Rubric-homework 4

Write your name here

12 May, 2022

1. **(0.5 points)**

```
full <- memory %>%
  group_by(task, word_frequency) %>%
  summarise("pred" = mean(recalled))
```

ANS: The average number of correctly recalled words by combination of the task and word frequency factors was:

Task	Word Frequency	Mean	Points
Free recall	High	12.76	**0.125 pts**
Free recall	Low	9.92	**0.125 pts**
Recognition	High	9.56	**0.125 pts**
Recognition	Low	14.72	**0.125 pts**

2. **(0.5 points)**

```
task <- memory %>%
  group_by(task) %>%
  summarise("mean" = mean(recalled))
```

ANS: The average number fo correctly recalled words by task was:

Task	Mean	Points
Free recall	11.34	**0.25 pts**
Recognition	12.14	**0.25 pts**

3. **(0.5 points)**

```
wf <- memory %>%
  group_by(word_frequency) %>%
  summarise("mean" = mean(recalled))
```

ANS: The average number fo correctly recalled words by word frequency was:

Word Frequency	Mean	Points
High	11.16	**0.25 pts**
Low	12.32	**0.25 pts**

4. **(0.5 points)**

```
grand_mean <- memory %>%
  summarise("mean" = mean(recalled)) %>%
```

```
  pull(mean)
```

ANS: The average number of correctly recalled words was **11.74**

5. **(0.5 points)**

```
alpha <- task$mean - grand_mean
```

ANS: The main effect of the free recall task was **-0.4**, the main effect of the recognition task was **0.4**

6. **(0.5 points)**

```
beta <- wf$mean - grand_mean
```

ANS: The main effect for high frequency words was **-0.58**, the main effect of low frequency words was **0.58**

7. **(0.5 points)**

```
memory <- memory %>%
  mutate("prediction_null" = grand_mean,
         "error_null" = (recalled - prediction_null)^2)
```

8. **(0.5 points)**

```
memory <- memory %>%
  mutate("prediction_task" = case_when(task == "free_recall" ~ grand_mean + alpha[1],
                                       task == "recognition" ~ grand_mean + alpha[2]),
         "error_task" = (recalled - prediction_task)^2)
```

ANS: The predictions of the task main effects model by combination of the factor levels are:

Task	Word Frequency	Mean	Points
Free recall	High	11.34	**0.125 pts**
Free recall	Low	11.34	**0.125 pts**
Recognition	High	12.14	**0.125 pts**
Recognition	Low	12.14	**0.125 pts**

9. **(0.5 points)**

```
memory <- memory %>%
  mutate("prediction_wf" = case_when(word_frequency == "high" ~ grand_mean + beta[1],
                                     word_frequency == "low" ~ grand_mean + beta[2]),
         "error_wf" = (recalled - prediction_wf)^2)
```

ANS: The predictions of the word frequency main effects model by combination of the factor levels are:

Task	Word Frequency	Mean	Points
Free recall	High	11.16	**0.125 pts**
Free recall	Low	12.32	**0.125 pts**
Recognition	High	11.16	**0.125 pts**
Recognition	Low	12.32	**0.125 pts**

10. **(0.5 points)**

```
memory <- memory %>%
  mutate("prediction_add" = case_when(
    task == "free_recall" & word_frequency == "high" ~ grand_mean + alpha[1] + beta[1],
```

```
    task == "free_recall" & word_frequency == "low" ~ grand_mean + alpha[1] + beta[2],
    task == "recognition" & word_frequency == "high" ~ grand_mean + alpha[2] + beta[1],
    task == "recognition" & word_frequency == "low" ~ grand_mean + alpha[2] + beta[2]
  ),
  "error_add" = (recalled - prediction_add)^2)
```

ANS: The predictions of the additive model by combination of the factor levels are:

Task	Word Frequency	Mean	Points
Free recall	High	10.76	**0.125 pts**
Free recall	Low	11.92	**0.125 pts**
Recognition	High	11.56	**0.125 pts**
Recognition	Low	12.72	**0.125 pts**

