

Week 4 quiz

Started: Feb 2 at 12:48pm

Quiz Instructions

This quiz will cover the asynchronous content from the [Week 4 module](#). It is due Wednesday, Feb 03 at 10:00 a.m. ET.

There is at least one question relevant to each of the readings for this week:

- [Chapter 2](https://bookdown.org/roback/bookdown-BeyondMLR/ch-beyondmost.html) (<https://bookdown.org/roback/bookdown-BeyondMLR/ch-beyondmost.html>) (§ 2.1–2.9, use your previewing and skimming strategies) and [Chapter 7](https://bookdown.org/roback/bookdown-BeyondMLR/ch-corrdata.html) (<https://bookdown.org/roback/bookdown-BeyondMLR/ch-corrdata.html>) (§ 7.3 and 7.8) of Roback, P. & Legler, J. *Beyond Multiple Linear Regression*. (2021). Retrieved from: <https://bookdown.org/roback/bookdown-BeyondMLR/> (<https://bookdown.org/roback/bookdown-BeyondMLR/>)
- Tip: you may like to read over the exercises for Chapter 7 beforehand, also.

Notes

- I suggest you use Chrome or Firefox to access this quiz. I use Chrome to write and check the quizzes.
 - Additionally, make sure your browser is up to date as out-of-date versions also cause issues.
 - **Possible 'hack' if images don't load:** Sometimes, right-clicking the image that is failing to load, and opening it in a new tab or downloading it, will let you see the image.
- This quiz is **open book**, so you are welcome to review the notes while completing it.
- From the time you start, you will have either **1 hour** to complete the quiz or 10:00 a.m. ET on Wednesday, whichever comes first. You *cannot* pause the quiz once you start it.
- The quiz will **auto-submit** any answers at the deadline.
- You have **one** attempt.
- You do not have to use RStudio while doing this quiz, but you are allowed to if you would like to.

Below is the description of the *Nurse stress study* from Section 7.10 of *Beyond Multiple Linear Regression*. Link: <https://bookdown.org/roback/bookdown-BeyondMLR/ch-corrdata.html#exercises-6>.
(<https://bookdown.org/roback/bookdown-BeyondMLR/ch-corrdata.html#exercises-6>)

"Nurse stress study. Four wards were randomly selected at each of 25 hospitals and randomly assigned to offer a stress reduction program for nurses on the ward or to serve as a control. At the conclusion of the study

period, a random sample of 10 nurses from each ward completed a test to measure job-related stress. Factors assumed to be related include nurse experience, age, hospital size and type of ward."

Questions 1 and 4 refer to this study.

Question 1

1 pts

What are the (level-one) **observational units** in the *nurse stress study*?

- ☐ Before and after tests for each nurse
- ☒ Nurses
- ☐ Wards
- ☐ Hospitals

Question 2

1 pts

Which ONE of the following best describes the **grouping units** in the *nurse stress study*?

- ☐ Nurses, whom are then grouped within wards.
- ☒ Nurses are grouped by receiving the stress reduction training or not (the control).
- ☐ Wards which are then grouped within hospitals.
- ☐ Hospitals.

Question 3**1 pts**

Suppose the variables we have in the *nurse stress study* are:

- hospital ID,
- ward ID (unique to each ward, across hospitals),
- nurse experience,
- nurse age,
- hospital size,
- type of ward,
- if the nurse received stress reduction training or not, and
- stress score (numeric scale).

Which variables should be included in the model as **fixed effects, random effects and the response**? Match each variable to its type below.

hospital ID

Random effect



ward ID

Random effect



nurse experience

Random effect



nurse age

Random effect



hospital size

Random effect



type of ward

Random effect

if the nurse received stress reduction
training or not

Fixed effect



stress score

Response



Question 4**1 pts**

Which ONE of the following designs best describes the *nurse stress study*?

- ☐ None of these.
- ☐ Crossed effect with every nurse experiencing every ward and hospital.
- ☒ Fully nested with one level of grouping.
- ☐ Fully nested with three levels of observational/grouping units.

