2. When a law firm represents a group of people in a class action lawsuit and wins that lawsuit, the firm receives a percentage of the group's monetary settlement. That settlement amount is based on the total number of people in the group—the larger the group and the larger the settlement, the more money the firm will receive.

   A law firm is trying to decide whether to represent car owners in a class action lawsuit against the manufacturer of a certain make and model for a particular defect. If 5 percent or less of the cars of this make and model have the defect, the firm will not recover its expenses. Therefore, the firm will handle the lawsuit only if it is convinced that more than 5 percent of cars of this make and model have the defect. The firm plans to take a random sample of 1,000 people who bought this car and ask them if they experienced this defect in their cars.

   (a) Define the parameter of interest and state the null and alternative hypotheses that the law firm should test.

   (b) In the context of this situation, describe Type I and Type II errors and describe the consequences of each of these for the law firm.

3. Men's shirt sizes are determined by their neck sizes. Suppose that men's neck sizes are approximately normally distributed with mean 15.7 inches and standard deviation 0.7 inch. A retailer sells men's shirts in sizes S, M, L, XL, where the shirt sizes are defined in the table below.

Shirt size	Neck size
S	$14 \leq$ neck size < 15
M	$15 \leq$ neck size < 16
L	$16 \leq$ neck size < 17
XL	$17 \leq$ neck size < 18

   (a) Because the retailer only stocks the sizes listed above, what proportion of customers will find that the retailer does not carry any shirts in their sizes? Show your work.

   (b) Using a sketch of a normal curve, illustrate the proportion of men whose shirt size is M. Calculate this proportion.

   (c) Of 12 randomly selected customers, what is the probability that exactly 4 will request size M ? Show your work.

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Question 2

Solution

Part (a):

p, θ, or π = proportion of all cars of the specified make and model that have the defect.

H_o: $p = 0.05$ OR $p \leq 0.05$
H_a: $p > 0.05$

Part (b):

Definition

Type I error: The law firm believes that the proportion of cars that have the defect is greater than 0.05, when in fact it is not.

Type II error: The law firm is not convinced that the proportion of cars that have the defect is greater than 0.05, when in fact it is.

Consequence

Type I error:
The firm will not recover its expenses, resulting in a loss to the firm.

Type II error:
The firm will miss an opportunity to make money on this case.

OR

Definition and Consequence

Type I error:

The firm will take the case when they should not have. The firm will not recover its expenses, resulting in a loss to the firm.

AND

Type II error:

The firm will refuse to handle the suit when it really should have. The firm will miss an opportunity to make money on this case.

Question 2 (cont'd)

Scoring

This problem is scored in three components. Part (a) is one component and part (b) is broken into two components for scoring purposes. Each component is then scored as either essentially correct (E), partially correct (P), or incorrect (I).

Component 1 (part a) is essentially correct (E) if it
1. correctly defines the parameter of interest AND
2. gives correct null and alternative hypotheses.

Component 1 is partially correct (P) if only one of the two elements above is present.

Component 2 (from part b) is essentially correct (E) if
1. correctly defines type I and type II errors for the stated hypotheses in part (a) AND
2. the definition of the two types of errors is in the context of the problem and consistent with the hypotheses given in part (a).

Component 2 is partially correct (P) if
The definitions of type I and type II errors are correct but not in context.
OR
The definitions are in context, but type I and type II errors are reversed.
OR
The definition of only one error is given correctly and in context.

Component 3 (from part b) is essentially correct (E) if
1. it discusses the consequences of each type of error AND
2. the discussion of consequences is consistent with the definition of type I and type II errors given in component 2.

Component 3 is partially correct (P) if
The consequences of only one type of error are discussed correctly.

OR
The student identifies consequences of two types of error, but the consequences are associated with the wrong type of error (given the definitions of type I and type II errors in component 2).
OR
The student correctly identifies for both errors that they take the case or that they do not take the case, but does not give economic consequences.

Question 2 (cont'd)

4 Complete Response (3E)

All three components essentially correct

3 Substantial Response (2E 1P)

Two components essentially correct and 1 component partially correct

2 Developing Response (2E 0P or 1E 2P or 3P)

Two components essentially correct and no components partially correct
OR
One component essentially correct and 2 components partially correct
OR
Three components partially correct

1 Minimal Response (1E 1P or 1E 0P or 0E 2P)

One component essentially correct and either 0 or 1 components partially correct
OR
No components essentially correct and 2 components partially correct