Question

Three growing methods were studied to evaluate which one is more effective for growing grass. Five varieties of grass seeds were randomly selected from a large population of varieties. Each method was applied to each of the varieties. Dry yield is measured at the end of the season. What type of effect is **Variety**?

- *a.* fixed
- *b.* random
- *c.* There is not enough information to determine the type.

Correct.
Variety is random because a random sample of varieties was selected from a large population, and the inference about methods applies to the entire population.

Question

A health-care provider wants to study the variation of the cost of a medical procedure in two types of U.S. health-care facilities (clinics or hospitals). The three factors of interest are **State**, **City**, and **Type**. The levels of the variables are selected for the study as follows:

- Five states are randomly selected within the U.S.
- Four cities are randomly selected within each state.
- Three of each type of facility (hospital or clinic) are selected within each city.

Which of the following statements about this study is true?

- *a.* **State** and **City** are both random effects and **Type** is a fixed effect.
- *b.* **State** is a random effect and **City** and **Type** are both fixed effects.
- *c.* **State**, **City**, and **Type** are all random effects.
- *d.* **State**, **City**, and **Type** are all fixed effects.

Correct.
State and **City** are both random effects because a sample of states and cities are randomly selected for the study from a large population within the U.S. **Type** is a fixed effect because three clinics and three

hospitals within each city are selected deliberately to evaluate the differences between only those types of facilities.

Question

Which of the following is **true** about linear mixed models and PROC GLIMMIX?

- *a.* Linear mixed models are a special case of general linear models that you fit using PROC GLM, PROC GLMSELECT, or PROC REG.
- *b.* Linear mixed models can handle normal and nonnormal responses.
- *c.* PROC GLIMMIX has a RANDOM statement to model random effects.
- *d.* PROC GLIMMIX can be used only to model random effects, and should not be used to model repeated measures data.

Correct.
PROC GLIMMIX has a RANDOM statement to model random effects. The other statements are false.

Question

To evaluate the productivity of two machines, five operators are chosen to operate on the machines. Each operator operates on each of the two machines three times. What type of classification is used for the factors **Operator** and **Machine**?

- *a.* crossed
- *b.* nested
- *c.* There is not enough information to determine the type of classification.

Correct.
The two factors are crossed because each operator can operate on each machine.

Question

If five operators are selected for each machine, and each operator operates only the assigned machine, are the operators nested within machines?

- *a.* yes
- *b.* no

Correct.
Operators are nested within machines because each operator can operate on only one machine.

Question

Five lots are chosen for a study. Four wafers are selected from each lot. The thickness of dioxide layers is measured from each wafer. What type of data classification is used?

- *a.* Wafers are crossed with lots.
- *b.* Wafers are nested within lots.
- *c.* There is not enough information to determine the type of classification.

Correct.
Wafers were selected from a particular lot, so wafers are nested within lots.

Question

Incorrectly specifying a random effect as a fixed effect can affect the inference about the treatment effects.

- *a.* true
- *b.* false

Correct.
This statement is true. Inferences about fixed effects pertain only to the levels that are involved in the study, and cannot be extended to other levels. Treating fixed effects as random allows for generalization. Therefore, incorrectly specifying a random effect as fixed can lead to different results.