Homework 3

Winter 2024

Question 1

Part a)

Using dummy codes, run a regression to assess whether *depress2001* differs by marriage status (*married01*). Use "Married" as the reference group. Create a table to display the results of the analysis (Hint: try using the `bind_rows()` , `tidy()` , and `kable`, or `stargazer`' functions. You could also use any other functions that you would like, as long as the table is clean and clear). Then, in the space below, write the regression equation and interpret the overall model (was there a significant effect of *married01* on *depress2001*? Cite the appropriate statistics) and the intercept.

```
arh_q1 <- arh |>
  dplyr::mutate(divorced_v_married = ifelse(married01 == "Divorced", 1, 0),
                nevmarried_v_married = ifelse(married01 == "Never Married", 1, 0),
                separated_v_married = ifelse(married01 == "Separated", 1, 0),
                widowed_v_married = ifelse(married01 == "Widowed", 1, 0),
                )

mod1 <- lm(depress2001 ~ divorced_v_married + nevmarried_v_married + separated_v_married + widowed_v_mar

stargazer(mod1, type = "latex", header = FALSE, ci=TRUE,
          digits=2, title = "Depression predicted by Marital Status.")
```

$$\widehat{\texttt{depress2001}}_i = 11.39 + 1\texttt{Divorced}_i + 1.68\texttt{NevMarr}_i + 0.012\texttt{Separated}_i + 1.38\texttt{Widowed}_i$$

Interpretations:

- **Overall model**: The overall model is statistically significant ($F(4, 817) = 4.0$, $p = 0.003$), meaning that marriage status has an effect on Depression. However, the model only explains a small amount of the variance in the dependent variable (R^2_{adj}=0.14).
- **Intercept**: The coefficient for the intercept is 11.39 and statistically significant (p<.001), which means that the predicted value of Depression for a person who is Married is 11.39.

Part b)

Based on the regression performed above in Part A, which groups can you conclude are significantly different (at $p < .05$)? List each specific pair of groups that differed.

Answer:

- Widowed vs. Married: $b = 1.38$, $p < 0.001$.

Part c)

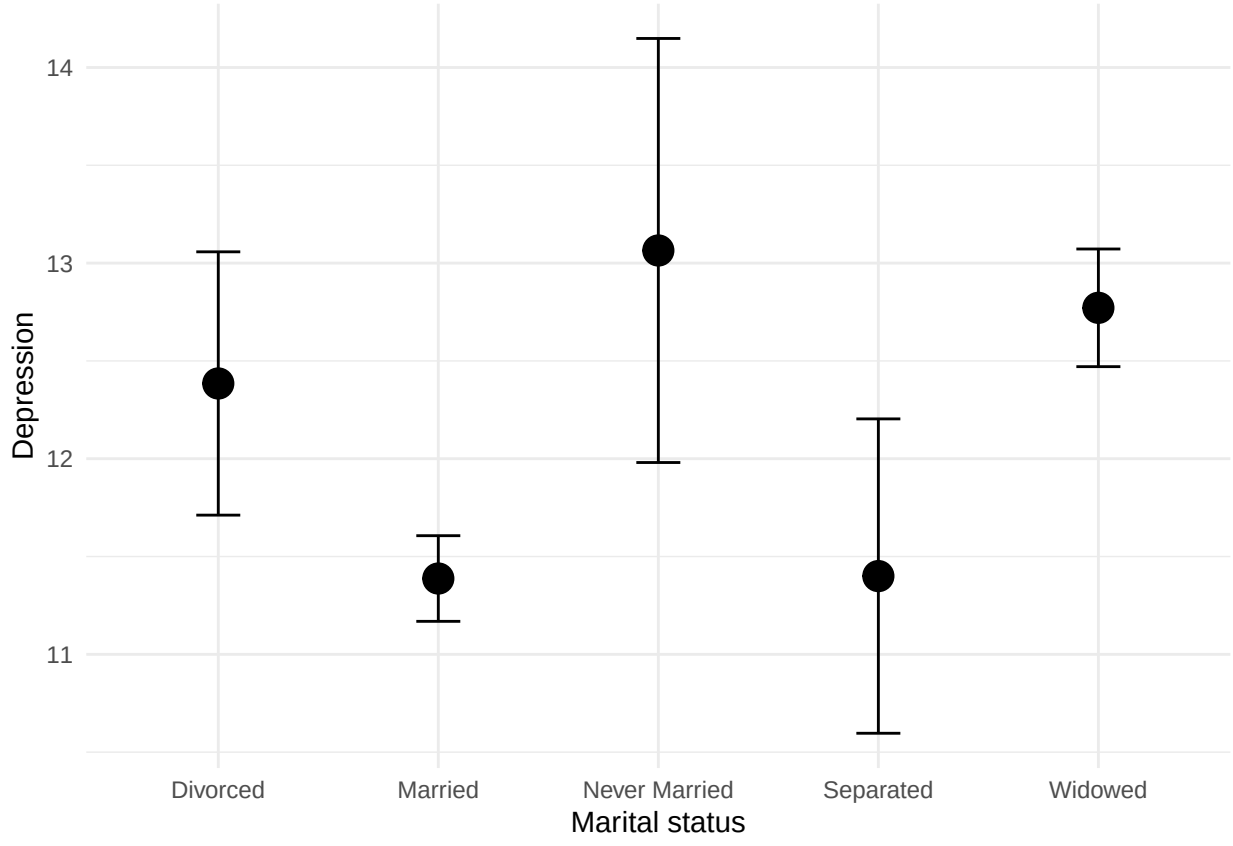
Create a plot with *married01* on the x-axis and average levels of *depress2001* on the y-axis (i.e., using `geom_point()`). Include standard error bars for plus and minus 1 SE.

