AP Statistics Activity 9.1B
Errors in Statistical Tests

Name _____
Per ___ Date _____

H_0: μ = specified level
H_a: μ < specified level

C 1. A company that produces paper towels continually monitors wet paper towel strength. If the mean strength from a sample drops below a specified level, the production process is halted, and the machinery inspected. Which of the following would result from a Type 1 error? H_0 True, Reject H_0
(a) Halting the production process when sufficient customer complaints are received. μ at level, but production halted
(b) Halting the production process when the wet towel strength is below specifications
(c) Halting the production process when the wet towel strength is within specifications
(d) Allowing the production process to continue when the wet towel strength is below specifications.
(e) Allowing the production process to continue when the wet towel strength is within specifications

a 2. A company will market a new hybrid luxury car only if they can sell it for more than $50,000 (otherwise, it will lose money). They do a random survey of 50 potential customers and run a hypothesis test with H_0: μ = 50,000 and H_a: μ > 50,000. What would be the consequences of Type 1 and Type 2 errors?
(a) Type 1 error: produce a non-profitable car; Type 2 error: fail to produce a profitable car.
(b) Type 1 error: fail to produce a profitable car; Type 2 error: produce a non-profitable car;
(c) Type 1 error: fail to produce a non-profitable car; Type 2 error: produce a profitable car
(d) Type 1 error: fail to produce a profitable car; Type 2 error: produce a profitable car
(e) Type 1 error: produce a non-profitable car; Type 2 error: fail to produce a non-profitable car

Don't produce profit. car

C or D

C TI: H_0 True, Reject H_0 produce non profit. car TII: H_a True, Fail to Reject H_0

C 3. A manufacturer of heart-lung machines periodically checks a sample of its product and performs and major recalibration if readings are sufficiently off target. Similarly, a rug factory periodically checks the sizes of its throw rugs coming off an assembly line and halts production if measurements are sufficiently off target. In both situations, we have the null hypothesis that the production equipment is performing satisfactorily. For each situation, which is the more serious concern, a Type 1 or Type 2 error?

I will also accept D for #3

H_0: pro. equip is satisfactory
H_a: below satisfactory

(a) Machine producer: Type 1, Carpet Manufacturer: Type 1
(b) Machine producer: Type 1, Carpet Manufacturer: Type 2
(c) Machine producer: Type 2, Carpet Manufacturer: Type 1
(d) Machine producer: Type 2, Carpet Manufacturer: Type 2
(e) This is impossible to answer without making an expected value judgement between human life and accurate throw rug sizes.

Machine: Type II H_A true, Fail to reject H_0

Carpet Type I: H_0 True, Reject H_0
Type II: H_a True, Fail to Reject H_0

C 4. An assembly line is supposed to turn out bowling balls with a diameter of 8.55 inches. Each day an SRS of five balls are pulled an measured. If their mean diameter is under 8.35 inches or over 8.75 inches, the machinery is stopped and an engineer is called to make adjustments before production is resumed. The quality control procedure may be viewed as a hypothesis test with H_0:μ=8.55 and H_a: $\mu \neq 8.55$. What would a type 2 error result in?
(a) A warranted halt in production to adjust the machinery
(b) An unnecessary stoppage of the production process
(c) Continued production of wrong size bowling balls
(d) Continued production of proper size bowling balls
(e) Continued production of bowling balls that randomly are the right or wrong size.

II: H_a true, fail to reject H_0
make wrong size bowling balls

b 5. When leaving for school on an overcast morning, you make a judgement on the null hypothesis: The weather will remain dry. What would the results be of Type 1 and Type 2 errors?
(a) Type 1: get drenched; Type 2: needlessly carry around an umbrella
(b) Type 1: needlessly carry around an umbrella; Type 2: get drenched
(c) Type 1: carry an umbrella, and it rains; Type 2: Carry no umbrella but the weather remains dry
(d) Type 1: get drenched; Type 2: Carry no umbrella but the weather remains dry
(e) Type 1: get drenched; Type 2: Carry an umbrella and it rains

H_0: Dry weather
H_a: not dry

TI: H_0 True Reject H_0
Carry umbrella needlessly

Type II: H_a True Fail to reject H_0
Dress for dry, but it rains

Exercise 19 refers to the following setting. Slow response times by paramedics, firefighters, and policemen can have serious consequences for accident victims. In the case of life-threatening injuries, victims generally need medical attention within 8 minutes of the accident. Several cities have begun to monitor emergency response times. In one such city, the mean response time to all accidents involving life-threatening injuries last year was $\mu = 6.7$ minutes. Emergency personnel arrived within 8 minutes after 78% of all calls involving life-threatening injuries last year. The city manager shares this information and encourages these first responders to "do better." At the end of the year, the city manager selects an SRS of 400 calls involving life-threatening injuries and examines the response times.

19. Awful accidents

(a) State hypotheses for a significance test to determine whether the average response time has decreased. Be sure to define the parameter of interest.

(b) Describe a Type I error and a Type II error in this setting, and explain the consequences of each.

(c) Which is more serious in this setting: a Type I error or a Type II error? Justify your answer.

a) $H_0: \mu = 6.7$ μ = the true mean response time for all accidents involving life threatening accidents in this city.
$H_a: \mu < 6.7$

b) Type I: H_0 true, reject H_0. City thinks response time has improved, but it really hasn't. Consequence is city stops trying to improve response time, more people die.

Type II: H_a true, fail to reject H_0. City thinks response time has not improved even though it has. Consequence spent more time and money trying to improve time.

c) Type I, the reason is given in part b.

21. Opening a restaurant You are thinking about opening a restaurant and are searching for a good location. From research you have done, you know that the mean income of those living near the restaurant must be over $85,000 to support the type of upscale restaurant you wish to open. You decide to take a simple random sample of 50 people living near one potential location. Based on the mean income of this sample, you will decide whether to open a restaurant there.[8]

(a) State appropriate null and alternative hypotheses. Be sure to define your parameter.

(b) Describe a Type I and a Type II error, and explain the consequences of each.

(c) If you had to choose one of the "standard" significance levels for your significance test, would you choose $\alpha = 0.01$, 0.05, or 0.10? Justify your choice.

a) $H_0: \mu = \$85,000$ μ = the true mean income of residents near the restaurant.
$H_a: \mu > \$85,000$

b) Type I: H_0 true, reject H_0. You believe residents make more than $85,000 when they don't. A consequence is you open the restaurant when residents can't afford to support it.

Type II: H_a true, fail to Reject H_0. You don't think residents make more than $85,000 when they do. Consequence is you don't open restaurant here.

c) Type I error worse than type II, so you want α as low as possible since $P(\text{Type I}) = \alpha$. So $\alpha = .01$