

## AP Review HW#15 Solution

1.

### Solution

#### **Part (a):**

A Type II error is the failure to reject the null hypothesis when it is false. For this study, a Type II error would be not concluding that the new cups insulate better on average than the traditional cups, when the new cups really do insulate better on average.

#### **Part (b):**

The probability of a Type II error and the probability of a Type I error (which is the significance level) are inversely related. As one of these probabilities is decreased, the other must necessarily increase. Thus, choosing a significance level of 0.10 would result in a smaller probability of Type II error because 0.10 is greater than 0.01.

#### **Part (c):**

The value of 0.88 represents the probability of correctly rejecting the null hypothesis and concluding that the true mean cooling time of the new cup is greater than that of the traditional cup, given that the true mean cooling time of the new cup is 2 minutes greater than that of the traditional cup. In other words, given that the mean cooling time of the new cup is actually 2 minutes greater than that of the traditional cup, if we were to apply the test on repeated samples of the same size, for about 88% of the samples we would expect to correctly reject the null hypothesis in favor of the alternative.

2.

### Solution

#### **Part (a):**

The sampling distribution of the sample mean  $\bar{X}$

1. is approximately normal
2. has mean  $\mu = 19,016$  pounds
3. has standard deviation  $\sigma/\sqrt{n} = 2324/\sqrt{40} = 367.46$  pounds.

#### **Part (b):**

$$P(\bar{x} > 19,168) = P\left(z > \frac{19,168 - 19,016}{367.46}\right) = P\left(z > \frac{152}{367.46}\right) = P(z > 0.41) = 0.34$$

#### **Part (c):**

The sampling method used in part (c) may not produce a sample that is representative of the population of trucks if the trucks leaving earlier in the day are heavier or lighter than usual. For example, it may be that trucks going out early in the day (the first trucks to leave the terminal) may carry lighter loads than the trucks leaving the terminal later in the day due to less loading time. In this case, the sampling method would provide data leading to a biased estimate of the population mean (in this case, a systematic underestimation of the population mean weight).