_0: $\mu = .250$
H_a: $\mu \neq .250$

b. Using MINITAB, the descriptive statistics are:

Descriptive Statistics: Tees

Variable	N	Mean	Median	TrMean	StDev	SE Mean
Tees	40	0.25248	0.25300	0.25256	0.00223	0.00035

Variable	Minimum	Maximum	Q1	Q3
Tees	0.24700	0.25600	0.25100	0.25400

The test statistic is $z = \dfrac{\bar{x} - \mu_0}{\sigma_{\bar{x}}} \approx \dfrac{.25248 - .250}{.00223/\sqrt{40}} = 7.03$

The rejection region requires $\alpha/2 = .01/2 = .005$ in each tail of the z-distribution. From Table IV, Appendix B, $z_{.005} = 2.575$. The rejection region is $z < -2.575$ or $z > 2.575$.

Since the observed value of the test statistic falls in the rejection region ($z = 7.03 > 2.575$), H_0 is rejected. There is sufficient information to indicate the process is performing in an unsatisfactory manner at $\alpha = .01$.

c. α is the probability of a Type I error. A Type I error, in this case, is to say the process is unsatisfactory when, in fact, it is satisfactory. The risk, then, is to the producer since he will be spending time and money to repair a process that is not in error.

β is the probability of a Type II error. A Type II error, in this case, is to say the process is satisfactory when it, in fact, is not. This is the consumer's risk since he could unknowingly purchase a defective product.

3rd edition (Sincich 7.37):

a. (above, part a)
b. sample mean = 0.25248, sample sd = 0.00223 (above, part b)
c. t = 7.03 (above, part b)
d. p is approximately 0 (p < .0001).
e. reject if $|t| > 2.575$ (above, part b)
f. yes (above, part b)
g. (above, part c)

Problem 4: Sincich 7.22

$$z = \frac{\bar{x} - \mu_0}{\sigma_{\bar{x}}} \approx \frac{49.4 - 50}{4.1/\sqrt{100}} = -1.46$$

p-value $= P(z \geq -1.46) = .5 + .4279 = .9279$

There is no evidence to reject H_0 for $\alpha \leq .10$.

Problem 5: Sincich, 7.54

a. To determine if the true mean breaking strength of the new bonding adhesive is less than 5.70 Mpa, we test:

H_0: $\mu = 5.70$
H_a: $\mu < 5.70$

b. The rejection region requires $\alpha = .01$ in the lower tail of the t-distribution with $\text{df} = n - 1 = 10 - 1 = 9$. From Table V, Appendix B, $t_{.01} = 2.821$. The rejection region is $t < -2.821$.

c. The test statistic is $t = \dfrac{\bar{x} - \mu_o}{s/\sqrt{n}} = \dfrac{5.07 - 5.70}{.46/\sqrt{10}} = -4.33$.

d. Since the observed value of the test statistic falls in the rejection region ($t = -4.33 < -2.821$), H_0 is rejected. There is sufficient evidence to indicate the true mean breaking strength of the new bonding adhesive is less than 5.70 Mpa at $\alpha = .01$.

e. We must assume that the sample was random and selected from a normal population.

Problem 6, Sincich 7.55 (a)-(e)

(a) H_0: $\mu = 2$; H_a: $\mu \neq 2$
(b) t = (xbar - 2) / (s / sqrt(20)) = -1.02
(c) Reject H0 if |t| > 2.093
(d) Do not reject H_0
(e) p = 0.322. If thhe true mean surface roughness were 2 micrometers and we repeated the experiment, then the chance of getting a test statistic at least as large of observed would be 32.2%.

Problem 7: Sincich, 7.61

To determine if the true mean crack intensity of the Mississippi highway exceeds the AASHTO recommended maximum, we test:

H_0: $\mu = .100$
H_a: $\mu > .100$

The test statistic is $t = \dfrac{\bar{x} - \mu_0}{s / \sqrt{n}} = \dfrac{.210 - .100}{\sqrt{.011} / \sqrt{8}} = 2.97$

The rejection region requires $\alpha = .01$ in the upper tail of the t-distribution with df $= n - 1 = 8 - 1 = 7$. From Table V, Appendix B, $t_{.01} = 2.998$. The rejection region is $t > 2.998$.

Since the observed value of the test statistic does not fall in the rejection region ($t = 2.97 \not> 2.998$), H_0 is not rejected. There is insufficient evidence to indicate that the true mean crack intensity of the Mississippi highway exceeds the AASHTO recommended maximum at $\alpha = .01$.