Table 1: Depression predicted by Marital Status.

	Dependent variable:
	depress2001
divorced_v_married	1.00
	(−0.28, 2.27)
nevmarried_v_married	1.68*
	(−0.10, 3.46)
separated_v_married	0.01
	(−2.50, 2.53)
widowed_v_married	1.38***
	(0.65, 2.11)
Constant	11.39***
	(10.92, 11.86)
Observations	822
R^2	0.02
Adjusted R^2	0.01
Residual Std. Error	4.88 (df = 817)
F Statistic	3.99*** (df = 4; 817)
Note:	*p<0.1; **p<0.05; ***p<0.01

```r
arh_mean <- arh |>
  dplyr::with_groups(
    married01,
    summarise,
    mean = mean(depress2001, na.rm = TRUE),
    n = length(depress2001),
    sd = sd(depress2001, na.rm = TRUE),
    se = sd / sqrt(n),
    upper = mean + se,
    lower = mean - se
    ) |>
  dplyr::filter(!is.na(married01))

arh_mean |>
  ggplot(aes(x = married01, y = mean)) +
  geom_point(size = 5) +
  geom_errorbar(aes(ymin = lower, ymax = upper), width = 0.2) +
  theme_minimal() +
  labs(x = "Marital status", y = "Depression")
```



Question 2

Part a)

Repeat the regression from Question 1, Part A (assessing differences in *depress01* based on *married01* grouping), but this time use "Divorced" as the reference group. Create a table to display the results of the analysis (Hint: try using the `bind_rows()` , `tidy()` , and `kable` functions. You could also use any other functions that you would like, as long as the table is clean and clear).

```
arh_q2 <- arh |>
  dplyr::mutate(married_v_divorced = ifelse(married01 == "Married", 1, 0),
                nevmarried_v_divorced = ifelse(married01 == "Never Married", 1, 0),
                separated_v_divorced = ifelse(married01 == "Separated", 1, 0),
                widowed_v_divorced = ifelse(married01 == "Widowed", 1, 0),
                )

mod2 <- lm(depress2001 ~ married_v_divorced + nevmarried_v_divorced + separated_v_divorced + widowed_v_
stargazer(mod2, type = "latex", header = FALSE, ci=TRUE,
          digits=2, title = "Depression predicted by Marital Status.")
```

Table 2: Depression predicted by Marital Status.

	Dependent variable:
	depress2001
married_v_divorced	−1.00
	(−2.27, 0.28)
nevmarried_v_divorced	0.68
	(−1.41, 2.77)
separated_v_divorced	−0.98
	(−3.73, 1.76)
widowed_v_divorced	0.39
	(−0.93, 1.70)
Constant	12.38***
	(11.20, 13.57)
Observations	822
R^2	0.02
Adjusted R^2	0.01
Residual Std. Error	4.88 (df = 817)
F Statistic	3.99*** (df = 4; 817)
Note:	*p<0.1; **p<0.05; ***p<0.01

Part b)

Interpret the slope for the dummy code for "Never Married" in both regressions (the one with "Married" as the reference group, and the one with "Divorced" as the reference group).