Student well-being study

Suppose a random sample of U of T students were selected to take part in a well-being study. They were each given a gratitude journal and basic training in meditation before the start of the semester. Then, during the semester they were assigned to:

- write in a gratitude journal for 3 weeks (J),
- do 40 minutes of meditation for 3 weeks (M),
- do BOTH gratitude journaling and 40 minutes of mediation for 3 weeks (JM), and
- *not* write in the gratitude journal nor do meditation for 3 weeks (C).

100 students participated and the order of which weeks the students did which task was randomly assigned, i.e., there was no pattern, they weren't in the order of the bullet points above. In a 12 week semester, one student's order was: J, J, C, M, JM, C, J, JM, M, C, JM, M.

Each week, each student was asked to rate their sense of well-being at the end of the week. The goal was to understand if any of these practices improved student well-being. This study had a balanced design.

Questions 5, 6, 7 and 8 refer to this study.

Question 5**1 pts**

Assume the data for the *student well-being study* is tidy, meaning each row represents an observational unit. How many rows will this dataset have?

Question 6

1 pts

Which ONE of the following would be an appropriate description of the *student well-being study*?

- ☒ Crossed-effect design with repeated measures on students.
- ☐ Observations are fully nested within student and treatment level.
- ☐ There are no grouping units in this design.
- ☐ There are four levels of grouping units, one for each well-being treatment level.

Question 7

1 pts

What would be an appropriate model for the *student well-being study*?

- ☐ $y_i = \beta_0 + \beta_1 \text{journal}_i + \beta_2 \text{meditate}_i + \epsilon_i$ where $\epsilon_i \sim N(0, \sigma^2)$
- ☐ $y_{ij} = \beta_0 + \beta_1 \text{journal}_i + \beta_2 \text{meditate}_i + \beta_3 \text{student}_j + \epsilon_{ij}$
where $\epsilon_{ij} \sim N(0, \sigma^2)$ and $\beta_3 \sim N(0, \sigma_\beta^2)$
- ☒ $y_{ij} = \alpha_i + b_j + \epsilon_{ij}$, where $b_j \sim N(0, \sigma_b^2)$ and $\epsilon_{ij} \sim N(0, \sigma^2)$
- ☐ $y_{ij} = \alpha_i + b_j + \epsilon_{ij}$, where $\alpha_i \sim N(0, \sigma_\alpha^2)$, $b_j \sim N(0, \sigma_b^2)$ and $\epsilon_{ij} \sim N(0, \sigma^2)$

Question 8

1 pts

Suppose you fit the following models for the *student well-being study*.

```
well_int <- lm(wellbeing ~ treatment*student, data = study)
```

```
well_main <- lm(wellbeing ~ treatment + student, data = study)
```

Suppose you want to estimate how much variation in well-being scores is explained by the interaction between **student** and **treatment**. Which ONE of the following would be the correct calculation?

- ☐ `summary(well_int)$sigma^2`
- ☐ `summary(well_int)$sigma^2) / (1200 - 99 - 4 +1)`
- ☐ `summary(well_main)$sigma^2 - (summary(well_int)$sigma^2) / 3`
- ☒ `summary(well_main)$sigma^2 - (summary(well_int)$sigma^2) / 4`

Question 9

1 pts

Which ONE of the following correctly describes what an interaction between a fixed effect and a random effect is?

- ☐ Depends on the context of the data.
- ☐ A fixed quantity.
- ☐ A variable dependant on the error term.
- ☒ A random variable.
- ☐ A dummy variable.

Question 10

1 pts

This question is based on what is covered in Chapter 2 of *Beyond Multiple Linear Regression*. Link: <https://bookdown.org/roback/bookdown-BeyondMLR/ch-beyondmost.html#learning-objectives-1>.

(<https://bookdown.org/roback/bookdown-BeyondMLR/ch-beyondmost.html#learning-objectives-1>)

Which ONE of the following best describes when it is appropriate to use a Likelihood Ratio Test?

- ☒ To compare two models where one is nested in the other.
- ☐ To compare two models that are not nested in each other.
- ☐ Comparing any models fit with likelihood methods.
- ☐ In any situation you'd use ANOVA, but want a lower type II error rate.

Quiz saved at 2:07am

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