

**Question 1 – 5** are based on the following. A consumer product agency wants to evaluate the accuracy of determining the level of calcium in a food supplement. There are a large number of possible testing laboratories and a large number of chemical assays for calcium. The agency randomly selects three labs and three assays for use in the study. Each lab will use all three assays in the study. Eighteen samples containing 10 mg of calcium are prepared and each assay-lab combination is randomly assigned to two samples.

1) 2 points – What is the experimental unit for this experiment?

- (a) Lab      (b) Chemical assay   (c) Sample      (d) level of calcium      (e) assay-lab combination

2) 2 points – What is the sampling unit for this experiment?

- (a) Lab      (b) Chemical assay   (c) Sample      (d) level of calcium      (e) assay-lab combination

3) 2 points – Does it seem more likely that the treatments are fixed or random?

- (a) Fixed      (b) Random

4) 2 points – What is the treatment arrangement for this experiment?

- (a) single factor      (b) factorial      (c) nested

5) 2 points – What is the experimental design for this experiment?

- (a) CRD      (b) RBD      (c) LSD      (d) Split-plot      (e) Repeated Measures

**Question 6 – 12** are based on the following. Soybean looper, *Chrysodeixis includens*, is one of the most destructive pests of soybean in the southern U.S. Induced host plant resistance has been extolled as an alternative tactic of insecticides to control this pest. In this study, three different known Systemic Acquired Resistance (SAR) chemicals, Actigard50WG (acibenzolar-S-methyl), Regalia (extract of *Reynoutria sachalinensis*) and MeJA(methyl jasmonate), together with a control group were applied to soybean plants at full flowering stage to determine if these chemicals could induce plant resistance and lower soybean looper fitness. The experiment was replicated in three plots with four rows per plot that were randomly assigned one of the four treatments. The variable of interest is the percent defoliation of the soybean leaf per row.

6) 2 points – What is the treatment arrangement for this experiment?

- (a) single factor      (b) factorial      (c) nested

7) 2 points – What is the experimental design for this experiment?

- (a) CRD      (b) RBD      (c) LSD      (d) Split-plot      (e) Repeated Measures

8) 2 points – What is the experimental unit for this experiment?

- (a) soybean leaf      (b) row      (c) soybean looper      (d) plot      (e) SAR chemicals

9) 2 points –What is the sampling unit for this experiment?

- (a) soybean leaf      (b) row      (c) soybean looper      (d) plot      (e) SAR chemicals

- 10) 2 points –If the design is RBD, what are the blocks?  
(a) soybean leaf chemicals (b) row (c) soybean looper (d) plot (e) SAR  
(f) NA

11) 2 points –The treatment degree of freedom is \_\_\_\_\_.

12) 2 points –The degree of freedom for the error used for testing treatments is \_\_\_\_\_.

**Question 13 – 20** are based on the following. As a Science Fair project, students sampled drinking fountains for bacterial growth. Three types of fountains were sampled, metal drinking fountains, ceramic drinking fountains and metal drinking fountains with built in cooling units. Sixty fountains were located for the study, 20 of each type. All fountains were washed and sterilized two weeks before the study. After the two weeks each fountain was swabbed for bacteria and each sample incubated in two culture plates (i.e. in total 120 plates). The dependent variable was the number of bacterial colonies on each culture plate. The students would like to know if there are differences between the three types of fountains.

- 13) 2 points – What is the experimental unit for this experiment?  
(a) colonies (b) fountain type (c) culture plate (d) a fountain (e) two weeks

- 14) 2 points – What is the sampling unit for this experiment?  
(a) colonies (b) fountain type (c) culture plate (d) a fountain (e) two weeks

- 15) 2 points – What is the treatment arrangement for this experiment?  
(a) single factor (b) factorial (c) nested

- 16) 2 points – What is the experimental design for this experiment?  
(a) CRD (b) RBD (c) LSD (d) Split-plot (e) Repeated Measures

- 17) 2 points – What is the treatment variable for this experiment?  
(a) colonies (b) fountain type (c) culture plate (d) a fountain (e) two weeks

- 18) 2 points –If the design is RBD, what are the blocks?  
(a) colonies (b) fountain type (c) culture plate (d) a fountain (e) two weeks  
(f) NA

19) 2 points –The treatment degree of freedom is \_\_\_\_\_.

20) 2 points –The degree of freedom for the error used for testing treatments is \_\_\_\_\_.

**Question 21:** Classify as fixed or random effect for the following seven examples.

1. The purpose of the experiment is to compare the effects of three specific dosages of a drug on response.
2. A textile mill has a large number of looms. Each loom is supposed to provide the same output of cloth per minute. To check whether this is the case, five looms are chosen at random and their output is noted at different times.
3. A manufacturer suspects that the batches of raw material furnished by his supplier differ significantly in zinc content. Five batches are randomly selected from the warehouse and the zinc content of each is measured.
4. Four different methods for mixing Portland cement are economical for a company to use. The company wishes to determine if there are any differences in tensile strength of the cement produced by the different mixing methods.
5. Compare reading ability of ten particular 2nd grade classes in NY.
6. Compare variability among all 2nd grade classes in NY by randomly selecting ten classes.
7. A supplier delivers several hundred batches of raw material to a company each year. The company is interested in a high yield from each batch of raw material (percent usable). Therefore, to investigate the consistency of this supplier, an experiment is done where five batches were selected at random and three yield determinations were made on each batch.

**Question 22 – 26** are based on the following. Grains or crystals adversely affect the sensory qualities of foods using dried fruit pulp. A study was conducted to determine the factors affect graininess. The factors were drying temperature (three levels), acidity (pH) of pulp (two levels), and sugar content (two levels). The experiment has two replications, with each replication using a different batch of pulp. Response is a measure of graininess.

- 22) 2 points – What is the experimental unit for this experiment?  
(a) acidity of pulp    (b) drying temperature    (c) sugar content    (d) batch    (e) graininess
- 23) 2 points – What is the sampling unit for this experiment?  
(a) acidity of pulp    (b) drying temperature    (c) sugar content    (d) batch    (e) graininess
- 24) 2 points – What is the treatment arrangement for this experiment?  
(a) single factor    (b) factorial    (c) nested
- 25) 2 points – What is the experimental design for this experiment?  
(a) CRD    (b) RBD    (c) LSD    (d) Split-plot    (e) Repeated Measures
- 26) 2 points – What is the treatment variable for this experiment?  
(a) acidity of pulp    (b) drying temperature    (c) sugar content    (d) batch    (e) graininess