Answer:

- **"Married" Reference Group**: In this model, the slope for "Never Married" is statistically non-significant and positive ($b = 1.68$, 95% CI [-0.11, 3.46], $p = 0.065$). It represents the difference between the mean level of depression of the "Married" group and the mean depression of the "Never Married" group. However, we do not have evidence to reject the hypothesis that the slope is different from zero.
- **"Divorced" Reference Group**: In this mode, the slope for "Never Married" is statistically non-significant and positive ($b = 0.68$, 95% CI [-1.41, 2.77], $p = 0.524$). It represents the difference between the mean level of depression of the "Divorced" group and the mean depression of the "Never Married" group. Similar to the previous slope, we cannot reject the hypothesis that it is different from zero.

Part c)

Based on the analysis performed with "Divorced" as the reference group, which groups can you conclude are significantly different at $p < .05$?

Answer:

- None of the other groups are significantly different from the "Divorced" group.

Question 3

Part a)

Using dummy codes, run a two-way factorial ANOVA model with *self_worth2001* as the outcome and *married01*, *smoke01*, and the interaction between these variables as predictors. For the *married01* variable, use "Married" as the reference group; for the *smoke01* variable, use "Non-Smoker" as the reference group. Display the results of the analysis in a table in the same way as above (i.e., with `tidy()` and `kabl()`).

```
arh$married01 <- factor(arh$married01,
                        levels = c("Married", "Widowed", "Never Married", "Divorced", "Separated"))
arh$smoke01 <- factor(arh$smoke01,
                      levels = c("Non-Smoker", "Smoker"))

mod3 <- lm(self_worth2001 ~ married01 * smoke01, data=arh)
stargazer(mod3, type = "latex", header = FALSE,
          ci=TRUE, digits=2, title = "Self-worth predicted by the interaction
          between Marital Status and Smoker status.")
```

Part b)

Interpret the intercept.

- **Answer**: The intercept of 4.70 refers to the mean Self Worth level for married and non-smoker people.

Part c)

Among the non-smoker group, which group(s) are significantly different from the reference group, at $p < .05$?

- **Answer**: Widowed and Never Married.

Part d)

Create a graph showing the means of *self_worth2001* (on the y axis) broken down by *married01* and *smoke01*, with +/- 1 SE bars. Try different ways of graphing the data (e.g., try putting *married01* on the x axis and coloring by *smoke01*, then try it the other way around; you could also try faceting the graph by *married01* and *smoke01*), and use the combination that you think emphasizes the most interesting effects in the data.