11. **(0.5 points)**

```
memory <- memory %>%
  mutate("prediction_full" = case_when(
    task == "free_recall" & word_frequency == "high" ~ full$pred[1],
    task == "free_recall" & word_frequency == "low" ~ full$pred[2],
    task == "recognition" & word_frequency == "high" ~ full$pred[3],
    task == "recognition" & word_frequency == "low" ~ full$pred[4]),
  "error_full" = (recalled - prediction_full)^2)
```

ANS: The predictions of the full model are:

Task	Word Frequency	Mean	Points
Free recall	High	12.76	**0.125 pts**
Free recall	Low	9.92	**0.125 pts**
Recognition	High	9.56	**0.125 pts**
Recognition	Low	14.72	**0.125 pts**

12. **(0.5 points)**

```
sse_null <- sum(memory$error_null)
sse_task <- sum(memory$error_task)
sse_wf <- sum(memory$error_wf)
sse_add <- sum(memory$error_add)
sse_full <- sum(memory$error_full)
```

ANS: The SSE by model are:

Model	SSE	Points
Null	819.24	**0.1 pts**
Me Task	803.24	**0.1 pts**
Me Word Frequency	785.6	**0.1 pts**
Additive	769.6	**0.1 pts**
Full	369.6	**0.1 pts**

13. **(0.5 points)**

```
n_total <- nrow(memory)
mse_null <- 1/n_total * sum(memory$error_null)
mse_task <- 1/n_total * sum(memory$error_task)
mse_wf <- 1/n_total * sum(memory$error_wf)
mse_add <- 1/n_total * sum(memory$error_add)
mse_full <- 1/n_total * sum(memory$error_full)
```

ANS: The SSE's by model are:

Model	MSE	Points
Null	8.19	**0.1 pts**
Me Task	8.03	**0.1 pts**
Me Word Frequency	7.86	**0.1 pts**
Additive	7.7	**0.1 pts**
Full	3.7	**0.1 pts**

14. **(1 point)**

```
bic_null <- n_total * log(mse_null) + 1 * log(n_total)
bic_task <- n_total * log(mse_task) + 2 * log(n_total)
bic_wf <- n_total * log(mse_wf) + 2 * log(n_total)
bic_add <- n_total * log(mse_add) + 3 * log(n_total)
bic_full <- n_total * log(mse_full) + 4 * log(n_total)
```

ANS: The BIC of each model is:

Model	BIC	Points
Null	214.93	**0.2 pts**
Me Task	217.56	**0.2 pts**
Me Word Frequency	215.34	**0.2 pts**
Additive	217.89	**0.2 pts**
Full	149.15	**0.2 pts**

15. **(1 point)**

ANS: The model with the lowest BIC was the Full model, which is the one that they should choose. However, try to grade on consistency, if there is an error on the code that made them get different BIC values, consider following the rule (choose the model with the lowest BIC) as a correct answer

16. Calculate the value of R^2 of the model that you choose in (14). What is the value of R^2 of the model you selected and how can you interpret it?

```
r2_task <- (sse_null - sse_task)/sse_null
r2_wf <- (sse_null - sse_wf)/sse_null
r2_add <- (sse_null - sse_add)/sse_null
r2_full <- (sse_null - sse_full)/sse_null
```

ANS: The correct answer should be: The proportion of variance accounted for by the **full** model was 54.89%.

However, if the student made a mistake in the code and selected a different model that is not the full, here are the rest of the possible values for R^2

Model	R^2
Me Task	0.02

Model	R^2
Me Word Frequency	0.04
Additive	0.06
Full	0.55

As long as the answer is consistent give them the points

17. **(1 point)**

ANS: Participants are better at free recall when the list is made up from high frequency words in comparison to low frequency words, in contrast, they are better at recognizing words that have a low frequency in comparison to high frequency words.

18. **(0.5 points)**

ANS: There is an interaction between the type of task (free recall vs recognition) and the frequency of the words that participants study. The effect of moving from low to high frequency words is positive in free recall tasks and negative in recognition tasks.

The answer doesn't have to be this specific but the idea is that the effect of word frequency is different by task.