

General Scenario Questions

Q.1. For each of the following scenarios, give the Analysis of Variance Table, with sources of variation, degrees of freedom, and whether the Factor (main effect or interaction) is fixed or random.

p.1.a. A construction company is interested in comparing 3 mixes of concrete (these are the only mixes of interest). They are also interested in 4 types of steel (only types of interest). They create 12 batches of each mix, and split each into 4 sub-batches, assigning them so that each sub-batch is assigned to exactly one steel type. After the concrete hardens, they measure the sturdiness of the concrete/steel structure.

p.1.b. A study is conducted to measure intra- and inter- observer reliability with respect to hip rotation in cricket bowlers. A sample of 10 bowlers is obtained, and a sample of 5 judges is obtained. Each judge gives numeric ratings of each bowler, with 3 viewings/ratings of the bowler (all viewings are in random order, and bowler is not identified in video). Note: the viewings can be thought of as replicates.

p.1.c. A study had 9 wine judges taste 6 randomly selected Ribiero wine varieties in 9 wineglasses of various shapes. Each judge tasted each wine in each glass once.

p.1.d. An experiment was conducted to measure the effect of aircraft noise on subjects. There were 18 males and 18 females, 6 of each being assigned to the number of occurrences of aircraft taking off in a 27 minute interval (3, 9, or 27). Each subject heard 3 aircraft types (A322, B737, and MD80) in different sessions. Regular background noise was played during remainder of each 27 minute session. Noise assessment scales were measured for each student/session.

Q.2. For the following scenarios, give the Sources of Variation, degrees of freedom, and appropriate error term for its corresponding F-test.

p.2.a. An experiment involves a taste comparison among the only 4 varieties of red wines produced by a family vineyard. A sample of 10 wine tasters from the city's wine tasting association is obtained. Each rater tastes each variety 5 times (blind, and in random order).

Source	df	Error Mean Square Term
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p.2.b. A textile company has 5 manufacturing plants. Within each plant there are many machine operators, and they sample 4 from each plant. There are 3 models of sewing machines used at the plants (the models are used at all plants, and each operator is trained for each machine). Each operator in the study makes 2 production runs on each machine, and the quality of each product is measured.

Source	df	Error Mean Square Term
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Q.3. For the following scenarios, write out the statistical model in terms of parameters and random effects, define factors as fixed or random, and fill in a skeleton ANOVA table (sources of variation and degrees of freedom).

p.3.a. An experiment is conducted to measure mercury levels in fish from lakes within a state. A sample of **12 lakes** from the state is selected. Within each lake, a sample of **15 locations** is obtained. For each location, **10 fish** are sampled and measured.

p.3.b. The effects of **4 different colors of paper** are to be compared. There are **4 different tasks** to be completed, and there are **20 subjects** in the study. Each subject completes each task once, and each color of paper once. Each task is assigned to each color the same number of times and vice versa. The colors and tasks are of specific interest to the researchers.

p.3.c. An experiment is conducted to compare **3 methods of teaching foreign language** to 5th graders in a large city. The **4 school districts** each sample **8 schools**, and within each school, **6 sections** of 5th graders are selected and randomly assigned so that 2 sections get Method 1, 2 sections get method 2, and 2 sections get method 3. The response is the mean proficiency score for the section.