Practice identifying analysis of variance situations. For each situation, specify the factors, how many levels they have, if they are fixed or random, and whether they are crossed with or nested within the other factors.

1. Three methods for treating migraine headaches are to be compared. Ninety persistent migraine sufferers are recruited for the study and 30 are randomly assigned to each of the three methods. Response is a measure of decrease in pain intensity.

2. A study is done to determine whether two issues affect test performance for students. The first issue is whether or not there is time pressure to finish. The second issue is whether the student takes the test in the same classroom as where the class has been held, or in an unfamiliar classroom. Students from a large class are randomly assigned to one of these four conditions, and performance on the test is the response variable.

3. A company has a national chain of hundreds of weight loss clinics, which offer a combination of diet and exercise programs. They have two diet plans and three exercise programs, and want to know what works best. They randomly select 10 of their clubs to participate in an experiment. Within each club they recruit 120 volunteers, and randomly assign 20 of them to each diet x exercise combination. The response variable is amount of weight lost over a 10 week period.

4. A company wants to compare three types of computer keyboards to see which type to buy. They randomly choose 10 employees whose main job is to type. They have each of the 10 employees try each keyboard for a day, with the order randomly assigned. The response is a measure of productivity for that day.

5. Same as #4, except now the company wants to know if there is a difference between males and females, given that males tend to have bigger hands than females do. Therefore, they randomly choose 10 males and 10 females, and have each of these 20 employees try each keyboard for a day.

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1. Three methods for treating migraine headaches are to be compared. Ninety persistent migraine sufferers are recruited for the study and 30 are randomly assigned to each of the three methods. Response is a measure of decrease in pain intensity.
There is only one factor, fixed, with 3 levels (the 3 methods).

2. A study is done to determine whether two issues affect test performance for students. The first issue is whether or not there is time pressure to finish. The second issue is whether the student takes the test in the same classroom as where the class has been held, or in an unfamiliar classroom. Students from a large class are randomly assigned to one of these four conditions, and performance on the test is the response variable.
There are two factors:
Time pressure to finish – yes or no, fixed, 2 levels
Familiar classroom – yes or no, fixed, 2 levels
The factors are crossed.

3. A company has a national chain of hundreds of weight loss clinics, which offer a combination of diet and exercise programs. They have two diet plans and three exercise programs, and want to know what works best. They randomly select 10 of their clubs to participate in an experiment. Within each club they recruit 120 volunteers, and randomly assign 20 of them to each diet x exercise combination. The response variable is amount of weight lost over a 10 week period.
There are 3 factors:
Diet plan, fixed, 2 levels
Exercise plan, fixed, 3 levels
Club, random, 10 levels
The factors are all crossed with each other.

4. A company wants to compare three types of computer keyboards to see which type to buy. They randomly choose 10 employees whose main job is to type. They have each of the 10 employees try each keyboard for a day, with the order randomly assigned. The response is a measure of productivity for that day.
This is a repeated measures design, specifically it's a randomized block design. There are 2 factors:
Keyboard type, fixed, 3 levels
Employee, random, 10 levels
The factors are crossed because the same employees try all 3 keyboards. (But the interaction cannot be included in the model, because there is only one measurement for each keyboard-employee combination.)

5. Same as #4, except now the company wants to know if there is a difference between males and females, given that males tend to have bigger hands than females do. Therefore, they randomly choose 10 males and 10 females, and have each of these 20 employees try each keyboard for a day.
There are now 3 factors:
Keyboard type, fixed, 3 levels
Sex, fixed, 2 levels
Employee, random, 10 levels, but levels are nested under the Sex factor.
So, keyboard type and sex are crossed, keyboard type and employee are crossed, but sex and employee are not crossed – each employee is under one level of sex only. There cannot be an employee by sex interaction because of the nesting, or an employee by keyboard interaction because there is only one observation per employee × keyboard type.