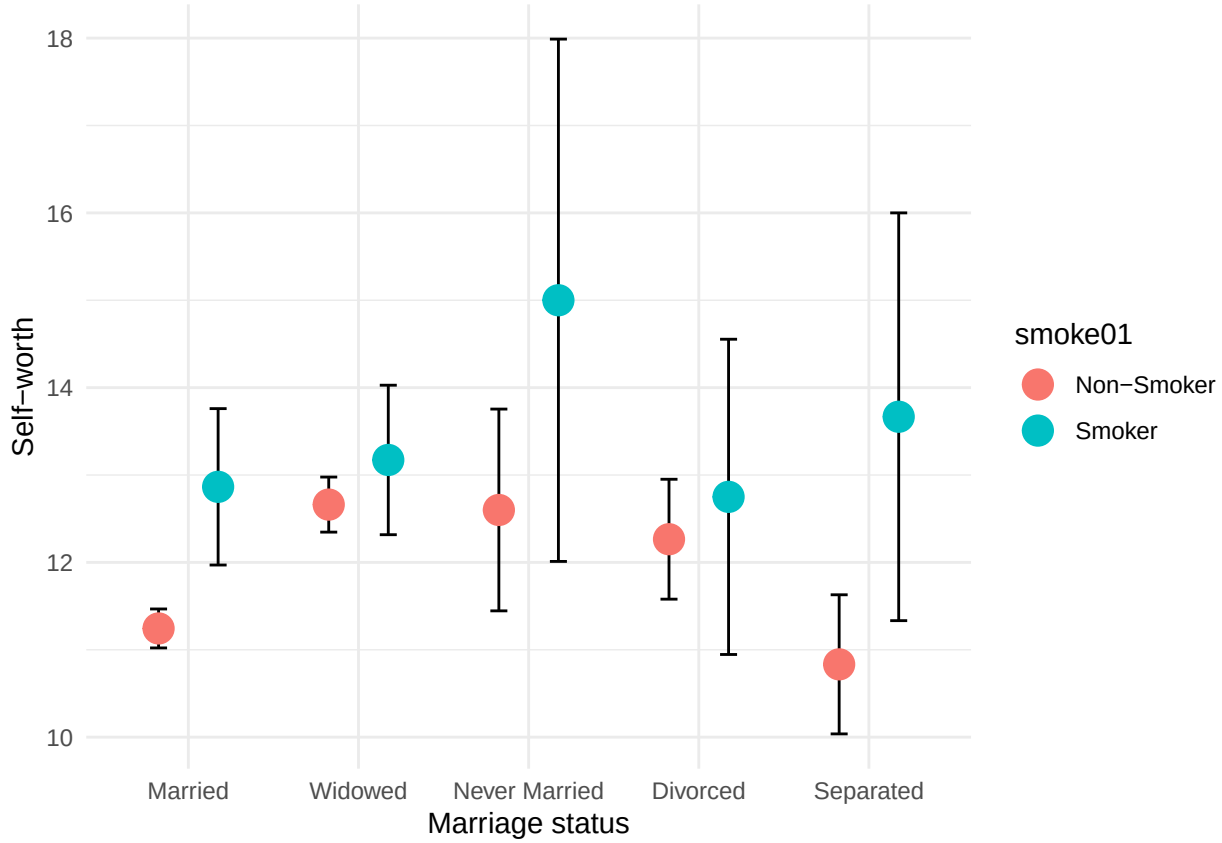
Table 3: Self-worth predicted by the interaction between Marital Status and Smoker status.

	Dependent variable:
	self_worth2001
married01Widowed	-0.27^{**}
	$(-0.50, -0.04)$
married01Never Married	-0.90^{***}
	$(-1.49, -0.32)$
married01Divorced	-0.02
	$(-0.45, 0.40)$
married01Separated	0.21
	$(-0.66, 1.07)$
smoke01Smoker	0.02
	$(-0.46, 0.49)$
married01Widowed:smoke01Smoker	0.45
	$(-0.29, 1.18)$
married01Never Married:smoke01Smoker	1.98^{***}
	(0.52, 3.45)
married01Divorced:smoke01Smoker	0.62
	$(-0.32, 1.56)$
married01Separated:smoke01Smoker	0.08
	$(-1.82, 1.97)$
Constant	4.70^{***}
	(4.56, 4.85)
Observations	803
R^2	0.03
Adjusted R^2	0.02
Residual Std. Error	1.44 (df = 793)
F Statistic	2.54^{***} (df = 9; 793)
Note:	*p<0.1; **p<0.05; ***p<0.01

Include a brief explanation of why you chose the graphed the data the way you did. There is not necessarily one right way to do this, as long as you can justify your decision.

```
arh_mean_2 <- arh |>
  dplyr::with_groups(
    c(married01,smoke01),
    summarise,
    mean = mean(depress2001, na.rm = TRUE),
    n = length(depress2001),
    sd = sd(depress2001, na.rm = TRUE),
    se = sd / sqrt(n),
    upper = mean + se,
    lower = mean - se
    ) |>
  dplyr::filter(!is.na(married01), !is.na(smoke01))

arh_mean_2 |>
  ggplot(aes(x = married01, y = mean)) +
  geom_errorbar(aes(ymin = lower, ymax = upper, group = smoke01), width = 0.2,
                position = position_dodge(width = 0.7)) +
  geom_point(aes(col = smoke01),size = 5, position = position_dodge(width = 0.7)) +
  theme_minimal() +
  labs(x = "Marriage status", y = "Self-worth")
```



- **Explanation**: This plot aims to show the mean level of Self-worth across all levels of marital status and within each level, splitting between smokers and non-smokers. By showing means and standard errors in the same plot, we make it easier for the reader to quickly identify which groups are more or

less similar. Additionally, by using colors to differentiate the smoking status in each marital status level, it is possible to identify a general trend in each subgroup.